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Occurrence of *Elysia bangtawaensis* Swennen in the mangroves of Anthropogenically polluted Thane creek, the Flamingo Bird Sanctuary, Central West Coast of India

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ABSTRACT

The solar powered *Sacoglossan molluscs*, *Elysia bangtawaensis* Swennen, ranging from 35 mm to 40 mm in length, were located for the first time from two locations in the Thane Creek Flamingo Bird Sanctuary. This is a North-western extension of its reported former range which was Ratnagiri in Maharashtra.

***Key words**: Elysia bangtawaensis, Thane Creek, Flamingo bird sanctuary, Solar Powered Sea Slug*

Introduction

Opisthobranchs are among the least studied molluscs in India. The work done on opisthobranch fauna is sparse and patchy. The earliest work dates back to the 1880s by Alder and Hancock (1864), Kelaart (1858a,b; 1859a,b,c; 1883), and Bergh (1877). The most recent work on the distribution and diversity of opisthobranch from India is by Apte and Desai (2017).

Gastropod molluscs of the family Elysiidae in the order Sacoglossa (Opisthobranchia) have acquired the ability to assimilate algal chloroplasts that can remain photosynthetically active for several months in the mollusc body (Rumpho *et al.*, 2000; Green *et al.*, 2000; Evertsen *et al*., 2007) With brilliant intuition, Rumpho *et al.* (2000) with permission from Dr. Bill Rudman, Australian Museum named these unusual forms of life as "solarpowered sea slugs". The classification of the Sacoglossa was most recently reviewed by Jensen (1996). The Plakobranchidae (Elysiidae) form the largest family in the Sacoglossa Approximately, 250–300 species of sacoglossan have been described, with *Elysia* (~70 species) as the most speciose genus (Jensen, 1996). *Elysia* are thought to be one of the few specialist herbivores in the marine environment (Williams and Walker, 1999). Several large species living in turbid water in mangrove forests have only been discovered during the last 20 years. The first known large mangrove *Elysia* was found in Hong Kong and named *E. leucolegnote* (Jensen, 1990). It was followed by *E.bangtawaensis*

(Swennen, 1998), found in the Gulf of Thailand. The two species are usually found aggregated on soft mud without algae in shallow, shaded pools during low tide.

The *E. bangtawaensis* was first reported from the Bay of Bengal along the east coast of India from Andhra Pradesh, about 20 km south of Kakinada, during 2002 by Swennen when he received some samples from Bouillon (Swennen, 2011). Subsequently during 2007–2008 the species was first documented by Jagtap *et al.* (2009) from Mandovi estuary, Goa west coast of India. listed the species from Ratnagiri coast along the Arabian sea with no particular mention of its occurrence from a specific location.

While studying the mangrove diversity of the Thane Creek Flamingo sanctuary in March 2015 we observed the solar powered slugs in the high tide zone on the mudflats during the low tide phase at Latitude 19° 5′8.95"N and Longitude 72°59′37.41"E (Fig. 1). *Avicennia marina* and *Sonneratia apetala* were the dominant mangrove species measuring up to two meters in height. The mudflat was soft with silty clay composition having several gully's and shallow muddy puddles. It was on this mudflat and puddles that we observed the slug which at first appeared like fallen aggregated mangrove leaves. However, the brilliant green colour with small yellow spots along the periphery coupled with its movement in the shallow puddles compelled us to examine the species. We surveyed two locations for an area of 0.25 hectare each spread one km apart and recorded an average of 8 ind/m^2 (±15 ind/m^2). We collected three specimens based on our permissions from the Mangrove cell, Maharashtra Forest Department and identified them in the laboratory. The specimens were 35 to 40 mm in length and had presence of wing-like parapodia bordering the posterior part of the foot. We identified the specimen as *Elysia species*, based on the explanation of the external characters

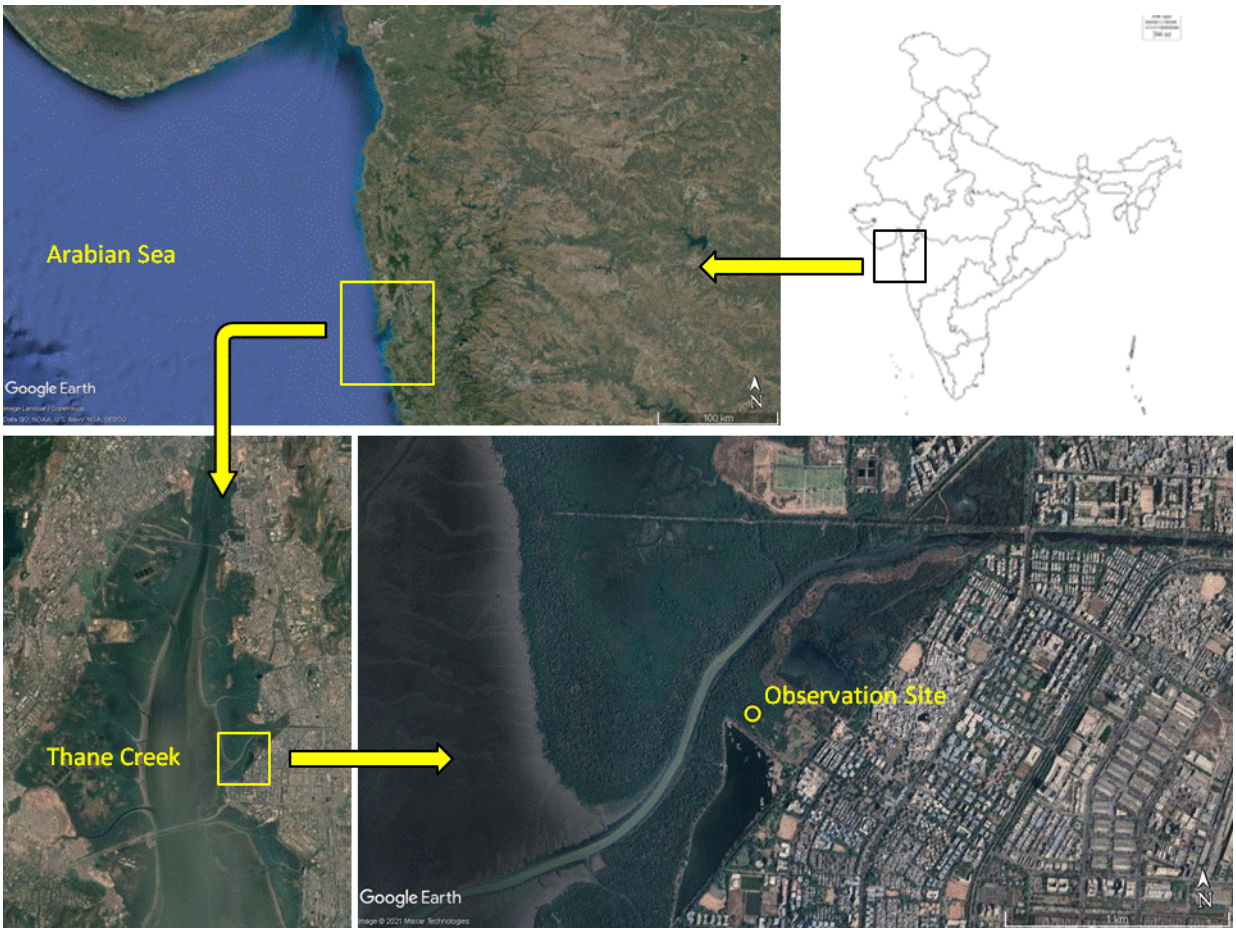

Fig. 1. Map showing Thane creek and the Location of *Elysia bangtawaensis*

provided by Jagtap *et al* (2009). To confirm the identification, we shared the photographs with Prof. Patrick J. Krug from California State University, who approved the identification as *Elysia bangtawaensis* Swennen (1998) (Fig. 2) and provided us the literature with earlier reports from India. Our survey of published literature and opisthobranch website groups (http://nudibranch.com; www.seaslugforum.net) revealed that the observation of *Elysia bangtawaensis* Swennen (1998) from Thane creek is the first record and North West occurrence of the species from west coast of India.

Thane creek (Long. 72°.55′ to 73°.00′ E and Lat. 19°.00′ to 19°.15′ N) is 26 km long. It is connected to the Mumbai harbour on its south and joins by a minor connection with the Ulhas river on its north near Thane city (Fig. 1). The creek has 13 species of mangrove and associate species with the salinity varying seasonally between 2 to 40 ppt. Along the east and west sides of the creek, many industrial units have come up and the creek is the immediate recipient of all treated and untreated liquid discharges from these industries. The discharges into the creek on its western side are dominated by Mumbai city sewerage and effluents from the industrial complexes, including the textile mills of South and Central Mumbai, the petrochemical, fertilizer and thermal plants at Chembur and the pharmaceutical and chemical complexes at Vikhroli, Bhandup and Mulund. The Trans-Thane Creek Industrial Area developed as a chemical zone by the Maharashtra Industrial Development Corporation. The area houses a number of major, medium and small scale industrial units largely involved in the manufacture, storage and use of chemicals, petrochemicals, pharmaceuticals and fine chemical products, pesticide formulation, etc. Of the 1800 odd industries registered in the area, nearly 50 could be termed as ma-

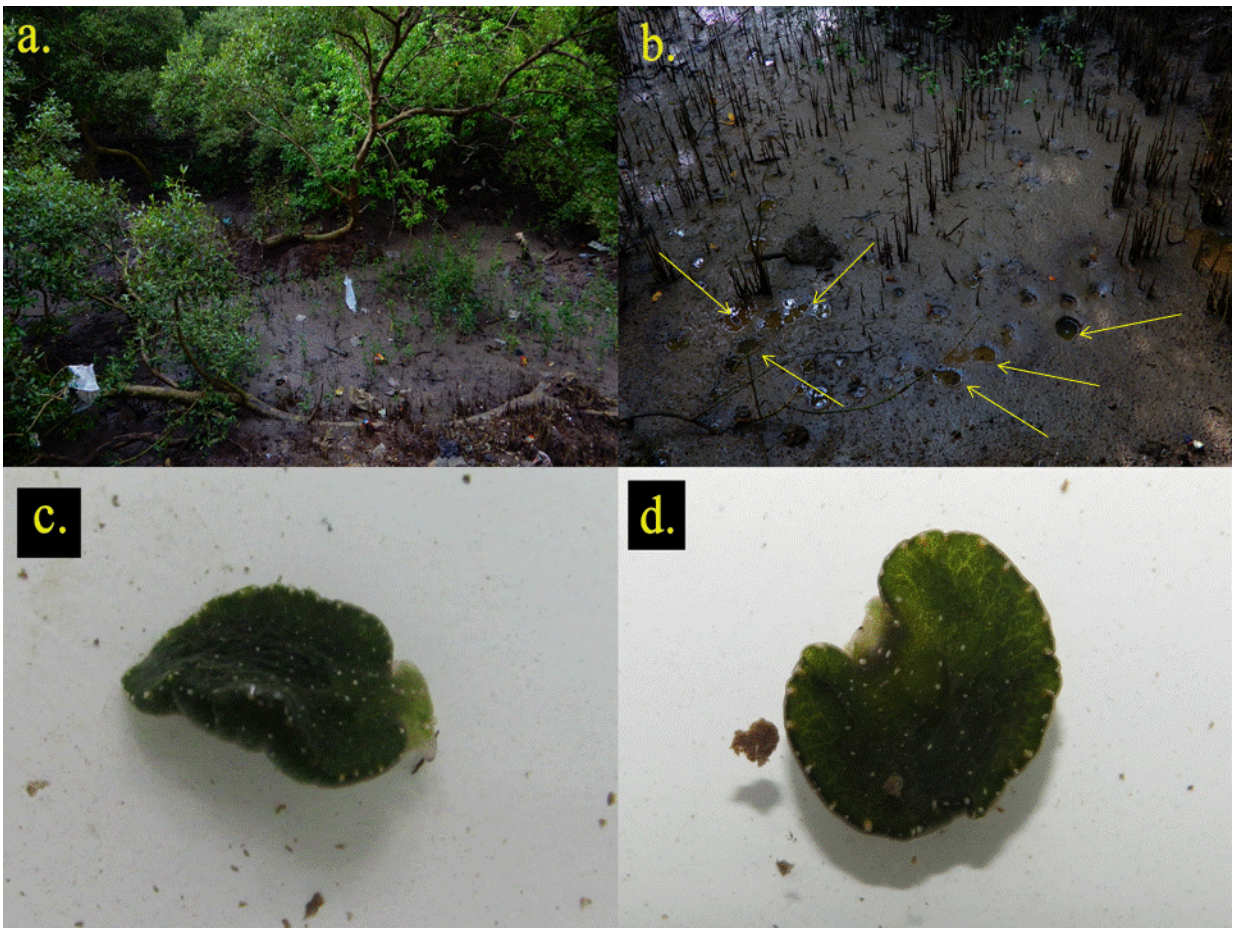

Fig. 2. a., b. Observation Site and habitat of *E. bangtawaensis* from Thane creek. c., d. *Elysia bangtawaensis* Swennen (1998) from Thane creek

jor and the rest as small and medium scale. Thane Creek mangrove sediment has also been reported to be contaminated with both carcinogenic and high molecular weight PAHs (Sukhdhane, 2015; Quadros *et al.,* 2016). The urbanization and industrialization around Thane creek and the load of the effluents indicate detrimental state of the ecosystem. The occurrence of *Elysia bangtawaensis* Swennen (1998) during the summer season with salinity varying between 25 to 40 ppt. in the anthropogenically polluted Thane creek is important indicating its tolerance to stress.

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