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Micro Algal Population in Mangrove Habitats of the Visakhapatnam, East Coast of India.

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Abstract

The present communication deals with the composition and distribution of micro algae in the estuarine habitats of the Meghadrigedda rain fed drain which merges with Bay of Bengal at Visakhapatnam. Sampling was conducted at two study sites in mangrove habitats of the estuarine region during the year 2013–2014. Data on both Hydrographical variables and distribution of phytoplankton were studied. A total of 55 genera belonged to four major groups such as Chlorophyceae (8), Bacillariophyceae (17), Cyanophyceae (7) and Euglenophyceae (2).

Key words: Estuary, Meghadrigedda, Mangrove habitats, Hydrographical variables, phytoplankton, Bay of Bengal.

Introduction

In estuarine ecosystems generally, mangrove habitats are referred to as nutrient traps. These nutrients support, high primary productivity, which in turn promote high levels of secondary production (Saifullah *et al.*, 2014, Bardarudeen *et al.*, 1996). Plankton, particularly phytoplankton plays important role to make such regions more productive. Phytoplankton are the initial biological components from which the energy is transferred to higher organisms through food chain (Ananthan *et al*., 2004, Tiwari and Chauhan, 2006). Consequently, estuaries support high biomass of secondary consumers and provide economic opportunities in terms of fishery yields. Data on species composition of phytoplankton are essential to know the status of an estuarine ecosystem. Phytoplankton species undergoes spatio-temporal changes in their distribution due to the different effects of hydrographical factors on individual species (Rajkumar, 2009). They serve as bio-indicators with reference to water quality and also serve as tool for assessing water quality. Phytoplankton present in the estuarine and mangroves habitats was studied by several investigators in different parts of our country (Subramanyam, 1946; Mani, 1992; Gouda and Panigrahy, 1996; Sawant and Madhupratap, 1996; Mohamed *et al.*, 2009 and Narasimha rao and Prayaga, 2010).

In the present study, an attempt has been made to investigate the composition of the micro algal forms present in the estuarine habitats of the Meghadrigedda drain of the Visakhapatnam. It is expecting that observing phytoplankton status in the mangrove area of Visakhapatnam is necessary to understand the hydrographical features and its influence on the organisms around the region.

Materials and Methods

Mangrove ecosystem of Visakhapatnam lies between latitudes 17^0 14′ to 17^0 45′ and longitudes 83^0 16′ to 18^0 21′ E. Meghadrigedda is a rain fed drain merges with Bay of Bengal at Visakhapatnam out Harbour. The tidal communication of the sea was recorded up to 3 KM of the stream. Two study sites were selected in the mini estuarine regions for collection of water samples. Two litre water samples were collected from the study sites and immediately fixed with 5% formalin solution to avoid the decay of the micro algal forms in the water. Then the samples transported to the laboratory and centrifuged at 3000 rpm for 15 minutes. The Phytoplankton counting was made in replicate on sedge wick rafter counting chamber. The species of the phytoplankton was identified by the following keys (Subramanyam, 1946; Prescott, 1951).

Results and Discussion

Seasonal data collected on hydrographical parameters of Station-1 and Station-2 of the Meghadrigedda drain was presented in Table.1. There is no much variation in hydrographical characteristics of two study sites of the Meghadrigedda drain system. There was no major difference in the physicochemical parameters in the study sites that were measured during the study period (Table-1).

Table 1: Average values of some Physico–chemical parameters and nutrients in two study sites during the study period.

Parameters	Station-1 (Bridge point)	Station-2 (Pipeline point)
Water temperature (°C)	25.7	24.5
Air temperature (°C)	34.9	32.4
Salinity (‰)	33	26
pH	6.7	7.0
DO (mg L^{-1})	4.42	3.63
Nitrate (mg L^{-1})	0.41	0.64
Phosphate (mg L^{-1})	0.045	0.065
Ammonium (mg L^{-1})	1.106	0.762

Generally, surface water temperature is influenced by the intensity of solar radiation, evaporation and insulation and the low temperature during monsoon could be due to strong sea breeze and cloudy sky (Saifullah *et al.,* 2014 Govindasamy and Kannan, 1996). It is revealed that phytoplankton diversity in different ecosystems and the effects of various biotic and abiotic on their population due to phytoplankton biomass, distribution and species composition continuously changed with variations in environmental temperature and nutrient availability (Cullen and Horrigan, 1981). The average surface water temperature at station one was 25.7ºC and of station two was 24.5ºC. The average air temperature values were recorded as 4.42 mg L^{-1} in station one and 3.93 mg L^{-1} in station two.

Average Salinity value of 33 ‰ was found higher in station one than station two (26 ‰). The salinity is the main physical parameter that can be attributed to the plankton diversity act as a limiting factor, which influences the distribution of plankton community (Saifullah *et al.,* 2014, Sridhar et al., 2006). Generally, changes in the salinity of brackish water habitats such as estuaries backwaters and mangrove are due to the influx of freshwater from land run off, caused by monsoon or by tidal variations. Water for both the study locations possesses mixed characteristics in terms of pH. The pH in surface water of study point one was 6.7 and of study point two was 7.0. Generally, fluctuations in pH values can be attributed to factors like removal of CO_2 by photosynthesis through bicarbonate degradation, dilution of seawater by freshwater influx, reduction of salinity and temperature and decomposition of organic matter (Saifullah *et al.,* 2014, Paramasivam, and Kannan, 2005). Average maximum value of D.O was 4.42 mg L^{-1} observed in station one compared to station two(3.63).

The present study revealed the influence of physico-chemical parameters and nutrients on the abundance and distribution of phytoplankton. The average nitrate value of 0.41mg L^{-1} was found at station one and of 0.64 mg L^{-1} at station two. The possible way of entering nitrate into the estuarine water is through oxidation of ammonia from nitrate to nitrite formation [Rajasegar, 2003]. The average phosphate value at station one was found to be 0.045 mg L^{-1} and at station two was 0.065mg L^{-1}. High concentration of inorganic phosphate is usually observed during monsoon might possibly be due to intrusion of upwelling seawater into the creek that increased the level of phosphate (Saifullah *et al*., 2014, Nair et al 1990). Recorded higher concentration of ammonium at station one and two was found to be 1.106 mg L^{-1} and 0.762 mg L^{-1} could be partially due to the death and subsequent decomposition of phytoplankton or other detritus matter. Nutrients are considered as one of the most important parameters in the estuarine environment influencing growth, reproduction and metabolic activities of living organisms.

Distributional pattern of nutrient depends on the surface runoff, seasonal fluctuation. Since the estuary transitions from nearly oceanic conditions at the mouth to freshwater at its extreme upstream limit, nutrient limitations also show a spatial trend with phosphorus more limiting at the freshwater extreme and nitrogen and silica more limiting freshwater extreme and nitrogen and silica more limiting near the mouth (Glibert et al.,1995). Nutrient concentration and availability are obvious factors controlling phytoplankton biomass (Ferguson et al., 2003, Jacquet et al., 2006) particularly in estuaries.

Generally, the distribution and abundance of phytoplankton varied remarkably due to the environmental fluctuations during season and these variations are well pronounced in the sheltered costal systems like mangroves (Rajkumar et al., 2009). A total 55 species of phytoplankton were identified from water samples collected from two stations of study area. Out of the 55 species, 8 species belongs to Chlorophyceae, 17 species of Bacillariophyceae 7 species belongs to Cyanophyceae and 2 species of Euglenophyceae (Table-2).

Table 2: List of phytoplankton reported in two study sites .during the study period

Taxa	Bridgepoint	Pipelinepoint
Chlorophyceae		
Chlorogonium euchlorum	+	+
Closterium acerosum	+	–
Cosmerium sp.	+	+
Coelanastrum indicum	+	–
Monoraphadium indicum	+	–
Scenedesmus sps	+	+
Chlamydomonas sps	+	–
Crucigera sps	–	+
Cyanophyceae		
Anabaena	+	–
Oscillatoria limosa	+	+
Spirulina platensis	+	+
Merismopedia sps	+	–
Aphanotheca gigantean	+	–
Microcystis sps	–	+
Phormidium sps	–	+
Euglenophyceae		
Euglena viridis	+	+
Phacus orbiscularis	+	+
Bacillariophyceae		
Navicula gregaria	+	+
Nitzschia logissima	+	+
Cyclotella meneghiniana	+	+
Cymbella cistula	+	+
Amphiprora gigantean	+	+
Synedra rumpens	—	+
Cocconeis pediculus	+	+
Fragillaria sps	+	–
Diatoma sps	+	–
Aulacoseira ambigua	+	–
Gyrosigma scalproides	+	–
Hantzschia sps	+	–
Skeletonema costatum	+	–
Pinnularia viridis	+	–
Stauroneisanceps	–	+
Nitzschia acuta	–	+
Gomphenema micropus	–	+
Achnanthus coarctata	–	+

The phytoplankton dominance recorded in the present study was similar to that of Bay of Bengal studied by (Gouda and Panigrahy, 1996). The distribution of phytoplankton depends on the environmental and nutrient conditions (Narasimha Rao and Prayaga, 2010). In Arabian sea Sawant and Madhupratap (1996) reported that the diatoms were the largest group followed by blue green algae. Radhakrishna et al. (1978) reported that the Nitzschia, Chaetoceros and Rhizosolenia were the dominant forms in the parts of Bay of Bengal. In the present study, changes in the distribution of phytoplankton may be due to changes in hydrographical conditions and light requirement of the species as reported by (Narasimha Rao and Prayaga,, 2010; Marshall, 1996). Among Chlorophyceae *Chlorogonium euchlorum*, *Cosmerium sp.*, *Scenedesmus sps* were common in both the study sites. *Closterium acerosum, Coelanastrum indicum* and *Chlamydomonas sps* were found in study site one and were not reported in study site two. *Crucigera sps.* was seen only in study site two. From the taxon Cyanophyceae, species such as *Oscillatoria limosa and Spirulina platensis* were reported from both the study sites during the study period. *Anabaena, Merismopedia sps. and Aphanotheca gigantean were found only at study site one. Microcystis sps and Phormidium sps were reported from study site two. Euglena viridis* and *Phacus orbiscularis of the taxon* Euglenophyceae were reported from both the study sites**.** *Navicula gregaria, Nitzschia logissima, Cyclotella meneghiniana, Cymbella cistula, Amphiprora gigantean, Cocconeis pediculus of bacillariophyceae were found in both the studt sites. Fragillaria sps, Diatoma sps, Aulacoseira ambigua, Gyrosigma scalproides, Hantzschia sps, Skeletonema costatum and Pinnularia viridis were seen in study site one where as Stauroneisanceps sps., Nitzschia acuta, Gomphenema micropus and Achnanthus coarctata were reported from study site two.*

The distribution of the groups of phytoplankton was found mainly influenced by temperature, pH, salinity, and nutrients viz. phosphate and ammonium and DO and the influence was higher in station one.

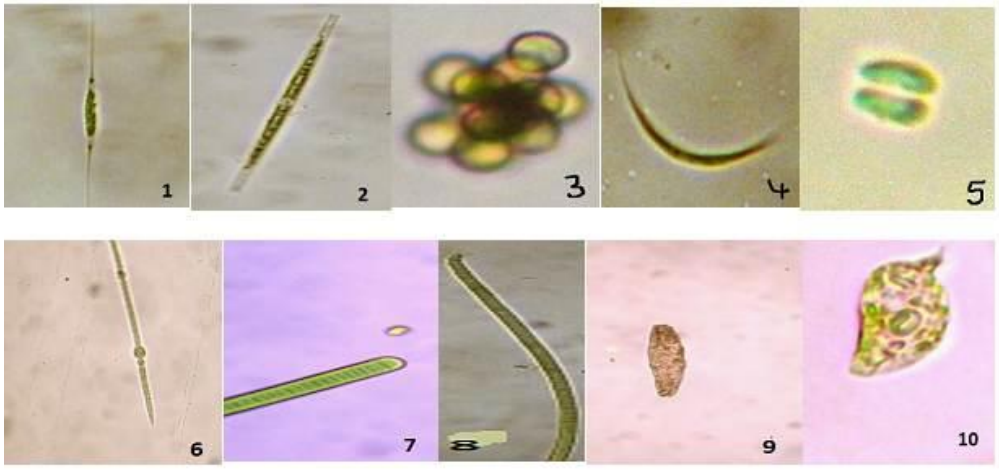
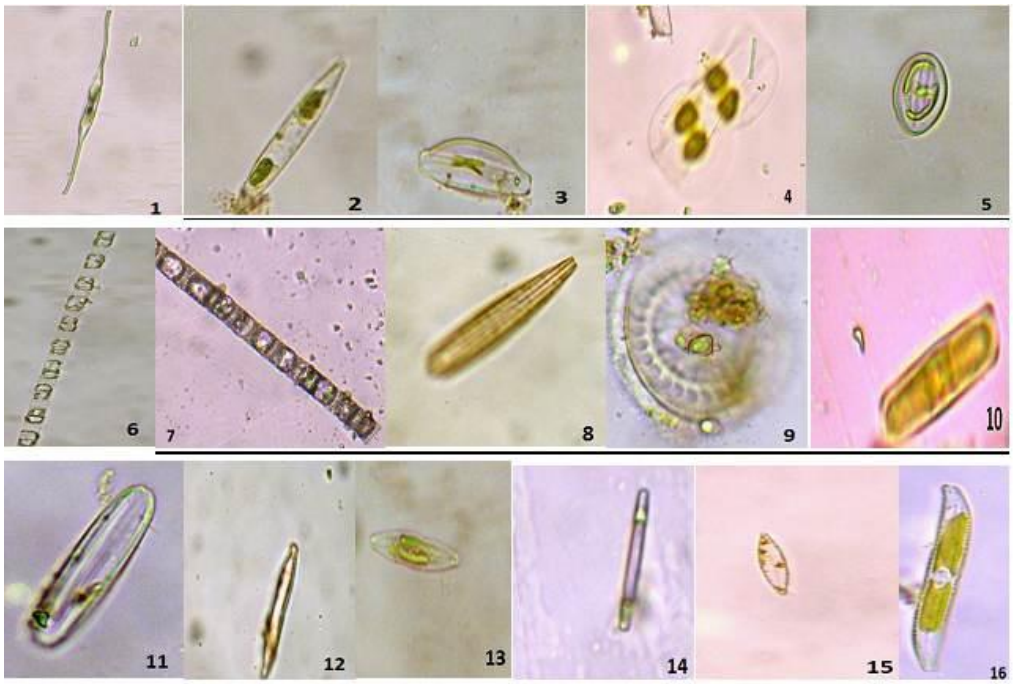


Plate –1 . Phytoplankton observed during the study period. 1) *Chlorogonium euchlorum 2) Closterium acerosum 3) Coelanastrum indicum 4) Monoraphadium indicum* 5) *Scenedesmu sps 6) Anabaena constricta 7) Phormidium sps 8) Oscillatoria limosa 9) Euglena viridis 10) Phacus orbiscularis*



Plate– 2. Phytoplankton observed during the study period. 1) *Nitzschia longissima 2) Nitzschia acuta 3) Cymbella cistula. 4) Amphiprora gigantean 5) Cocconeis pediculus 6) Skeletonema costatum7) Aulacoseira ambigua 8) Gomphonema micropus 9) Cyclotella meneghiniana 10) Pinnularia viridis 11) Achnanthes coarctata 12) Hantzschia sps 13) Navicula gregaria 14) Synedra rumpens 15) Stauroneis sps 16) Gyrosigma scalproides*

Conclusions

Diatoms were found most dominant group of phytoplankton in both the locations. Some common phytoplankton species were found in both the estuaries though there was difference in physico-chemical characteristics of water. The abundance and diversity of phytoplankton were influenced by water quality parameters. Present study will provide the baseline information for further investigation on density of phytoplankton in relation to nutrients and organic matter.

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