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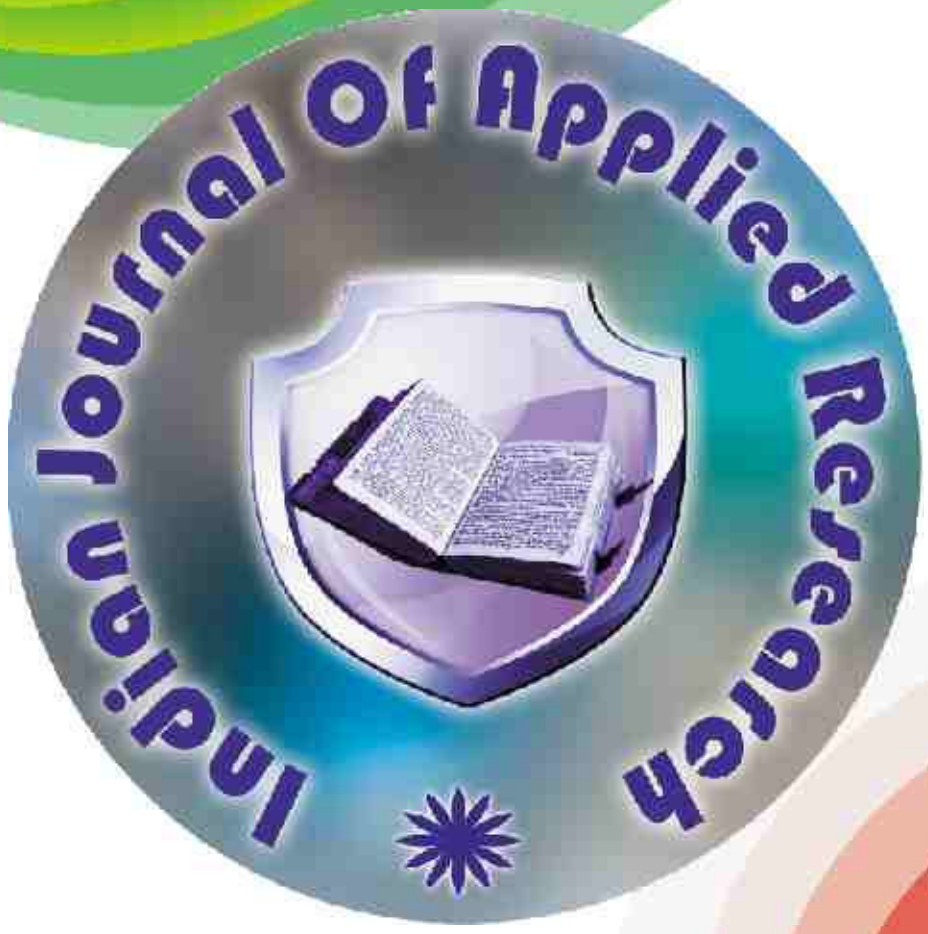

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Research Paper Environmental Science

Phytoplankton Diversity From Godavari River Water (Maharashtra)

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ABSTRACT

The Phytoplankton sampling and physicochemical parameters on monthly basis were carried out for a period of two years from October 2009 to September 2011 from Godavari River water. Standard keys and other literature were used for identification of different species. Four major groups of phytoplankton (Chlorophyceae Bacilloriophyceae, Cynophyceae and Euglenophyceae.) were studied for diversity and seasonal abundance. Among the groups of phytoplanktons, the population density showed variations due to their adaptability to seasonal changes in water quality. Some plankton population disappeared at a specified period and reappeared during other period. This disappearance may be due to the fact that some species occur in spores, under favorable conditions spore germinate and appear as plankton. Assessment of river water bodies with reference to species diversity of flora was done in three different seasons' summer, monsoon and winter.

Keywords : Godavari River Water, Water quality, Phytoplankton diversity.

Introduction

Water is one of the most natural resources for all the living organisms, weather unicellular or multi cellular, since it is required for various domestic purposes irrigation, shipping, power generation and industries. The man's influence on these water bodies caused by rapid cutting of surrounding vegetation, thus increasing silt and nutrient load, disposal of sewage and industrial waters, use for defecation, cultural activities, and agriculture chemicals greatly increased the quantity of nutrients and organic input into a water body (Patil. et.al. 2011). Considering ecological, economical and recreational promise of the water body, present work was undertaken to assess water quality in terms of its physicochemical nature, and seasonal diversity and population density of Phytoplankton. In the present study attempt was made to study eco-sustainability assessment of Godavari river water flowing in Maharashtra from Nasik to Nanded by studying phytoplankton quantification and their seasonal abundance and their seasonal diversity to indicate the sustainability of water from drinking point of view.

Material and Methods

Survey of Godavari river water bodies was carried out to assess the phytoplankton quantification and their seasonal abundance for their seasonal diversity to indicate the sustainability of water quality at different stations of upper and lower Godavari to know the present status of Water Quality. Nearly of about 12 sampling stations were selected after survey such as Trimbakeshwar-S1, Downstream of Ramkund at Nasik bridge-S2, Niphad-S3, Kopergaon Bridge-S4, Nandur Madhemeshwar Dam-S5, Kaygaon Toka-S6, Jaikwadi Dam-S7, Kholi Naka-S8, Shahgad Bridge-S9, Dhangar Takli-S10, Vishnupuri Dam at Nanded-S11 and Rawer-S12, from upper Godavari and lower Godavari river basin approximately at the distance of 50 km, as per the guidelines of Maharashtra Pollution Control Board and Central Pollution Control Board. The water samples for physicochemical analysis were collected from Godavari river water between 8am to 11am in last week of every month. The samples were collected in acid washed plastic bottles from depth 5-10cms below the surface of water. Separate samples were collected for dissolved oxygen in 250 ml bottles. The dissolved oxygen in the BOD bottles was fixed in the field itself by adding alkaline iodide-azide solution immediately after collection (Jadhavar. et.al. 2010). The analysis of samples was carried out in the research laboratory. The survey of Godavari river water is carried out with references to species diversity of flora such as location, nature of catchment area and main human activities. Seasonal population density of flora (Trivedy et.al. 1987) was also carried out qualitatively to evaluate their biotic potential. The Phytoplankton sampling on monthly basis was carried out for a period of two years from October 2009 to September 2011 from Godavari river water. For qualitative analysis a compound microscope was used. Standard key and other literature were used for identification of different species (Auti et. al. 2003, Patil et. al 2008)

Results and Discussion

Water quality characteristics were carried out in summer, monsoon and winter from different locations all along the Godavari river bed from Nashik to Nanded the river end of Maharashtra (Table-1). The temperature recorded at high levels in summer due to increasing temperature in the surrounding environment and reduction of water flow into the river. Whereas, dissolved oxygen, BOD and COD were at low levels. Dissolved oxygen was high in winter due to the increased water level and low turbidity and also due to increased biotic activity like photosynthesis of algal biomass. In monsoon, alkalinity were at high levels where as pH was at low level. The pH was ranged between 6.73 to 7.98 which are favorable for life in water body. pH plays an important role in the interaction between heavy metals and parameters such as carbonates, bicarbonates, hardness and organic compound. The increase in alkalinity during summer may be due to agricultural runoff in addition to the domestic wastes from nearby villages.

The higher alkalinity of water also may be due to the accumulation of carbonate salts from surrounding and removal of carbon dioxide due to excessive photosynthesis. The observed low values of dissolved oxygen from the locations studied from river water might be attributed to the activity of domestic sewage causing anoxic conditions due to decay of organic matter. The maximum values of dissolved oxygen in winter were probably accounted due to progressive lowering of turbidity resulting in resumption of photosynthetic activity in the river water at particular locations.

In winter, high values of COD indicated high organic load in to the water bodies and high organic waste disposal on the shore of the river and municipal waste discharge into the water body. Low COD concentrations in summer due to strength of population in relation to dilution available from clear water flow. The untreated domestic sewage are being dumped into the river resulting in accumulation of large amounts of organic matter thereby giving a high biological oxygen demand, while the lower values of BOD from summer indicated the retaining capacity of water to recover from pollution stress or organic substance.

In the present study among the group of phytoplankton's the Chlorophyceae were recorded maximum flowed by Bacilloriphyceae, Euglenophyceae and Cynophyceae (Table-2).

In summer and monsoon at all stations the Chlorophyceae was maximum followed by Bacilloriophyceae, Cynophyceae and Euglenophyceae. However, in winter Bacilloriophyceae was maximum followed by Chlorophyceae, cynophyceae and Euglenophyceae.

Some plankton population disappeared at a specified period and reappeared during other period. This disappearance may be due to the fact that some species occur in spores, under favorable conditions spore germinate and appear as plankton (Dahiwale, 2008) (Plate I & II).

In the present study it is observed those 10 genera of Chlorophyceae, 6 genera of Bacilloriophyceae, 5 genera of Cynophyceae and 4 genera of Euglenophyceae. Chlamydomonas, Cladophora, Oedogenium and pediastream species were dominant from Chlorophyceae probably due to favourable environmental conditions (Kumawat and Jawale 2003; Yeole and Patil 2005; Pawar et.al. 2006) Low phytoplankton's especially Euglenophyceae was observed to be less in quantity in almost all the stations during all the seasons (Somani and Pejavar, 2003) (Table-3).

The Bacilloriophyceae was maximum in summer and minimum in monsoon in almost all the stations. The production of phytoplankton is directly correlated with phosphate, silicates as well as nitrogen (Borse et.al. 2000). Cyanophyceae are found generally on rocks or soil forming a blackish crust when dried out. It contains Chlorophyll a Phycobicyanin and other pigments help the algae to synthesize their own food from carbon dioxide and water in presence of sunlight (Bhadran, 2001). The Euglenophyceae are in greater number at organically polluted water bodies. Munawar (1974) observed blue green algae and euglenoid flagellater's were mostly associated with organically rich effluents, low in dissolved oxygen. In the present study, Euglenophyceae was found to be maximum in summer and minimum in winter water in almost all stations due to sufficient amount of dissolved oxygen and good amount of nutrients (Pendse et.al. 2000). The temperature ranged 28-350 C, low pH and high iron content are also favorable factors for the growth of Euglenophyceae (Borse et.al. 2000; Pendse et.al. 2000; Bhadran, 2001).

The conservation of Godavari river water is in interest of man as it's ecological, cultural and tourist value is immense. This study will help in understanding the amount of toxic compounds being received in river and its biological magnification in animals particularly those at the lower level of food chain. This study will also help to make aware the local peoples for proper management of waste disposal and also to minimize the waste land and its biological magnification of toxic metals due to toxic compounds in food chain, which is a challenge to scientists, policy makers, administrators and all those involved in the conservation of the environment. Thus there is need to stop these ecologically destructive developments in the river and its environment.

Conservation of the fresh water bodies including all rivers must be considered as pious duty of the State and the citizens of the Country. The river must be conserved at any cost for the benefit of the present and future generations. No commercial and selfish interests should be allowed to play their diabolical role and the State should achieve the national goal of the potable water to all free of cost.

TABLE-1: Water Quality Criteria of Godavari River water.

Sr. No.	Parameter	Winter	Summer	Monsoon
1.	Water Temperature (^{0}C)	27.62-20.4	30.24-28.2	29.26-26.6
2.	PH	7.94-7.2	7.98-6.73	7.73-6.97
3.	Electrical Conductivity **mhos/cm**	289.50-215.62	310.62-224.6	259.62-218.9
4.	Alkalinity	489.34-338.3	524.3-402.68	496.4-349.2
6.	Nitrate	5.93-3.82	6.21-2.69	6.73-4.05
5.	Dissolved Oxygen	9.13-6.34	8.34-6.42	8.69-5.98
7.	B.O.D.	12.57-2.48	14.46-3.46	13.83-2.85
8.	C.O.D.	53.41-15.54	70.04-18.68	52.46-10.09

(All the values are in mg/lit. except temperature, conductivity and pH).

PLATE I (Phytoplankton)

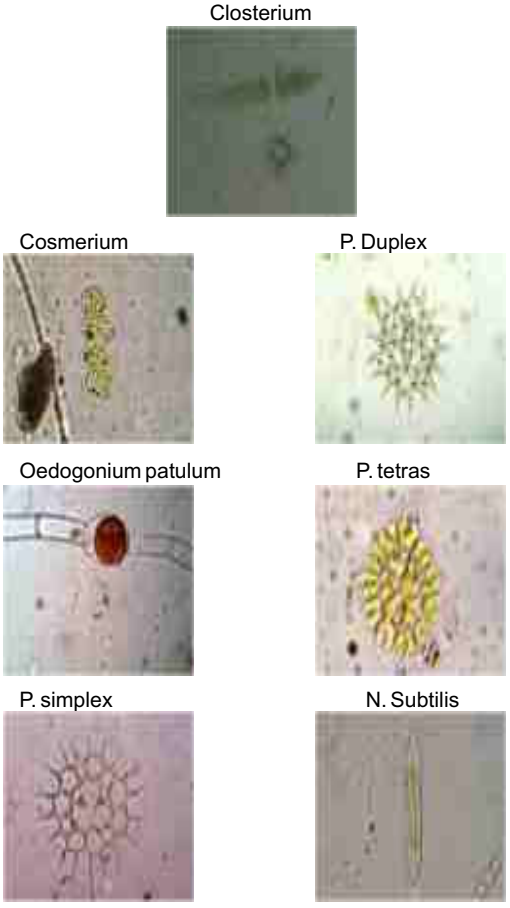

TABLE-3: Phytoplankton population of Godavari River Water.

Sr. No.	Phytoplankton	Species
1.	**Chlorophyceae**	Closterium, Cosmerium
2.	**Bacilloriphyceae**	P. Duplex , Oedogonium patulum
3.	**Euglenophyceae**	P. tetras , P. simplex , N. subtilis
4.	**Cynophyceae**	E. acus, Nitzshia, Navicula accomoda O. chlorine, O. cortiana, Spirulina E. granulate

TABLE-2: Seasonal Variation in Phytoplankton's (per ml) at different stations along the bank of Godavari River from Maharashtra (2009-2011).

Phytoplanktons	S1			S2			S3			S4		
Seasons	S	M	W	S	M	W	S	M	W	S	M	W
Chlorophyceae	38 33.93%	21 25.30%	13 27.66%	46 34.33%	29 28.71%	15 21.43%	30 38.5%	36 37.11%	28 38.36	49 33.11%	53 34.87%	39 35.14%
Bacilloriophyceae	32 28.57%	16 19.28%	12 25.73%	38 28.36%	18 17.82%	19 27.14%	28 23.73%	29 29.90%	17 23.29%	39 26.35%	29 19.08%	24 21.62%
Cynophyceae	24 21.43%	33 39.76%	13 27.66	27 20.15%	36 35.64%	22 31.43%	26 22.03%	21 21.65%	19 26.03%	29 19.59%	33 21.71%	23 20.72%
Euglenophyceae	18 16.07%	13 15.66%	09 19.15%	23 17.16%	13 12.87%	14 20.00%	14 11.86%	11 11.34%	09 12.33%	31 20.95%	37 24.37%	25 22.52%
Total	112	83	47	134	101	70	118	97	73	148	152	111
Phytoplanktons	S5			S6			S7			S8		
Seasons	S	M	W	S	M	W	S	M	W	S	M	W
Chlorophyceae	53 35.33%	46 30.67%	42 36.52%	47 32.64%	43 33.59%	39 40.63%	67 37.64%	53 30.64%	48 36.36%	54 36.24%	62 41.61%	47 40.86%
Bacilloriophyceae	42 28.0%	39 26.0%	26 22.61%	31 21.53%	39 30.47%	24 25.0%	47 26.40%	49 28.32%	38 28.79%	43 28.86%	40 26.85%	31 26.96%
Cynophyceae	29 19.33%	36 24.0%	30 26.09%	37 25.69%	29 22.66%	22 22.92%	33 18.54%	38 21.89%	25 18.94%	29 19.46%	28 18.79%	20 17.39%
Euglenophyceae	26 27.33%	29 19.33%	17 14.53%	29 20.14%	17 13.28%	11 11.46%	31 17.42%	33 19.08%	21 15.91%	23 15.44%	19 12.75%	17 14.78%
Total	150	150	115	144	128	96	178	173	132	149	149	115
Phytoplanktons	S9			S10			S11			S12		
Seasons	S	M	W	S	M	W	S	M	W	S	M	W
Chlorophyceae	60 41.38%	69 49.64%	48 48.48%	62 38.51%	46 41.07%	34 38.64%	69 40.35%	58 42.34%	45 40.91%	53 38.97%	58 44.27%	42 44.68%
Bacilloriophyceae	39 26.90%	27 19.42%	21 21.21%	43 26.71	36 32.14%	29 32.95%	41 23.98%	31 22.63%	26 23.64%	33 24.26%	37 28.24%	24 25.53%
Cynophyceae	19 13.10%	14 10.07%	10 9.9%	29 18.01%	16 14.28%	13 14.77%	38 22.22%	29 21.17%	22 20.0%	29 21.32%	20 15.27%	15 15.96%
Euglenophyceae	27 18.62%	29 20.86%	20 18.18%	27 16.77%	14 12.5%	12 13.64%	23 13.45%	19 13.87%	17 15.45%	21 15.44%	16 12.21%	13 13.83%
Total	145	139	99	161	112	88	171	137	110	136	131	94

(S1to S12= Station 1 to Station 12). (S = Summer, M = Monsoon, W = Winter).

PLATE II (Phytoplankton)

E. Acus

Nitzshia

Navicula accomoda

O. Chlorina

O. Cortiana

Spirulina

E. granulate

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