



Taxonomy of potentially harmful diatom *Coscinodiscus c.f.wailesii* Gran et Angst (Coscinodiscales, Bacillariophyta) from Pakistan waters

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ABSTRACT

Coscinodiscus wailesii is a large solitary centric diatom species. We identified this species and investigated taxonomy from coastal waters of Manora Channel, Karachi Pakistan (2008). The cells were observed under light and scanning electron microscopes. The typical characteristics of Family Coscinodiscaceae and *Coscinodiscus c.f. wailesii* including central hyaline area, flat valve surface, two marginal rings of rimoportulae and two macrorimoportulae and small rimoportulae scattered over the valve face were observed. *Coscinodiscus wailesii* considered as a massive bloom forming diatom species found with high carbon biomass values from Pakistan waters, but its morphology has not been described before from this area. Further studies are required for the analysis of relationship of environmental variables with this species.

Key words: *Coscinodiscus wailesii*, taxonomy, HAB species, Manora Channel, Pakistan coast.

INTRODUCTION

Phytoplankton blooms are the subject of major interest during the last two decades all over the world. Phytoplankton has 3400-4100 microalgae species and among them 300 species could produce blooms (Smayda 1997). The diatoms are the major phytoplankton group proliferates as extensive blooms that can result the mass mortality of marine organisms. Large centric diatom *Coscinodiscus wailesii* Gran et Angst when high in abundance, it apparently produces copious amounts of polysaccharide exudates or mucilage. The mucilage produced by *Coscinodiscus wailesii* clogs the fishing nets, therefore it is considered as potential Harmful Algal Bloom (HAB) species (Mahoney and Steimi 1980). *C. wailesii* was first recorded in Europe in 1977. The distribution of this species was first restricted to the tropical Pacific and West Atlantic oceans, now has extended to Europe, the USA and Japan in recent years. The species was recently reported in the Brazilian waters (Fernandes *et. al.*, 2001). The species was not found in the Indian ocean during the 1964-65 R/V 'Meteor' expedition (Simonsen 1974), and its current status is not verified. It is possible that *C. wailesii* invaded there. Manora Channel is a major coastal area of Karachi, facing the problems of eutrophication. Presence of Harmful Algal Bloom (HAB) species is an alarming situation in the region that can affect the local fishery industry.

MATERIALS AND METHODS

Water samples were collected from 1m depth in November 2008 by net tows from Manora Channel, coastal waters of Karachi at the mouth of the channel 24°47.93'N 66°58.87'E (Fig 1) . Samples were fixed in Lugol's solution and used for analysis by light microscopy (LM) using an inverted microscope (Olympus, BX-51, Japan). Samples for scanning electron microscopy (SEM) were cleaned by KMNO₄ oxidation of the organic material (Sournai 1978). Specimen was prepared for SEM by air drying material on clean cover slips. Material was picked up onto a double sticking tape which was then mounted on a stub. Stubbs were gold coated and viewed on a SEM (JSM6380A) Identification was based on LM and SEM characteristics described by (Tomas 1997).

For the calculation of biovolume and biomass geometric shape was selected (Hillebrand *et.al.*, (1999) and Sun and Liu (2003). The mean biovolume was calculated from mean value of individual cell biovolumes. Carbon estimates were derived from measured cell dimensions, calculated cell volumes using the geometric formulae (Hillebrand *et. al.*,1999; Sun and Lui 2003; Menden-Deuer and Lessard 2000) as $\log \text{pg C cell}^{-1} = \log - 0.541 + 0.811 \times \log V (\mu\text{m}^3)$.

RESULTS

Taxonomy

All genera and species placed in the family Thalassiosiraceae Lebour emend Hasle are characterized by the presence of areolae with cribra on the biological

interior and foramina on the biological exterior and secondly most importantly, a marginal ring of strutted processes known as Fuloportulae and mostly, a single central strutted process. All images presented here have illustrated the biological interior of the valve with two marginal rings of micro labiate processes (rimoportulae), two macro labiate processes (kidney-shaped), radial rows of areolae with their internal foramina (Fig 2, C, D, F). All the processes were labiate processes and there was no evidence of strutted processes. Further, the structure of the areolae, especially the position of cribra (sieve membrane) and the foramina (openings) clearly indicate

that the species belong to the family Coscinodiscaceae. Furthermore, the presence of internal foramina and the labiate process patterns and the absence of strutted processes would be sufficient to recognize the family Coscinodiscaceae. The *Coscinodiscus c.f. wailesii* has flattened valve as seen in light microscopy (Fig 2, A). The cell diameter was measured 493µm. The number of areolae was 3 per 10µm from the margin. The traces of small rimoportulae scattered over the valve face that may be destroyed by cleaning process (Fig 2, D, E). The valve center is irregularly hyaline due to a variable termination of the radial rows of areolae (Fig 2, F).

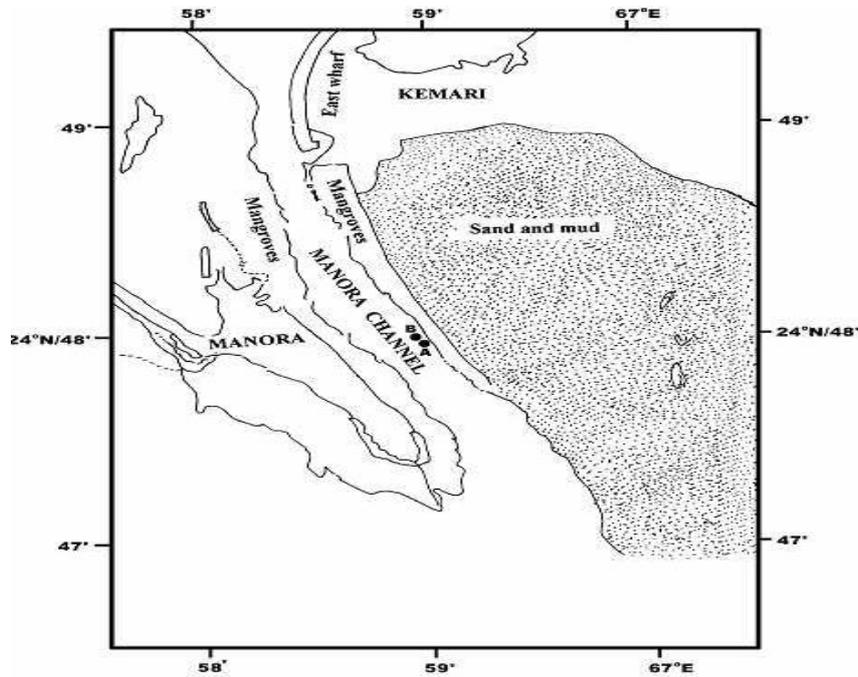


Fig. 1. Map showing sampling location.

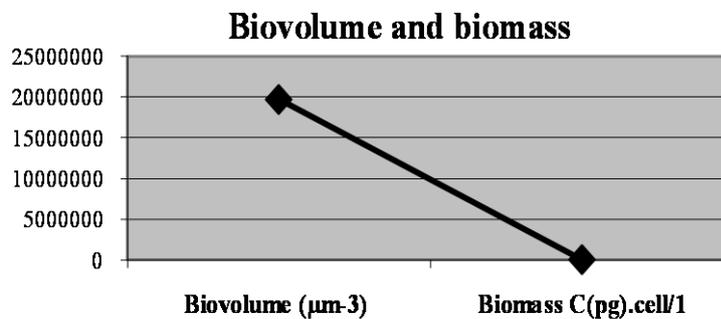


Fig. 3 Biovolume (µm³) and biomass (pgCcell⁻¹) of *Coscinodiscus c.f. wailesii*.

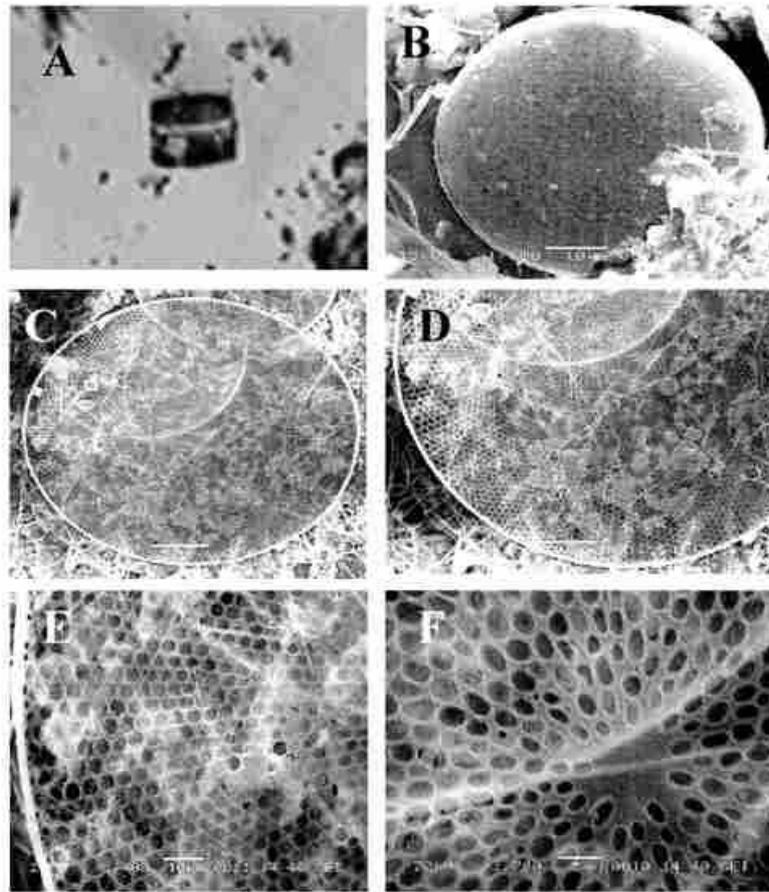


Fig. 2. Light microscopic (LM) and scanning electron micrographs of *Coscinodiscus wailesii*.

- A. Girdle view shows flattened valves
- B. Whole cell valve without cleaning
- C. Entire cell with marginal rings
- D. Radial rows of areolae
- E. Two macro labiate processes
- F. Valve center is irregularly hyaline

Biovolume and biomass

The cell biovolume and carbon biomass of *Coscinodiscus* c.f. *wailesii* was calculated from randomly selected cells from the samples. Total cell biovolume was $19720000(\mu\text{m}^3)$. The derived biomass was recorded as $5.37 (\text{pg C cell}^{-1})$ presented in Fig 3.

DISCUSSION *Coscinodiscus wailesii* is a common blooming species around many regions of the world. The species has been previously reported by Ghazal *et. al.*, 2006 from the coastal waters of Pakistan, but the author did not present any LM (light microscopy) or SEM (Scanning electron microscopy) photographs for the identification and its confirmation. Shameel; Tanaka 1992 recorded fourteen species of genus *Coscinodiscus* from Karachi coast except *Coscinodiscus wailesii*. This is the first detail description from Pakistan coast.

The taxonomical characters have been reported earlier by Cupp, 1943; Hasle and Fryxell 1995, Nagai and Imai 1997 and here only the complementary information on morphology of the species from this region is described. The species can be easily confused with the other *Coscinodiscus* species like *Coscinodiscus concinnus* W. M. Smith and *Coscinodiscus centralis* Ehrenberg because of the presence of some similar characteristics, for instance valve size, central rosette area and number of areolae etc. Despite these similarities the *Coscinodiscus wailesii* has flate valve surface and scattered small rimoportulae observed from light microscopy in our studies.

Intensive blooms of *Coscinodiscus wailesii* were recorded from European Atlantic (Gomez and Souissi 2010). These bloom conditions could results in sharp decrease of microorganisms, were observed from Brazilian waters (Fernandes *et.al.*, 2001). The presence of this Harmful Algal Bloom (HAB) species in coastal waters of Manora Channel Karachi, with high biomass

values is an alarming condition for the fisheries industry of the area and it is suggested that a regular monitoring of seasonal abundance of this species should be initiated. The global climate change causing the development of alien species in different areas. Huge or massive transportation of species due to the different factors is the major cause of introduction of new species. This species may be misidentified or overlooked in the past studies from coastal waters of Karachi. It is also questionable that this species is a native one or introduced itself recently or few years back in the region where it was not present previously.

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