

First and New Record of *Ceratium vulture* v. *sumatranum* and *Pediastrum species* from coastal waters of Paradip, Bay of Bengal, East Coast of India

Anupama Pati¹, Rajesh Kumar Behera^{1, 2}, Saumya Dash¹, Pradipta Kumar Mohapatra², R.K.Sarangi³, Dipti Raut¹, Biswaprajna Mohanty¹ & Lipika Patnaik*¹

¹ Department of Zoology, Ravenshaw University, Cuttack, 753003, Orissa, India

² Department of Botany, Ravenshaw University, Cuttack, 753003, Orissa, India

³ Marine Ecosystem Division, BPSG/EPISA, Space Applications Centre (ISRO), Ahmedabad, 380015, India

*[E mail: lipikapat@gmail.com]

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Plankton diversity studies were carried out in the coastal waters of Paradip, Bay of Bengal from January 2015 to October 2015. There was broad variation in plankton diversity and water quality indices. Higher number of plankton taxa was reported in the month of October when SST, DO and nutrient (NO₃ and SiO₃) concentration was also higher. In the month of October the SST value was 30.80°C and dissolved oxygen varied from 3.28mg/l to 5.21mg/l. Nitrate and silicate both show maximum in October month i.e., 76.89µM/l and 36.67µg/l respectively. Salinity was maximum in the month of March (37.21ppt) and minimum in the month of October (23.95ppt). Phosphate was maximum in January month (0.113mg/l) and minimum in March (0.08mg/l). Nutrients (nitrate and silicate), SST, DO and Salinity act as limiting factor in the distribution pattern of planktons.

[**Key words:** Plankton, Physicochemical parameters, nutrients]

Introduction

Phytoplanktons are the only organism which can synthesise organic compound from inorganic nutrients, contribute to about 90% of total atmospheric oxygen and form the baseline of the aquatic food web. They provide vital source of food to a wide range of species, from microscopic zooplanktons to huge whales in marine eco system^{1,2}. The Bay of Bengal connects a number of rivers along Odisha coast and receives about 6.6% of total global river fluxes³. During monsoon season nutrient are injected into the mouth of Bay of Bengal, which significantly affects the growth of phytoplanktons. The vertical distribution of phytoplankton influences primary production and energy flow in the tropic levels⁴. Vertical stratification and gravitational settling of nutrients predicts the homogenous distribution of phytoplankton biomass⁵. Upwelling and down welling of nutrients play significant and crucial role in the phytoplankton growth. Planktons can be used as bio indicators for assessing the water quality, which will in turn determine the type of organisms thriving in it. Significant research work has been done worldwide in relation to phytoplankton diversity and its relation with water quality parameter. Some of the

notable studies include report on Gulf of Aquaba⁶, Northern Arabian Sea⁷, Bay of Bengal water⁸, Palk Bay, South east coast of India⁹, coastal water of Chennai¹⁰ and Eastern Indian Coast¹¹. The present investigation is based on observation of phytoplankton variability and its relation with other water quality indices in coastal water of Paradip as no work has been done in this region pertaining to Phytoplankton diversity.

Materials and Methods

Sampling was done in coastal waters of Paradip with geographical co-ordinate 20°17'6.4"N and 86°42'9.67"E. The study area covered 10 different stations starting from 0km to 10km into the sea. The starting point was after Mahanadi river mouth and the following points were approximately one kilometre apart from each other. Samples were collected for analysing plankton diversity and different water quality parameters. The samples were collected bimonthly. Water samples from different depths were collected using Niskin water sampler and then transferred to tarson containers for storage. Plankton collection was done on-site by filtering water through plankton net and was preserved using Lugol's iodine.

SST was also measured on site by using a precision thermometer. Samples for dissolved oxygen were fixed immediately after transfer into BOD bottles. Other parameters like salinity, nitrate, phosphate and silicate were analysed in the laboratory as per the standard methods¹².

Results and Discussion

The results show seasonal variability in water quality which also influences the phytoplankton diversity. The SST was minimum in January (22.08°C) and maximum in October (30.80°C). Seasonal variation in SST was observed to be affected by atmospheric temperature. In October month suitable nutrient concentration supported phytoplankton density which in turn traps high solar radiation, thus the SST value increased in this month as compared to the other months. Salinity is an important limiting factor for marine plankton growth. During the study lowest salinity was reported in the month of October (23.95ppt) and it was slightly increased in January (24.7ppt) but it was highest in the month of March (37.2ppt). The increased value of salinity during March month was due to higher evaporation rate. Likewise dissolved oxygen also varied seasonally showing minimum value in March (3.28mg/l) and maximum in October (5.21mg/l). Nitrate was maximum in October (76.89µM/l) and minimum in January (9.61µM/l). This variation was due to winter cooling, which reduced microbial activity hence less production of organic matter was done. Silicate concentration in Paradip water ranged from minimum (21.25µg/l) to maximum (36.67µg/l). The silicate concentration variation was also due to microbial activity. Mild deviation in the concentration of phosphate was observed compared to other nutrients. Phosphate value was maximum in January (0.113mg/l) and minimum in March (0.08mg/l). This deviation shows that phosphate concentration in Paradip water was not only affected by microbial activity but it was also introduced in to the water through other anthropogenic sources. It may be noted that the increased water temperature and high microbial activity induced faster nutrient regeneration and higher dissolved nitrate level which could also be well co-related with the phytoplankton density. Riverine flow from Mahanadi and organic matter input from the harbour and port area has increased the nutrient load. The result revealed that plankton density in Paradip region increased with increase in temperature, dissolved oxygen, nitrate and

silicate. Prolonged analysis of plankton diversity and related water quality parameter is necessary for predicting the impact of plankton and nutrient load on coastal primary productivity. The two new species recorded in the coastal waters of Paradip are *Ceratium vulture* v. *sumatranum* and *Pediastrum species* (Fig1a, Fig2a-c). Occurrence of *ceratium vulture* v. *sumatranum* was reported in Cochin backwaters in the year 1972¹³ and there are no reports from coastal waters of Bay of Bengal, Odisha. *Ceratium vulture* v. *sumatranum* in coastal waters of Paradip was observed only at 5 kms of offshore sampling. The number of *Ceratium vulture* v. *sumatranum* was found to be very low throughout the monitoring and sampling phase. *Ceratium vulture* v. *sumatranum* forms typical chain like structure and appears to be triangular based on its horns (Cleve, 1900 [51-66]). The central horn of *Ceratium* is comparatively shorter to that of right and left horn. First and new

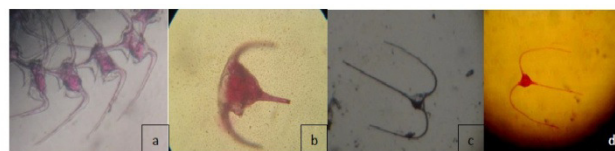


Fig. 1 a. — *Ceratium vulture* v. *sumatranum* (New species in Paradip coastal waters) b. *Ceratium symmetricum* c-d. *Ceratium trichoceros*

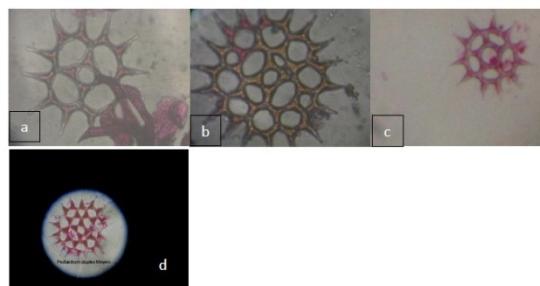


Fig.2 — a-c. *Pediastrum simplex* d. *Pediastrum duplex*

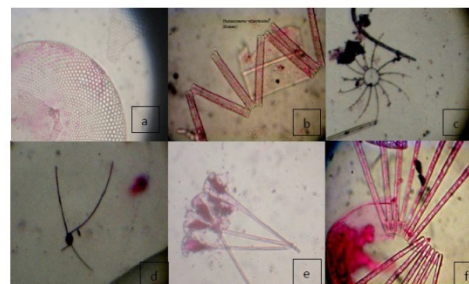


Fig. 3 — a. *Coscinodiscus* sp., b. *Thalassiothrix* sp., c. *Bacteriastrum hyalinum*, d. *Chaetoceros danicus*, e. *Asterionellopsis glacialis*, f. *Thalassiothrix mediterranea*,

occurrence of *Pediastrum* and *Ceratium* species has been reported from Rusikulya estuary¹⁴. Other phytoplankton species observed were *Ceratium symmetricum*, *Ceratium trichoceros*, *Asterionellopsis glacialis*, *Coscinodiscus* sp., *Thalassiothrix* sp., *Bacteriastrum hyalinum*, *Chaetoceros danicus*, *Thalassiothrix mediterranea*, *Thalassionema nitzschioides* (Fig 1b-d, Fig3a-d). Genus *Ceratium* was found to be the dominant dinoflagellate in the waters of Red sea¹⁵ and Grand-Lahou Lagoon¹⁶ and are presumed to be important tool for defining ocean current and temperature.

Conclusion

The results show seasonal variation of plankton in Paradip coastal water and its relation with other water quality indices. The present study is the first report of *Ceratium vulture* v. *sumatranum* from the waters off Paradip, Odisha, India. From this result it was concluded that Paradip is a nutrient rich area which supports different phytoplankton species. Paradip water is also influenced by several geophysical as well as anthropogenic activities. Hence regular investigation of plankton density and water quality parameter in coastal water of Paradip should be done to analyse its environmental status.

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