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Epiphytic Diatoms on the Seagrass Blade from Palk Strait, Tamilnadu, India

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Abstract: Diatom is a single celled eukaryotic group of epiphytic algae belonging to the division of Bacillariophyta. The cell walls are composed of silica. They are an important component distributed in ponds, rivers and most of the marine ecosystems. Seagrass of *Cymodacae serrulata* were collected in shallow region in and around of the Thondi coastal regions, Palk Strait and the epiphytic diatom *viz., C. scutellum, C. meneghiniana* and *D. robustus* were first time identified. The Scanning Electron Microscopic (SEM) studies showed fine nanostructure pore girdle and valves view and raphe is very legibly. This is the one of the new distributional record is observed, identified and reported from our "Palk Strait region", we formally detailed on its taxonomy, morphology and SEM observations have extended out knowledge of general biology of the species.

Key words: Seagrass · Epiphytic diatoms · SEM · New Distributional record · Taxonomy

INTRODUCTION

Seagrasses are defined as flowering plants (Angiosperms) living their complete life cycle submerged in marine environments. They are found in all coastal areas of the world except along the Antarctic shores [1, 2]. Seagrass meadows are ecological and economically an important habitat and one of the most production amongst the aquatic primary producer in the coastal and marine ecosystems [3, 4]. The diverse array of epiphytic organisms especially diatoms that contribute to the productivity of the seagrass beds in different ways [5]. An importance of seagrass meadows to the coastal marine ecosystem is not fully understood and also epiphytes algae are submerged microphyte and it has functional substrates which act as indicators of biodiversity and ecological status. Epiphytic diatom is a primary producer and its potential is important food sources for herbivorous and associated animals [6]. Recently, the new epiphytic diatom was reported in the Bacillariophyceae member in the Palk Strait region, Bay of Bengal [7, 8].

Present study is focus to recognize the occurrence, taxonomy, morphology and general biology of the species. The results obtained the basic biological subsequences involving the epiphytic diatom of *Cocconeis scutellum, Cyclotella meneghiniana* and *Diploneis robustus* contribute to a better understanding the morphological characteristic by using SEM observation and also to know the distribution and occurrence of the species as an epiphytic mode of life in the Thondi coastal region, Palk Strait, Bay of Bengal.

MATERIALS AND METHOD

Samples Collection: Thondi (Lat. 9°45'N and Lang. 79°3'E) is situated 40 km south of Manelmalkudi and 45 km north of Devipattinam. Thondi was popular as the historical Port. Here the coastal region was muddy and swampy in nature. This coastal region was polluted by bulk quantity of domestic and agricultural wastes. Anthropogenic inputs including fecal contamination also high in this area.

Samples were randomly collected from Thondi coastal region during the month of January 2011. *Cymodacea serrulata* is one of the most common seagrass found in around this coastal region. This region is accumulated with five seagrass, but *Cymodacea serrulata* is dominant growth of species in this region. Seagrass leaves were collected at 3-5m depth by using SCUBA Diving equipment Model (SCUBA EA 2/07) and the young leave reach their maximum size. All leaves were present covered with a dense growth of diatoms.

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Epiphytic diatoms were removed by scarping the individual leaves in 1cm^2 areas with the tip region in spatula [9].

Acid Wash Preparation: The studies were done following hot HCl and $KMnO_4$ method (recommended technique of acid digestion) [10]. The epiphytic diatom samples subjected to Scanning Electron Microscopic (SEM) observations. The SEM photos were taken at CAS in Botany, University of Madras, Guindy Campus, Chennai -25.

Scanning Electron Microscopy (SEM): The specimens were cleaned by adopting the same method as described earlier. Acid washed samples were placed onto a clean glass cover slip and the samples were left air dried overnight. The samples were coated using gold-platinum using a JEOL JFC-1600 Auto Fine Coater (JEOL, Tokyo, Japan). The samples were then examined under a JEOL JSM-6390 LA Analytical SEM (JEOL, Tokyo, Japan) and digital images were taken using the system.

Systematic Position:

Cocconeis scutellum:

Empire : Eukaryota
Class : Bacillariophyta
Order : Achnanthales
Family : Cocconeidaceae
Genus : *Cocconeis*
Species : *scutellum*

Cyclotella meneghiniana:

Order : Thalassiosirales
Family : Stephanodiscaceae
Genus : *Cyclotella*
Species : *meneghiniana*

Diploneis robustus:

Order : Navicules
Family : Diploneidaceae
Genus : *Diploneis*
Species : *robustus*

RESULTS

Analysis of the samples with Scanning Electron Microscopy (SEM) yielded for pennate and centric diatoms belonging to the genera *Cocconeis, Cyclotella* and *Diploneis*. Taxa observed the samples differed in many aspects when compared to the previously described species. The detailed Scanning Electron Microscopic observations are given below.

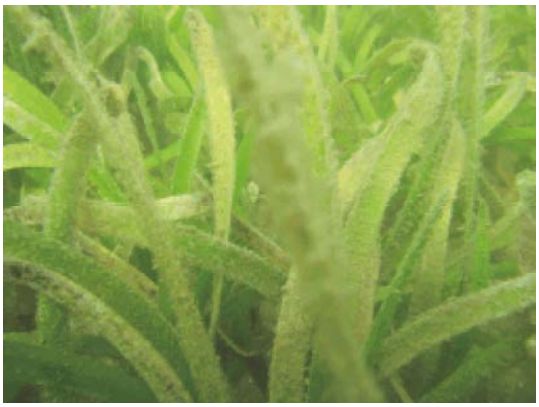

Fig. 1: A underwater photo view of *Cymodacae serrulata*

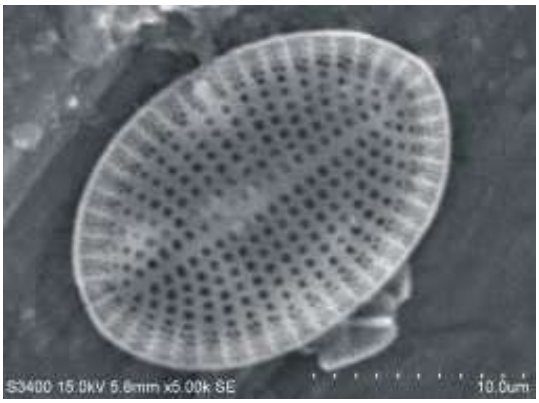

Fig. 2: SEM View of *Cocconeis scutellum* (S340015.0KV 5.8mm x4.00xSE; 10.0µm)

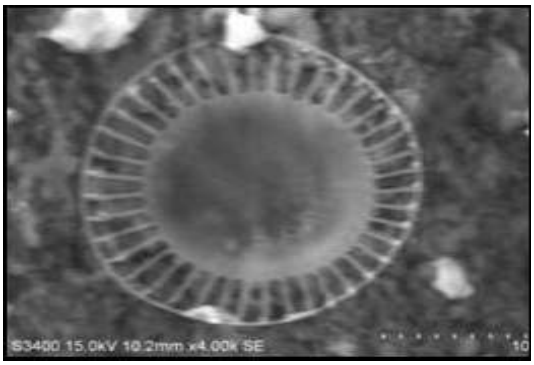

Fig. 3: SEM View of *Cyclotella meneghiniana* S3400 15.0KV 10.2mm x4.00 k SE; 10.0µm)

Habitat and Distribution: Cosmopolitan in distribution, in benthic, ubiquitous, pelagic, epiphytic or attached to various soft substratums of the marine plants especially in Seagrass young leaves (Fig. 1). This taxon has a cosmopolitan in distribution in the benthos and plankton of eutrophic, electrolyte rich coastal and marine (Fig.2-4).

Fig. 4: SEM View of *Diploneis robustus* (S3400 15.0KV 4.7mm x2.70k SE; 20.0µm)

***Cocconeis scutellum*:** The distribution of these diatoms are Swan River (W.A); Port Hacking (N.S.W); Ansons Bay, Georges Bay, Orielton Lagoon, Pipeclay Lagoon (Tas); Gippsland Lakes, Port Phillip Bay, Western Port Bay (Vic.); Japan, the Baltic Sea, the Mediterranean Sea, the Black Sea.

***Cyclotella meneghiniana*:** Littoral form, coast of entire Europe; occurs in water of all concentrations, Fresh, brackish and marine. Records from N. America, India; fossils from Germany, Lower Austria, Italy, Moravia, Sumatra, Karewa Beds of Kashmir in India, is including the Palk Strait region.

***Diploneis robustus*:** Cosmopolitan is distribution, one of the commonest forms in the European coastal region, particularly frequent in the temperate parts, becoming rare towards the north, the Bay of Bengal and plankton of the Madras coast, including the Palk Strait region (Present Report).

Description: Valves broadly elliptic to elliptic-lanceolate, 20-60µm long, 12-40 µm wide. Raphe valve with a straight raphe, proximate central endings and a narrow linear axial area, slightly widened in the middle; transapical striae radiate, 10-12 in 10 µm, composed of circular areolae. Araphid valve with a narrow linear sternum; transapical striae robust, 5-8 in 10 µm; areolae circular to quadrangular. A ring of striae present along the valve margin, composed of a few rows of small punctate; areolae arranged in irregular longitudinal rows, 5-8 in 10 µm (Fig. 2).

The cell wall was drum shaped. Valves are circular with a tangential undulation in the central zone. The margin of the cell well distinct and clearly differentiated from the central part of the valve face. The marginal zone had 6-10 radial striae measured at 10µm, each composed of a single alveolus which was open on the inside of the valve. This gave the marginal zone a chambered appearance. The interstriae are distinct, each penetrated by a fultoportula and with associated spines around the valve margin. A single marginal rimoportula was present. The central zone was structures less which are radially streaked. One to several fultoportulae is visible on the valve face (Fig. 3). Valves linear-elliptical with broadly round rounded poles. Sides slightly drawn in the middle; 34µm and long 12µm broad. Raphe straight, narrow. Central nodule quadrate, wavy at the sides, with well-developed horns. Furrows narrow diminishing in breath from the centre towards the poles. Transapical coast very well developed, robust, swollen at the tip; some radially arranged 6 in 10 µm. Two rows of alveoli on either side on the central axial area, one against each coast, but interrupted in the middle (Fig. 4).

DISCUSSION

This study revealed that the percentage of seagrass was moderate at shoreward side where as seagrass percentage and distribution was low in seaward side. Their natural environment seagrass are exposed to wind driven currents, tides, waves and wave driven currents [11]. *C. serrulata* was dominant species in the Palk Strait region because *C. serrulata* is the runner and posses more root density and also drop of all leaves during seasonal charges (especially during post monsoon season wind wave action). Scanning Electron Microscopic (SEM) analysis had a more profound impact on diatom taxonomy [12]. They are three dimensional structures of diatom valves and the highly characteristic architecture of the silica shell through SEM analysis [13-15].

A fine morphological structure of genus in diatom *C. scutellum, C. meneghiniana* and *D. robustus* has been documented by this study and the morphological structures of diatom species from the various locations are currently underway. So, as to provide a comprehensive documentation of diatom species in Thondi coastal region. The epical valve and also the spines were very clear in the SEM images and also the higher magnification of the valve features were observed in even greater detail. Above the SEM images were helpful to explore the unexplored fine structure of diatoms collected especially from seagrass of marine ecosystems. The results of our paper represent taken towards the prediction of the associated or epiphytic diatoms

morphological characteristic of the, *C. scutellum, C. meneghiniana* and *D. robustus* scarped from *C. serrulata* species of seagrass. On the basis of the local distribution, diversity, species composition and richness of the biodiversity of epiphytic diatom on seagrass and other associated epiphytic organisms and for correct conservation and management of priority habitat.

CONCLUSION

The pennate and centric diatom of, *C. scutellum, C. meneghiniana* and *D. robustus* scraped from *C. serrulata* of seagrass clearerly suggests that the epiphytic species is able to well adapt to the marine environment. Further, the future studies should be carried out to clarify its complete life history and morphogenesis and in addition to know the distribution and diversity of the seagrass associated flora.

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