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Distribution of Microalgae in Aquatic Environment of River Narmada at Mandla District

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Abstract:- Aquatic algae has drawn much attention due to their primary productivity in the food chain of water ecosystem diversity, their biological assessment of water quality, pollution abatement capacity and as a source of structurally novel and biologically active metabolites with antimicrobial capacity etc. Distribution of fresh water algae of River Narmada in Mandla, Madhya Pradesh, has been investigated. Fresh water algal samples for a period of three consecutive years were collected seasonally viz., winter,summer and rainy seasons from two unexplored selected sites along the bank of River Narmada. Seventeen algal taxa comprising eight Chlorophyceae, four Cyanophyceae and five Chrysophyceae as unicellular, colonials and filamentous algae were identified based on microscopic observation and characters such as average filament length, colonial characteristics. Results revealed that these microalgae belonging to three major classes Chlorophyceae (green algae), Bacillariophyceae (diatoms) and Cyanophyceae (blue green algae) follows a seasonal succession in their distribution and abundance. Maximum algal taxa belonged to green algae followed by blue- green algae and diatoms. The occurrence of fresh water algae, their diversity and distribution was interpreted with water quality and its physico-chemical characteristics. The present study not only discusses the basic information of fresh water algal presence, distribution but also helps for future environmental monitoring studies.

Keywords:- *Aquatic Algae, River Narmada, Mandla District.*

I. INTRODUCTION

The genetic and phenotypic diversity of algae is manifested in their nearly ubiquitous distribution in the biosphere. Fresh water ecosystems vary in size and composition and contain a large variety of organism. Microalgae are vast group of prokaryotic and eukaryotic photosynthetic organisms found in many different forms viz. individual cells, colonies or extended filaments and exhibit vast diversity in the ecosystem [1].Morphology and physiology of the individual cells are the fundamental basis on which the algae were classified. They are cosmopolitan in nature found everywhere like oceans, lakes, rivers, ponds, puddles, moist surfaces and fresh water etc. [2]. These organism's potential can be utilized in various fields such as agriculture, feed, fine chemicals, bio energy and bioremediation. They are also rich source of carbohydrates, proteins and other nutrients, similar to higher plants [3, 4].Algae are considered as of the most helpful indicators of water quality [5, 6]. The algal community both planktonic and benthic are important among other aquatic organisms inhabits at different depths, where environment of water influence the algal diversity [7]. The dominance of green algae and diatoms presence in relatively clean and oligotrophic water bodies, whereas bluegreen algae bloom formation indicates that the water body is polluted or eutrophic. Few survey report based on the assessment of water quality as an ecological parameters are available for India [8,9] but fresh water algal floristic identification and water quality monitoring in aquatic bodies of tribal regions of Madhya Pradesh is absolutely neglected .Water quality refers to the physical, chemical and biological characteristics of the water environment [10].Therefore, the present investigation has been carried out to assess fresh water algal diversity along with the physico-chemical parameters of the water to interpret water quality. The River Narmada is the important river of India flowing westerly and is the fifth largest river of India. Due to its sacred importance this river is in direct influence of human interferences along the bank sides of the cities.

II. MATERIALS AND METHOD

Mandla district is situated in the eastern-central part of Madhya Pradesh. The district lies entirely in the catchment of river Narmada and its tributaries. It comprises rich amount of rivers and forest. The extreme length of the district is about 133 kilometers from north to south. It covers a total area of 8771kilometer and consists of a total population of 779414. The town is situated in a loop of Namada River that surrounds it on three sides and for 15 miles between Mandla and Ramnagar, the river flows ina deep bed unbroken by rocks. The Mandla district is having 17 ghats alongthe bank of river Namada as, Khair ,Shamshan, Hanuman,Peepal,Vaidyaghat,Rangreighat, Naoghat. Sangamghat, Singhvahinighat andJalghat, Kacharighat, Raptaghat, Deodarghat, Shamshanghat. Two sampling sites were marked for the study:

Raptaghat -This area is in regular disturbance of human activities. A sewage drainage system directly discharges its effluents at this site, is a major source of pollution.The major tributary River Benjar joins to River Narmada and it leaves Mandla town at this sampling site .

Rangrejghat- This sampling site is in direct contact of industrial effluents of Mandla. The ferry to cross the river is situated at this station. Wooden dugouts transports people

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throughout the year and this site is highly disturbed by the Human activities.

For analyzing water quality of river Narmada, the water samples were collected seasonally from the marked stations for a period of three consecutive years of study. The water samples were analyzed by following the methods of APHA [11,12].

Algal samples were studied morphologically and taxonomic characterization was as per the standard keys available in monographs and research literatures. [13,14, 15].

III. RESULTS AND DISCUSSION

Chlorophyceae constitute the dominant flora in the winter season. *Spirogy*ra, *Cosmarium* and *Mougeotia* were found in summer season also.

Oscillatoria and *Anabaena* were the dominant Cyanophycean reported during the winter seasons. Bacillariophyceae were found in the rainy season. The average mean values computed for all the algae to be present in all the three seasons is as Chlorophyceae – 6.0 (S.D. -7, Variance -49), Cyanophyceae -6.0 (S.D. -1.7, Variance -3), Bacillariophyceae – 12 (S.D. -7.5, Variance -57), i.e. Chlorophyceae = Cyanophyceae < Bacillariophyceae.[Table:1]

Maximum variance was found for Bacillariophyceae as their occurrence increased during the rainy season. The Chlorophyceae were maximum in the winter season, hence their standard deviation and variance was found to be high.During the low water regime, between January to June the decline in the riverdischarge and accumulation of sewage pollute the river. Withnegligibleoutflow, the river at Mandla form a standing water body similar to any deep reservoir during winter and summer time. The addition of fertilizers for raising crops on the sandy banks of River Narmada on the right and left bank at Mandla has increased loading of nitrogen, phosphorus and potassium into the river accelerating the level of eutrophication of the River water.

The pH Value recorded in the summer seasons from the two sampling stations was in the range of pH 7.0-7.2 and in winter pH 6.8 was reported. The summer temperature ranges between 24^0C to 35^0C, In winter the temperature was recorded as 18^0C and in the range of 22^0C to 26^0C in rainy seasons. Conductivity values was recorded as 70µmhoscm^{-1} in rainy season in summer and found to be increased at 90µmhoscm^{-1}in winter. Turbidity ranges 42 NTU in winter and the value increased to 45 NTU in summer and marked increase to 66 NTU in rainy season. The TDS unit of river water in winter season was 33.33 mgl^{-1} and maximum as 222 mgl^{-1} in summer. Dissolved oxygen was recorded minimum at its value 8.0 mgl^{-1} in the rainy season and 14 mgl^{-1} in winter.

Several factors are attributed to the variations in the temperature of river water as basin morphometry, altitude topography and vegetation. Air temperature strongly regulates the water temperature in the same climatic features and it plays a very important role in the acceleration and retardation of growth and reproduction of algae. So the dominance of Chlorophyceae in winter Cynanopyceae in summer shows that temperature affects the periodicity by accelerating or retarding the physiological processes of algae. This in concordance with [16,17,18], low pH indicates the discharge of untreated waste effluents into the river system and high pH values shows the high rate of photosynthesis which results in excess release of carbonate making the water alkaline. Most of these values are in concordance with the observations. [19]

River water receiving sewage and industrial effluents increases the number of ions discharge and hence the conductivity and is correlated with the abundance of Cyanophyceae indicates the pollution level of water: turbidity arises due to high amount of silts during the rains. Total dissolved solids TDS of the river water was found as 850 mg/l in the rainy season. Dissolved oxygen DO was found at level as 8.0 to 9.0 mg/l is probably due to presence of organic matter demanding more oxygen and it indicates the deterioration of the water quality.[Table :2]

The present study correlates the water quality with seasonal distribution patterns of various algal forms. It is found that in winter season Chlorophyceae showed positive correlation with dissolved oxygen and negative with temperature and pH and Cyanophyceae shows positive correlation with these factors.The population of planktons fluctuates in different seasons. The composition,distribution and abundance of algal population are governed by various physico-chemical factors of the river water.

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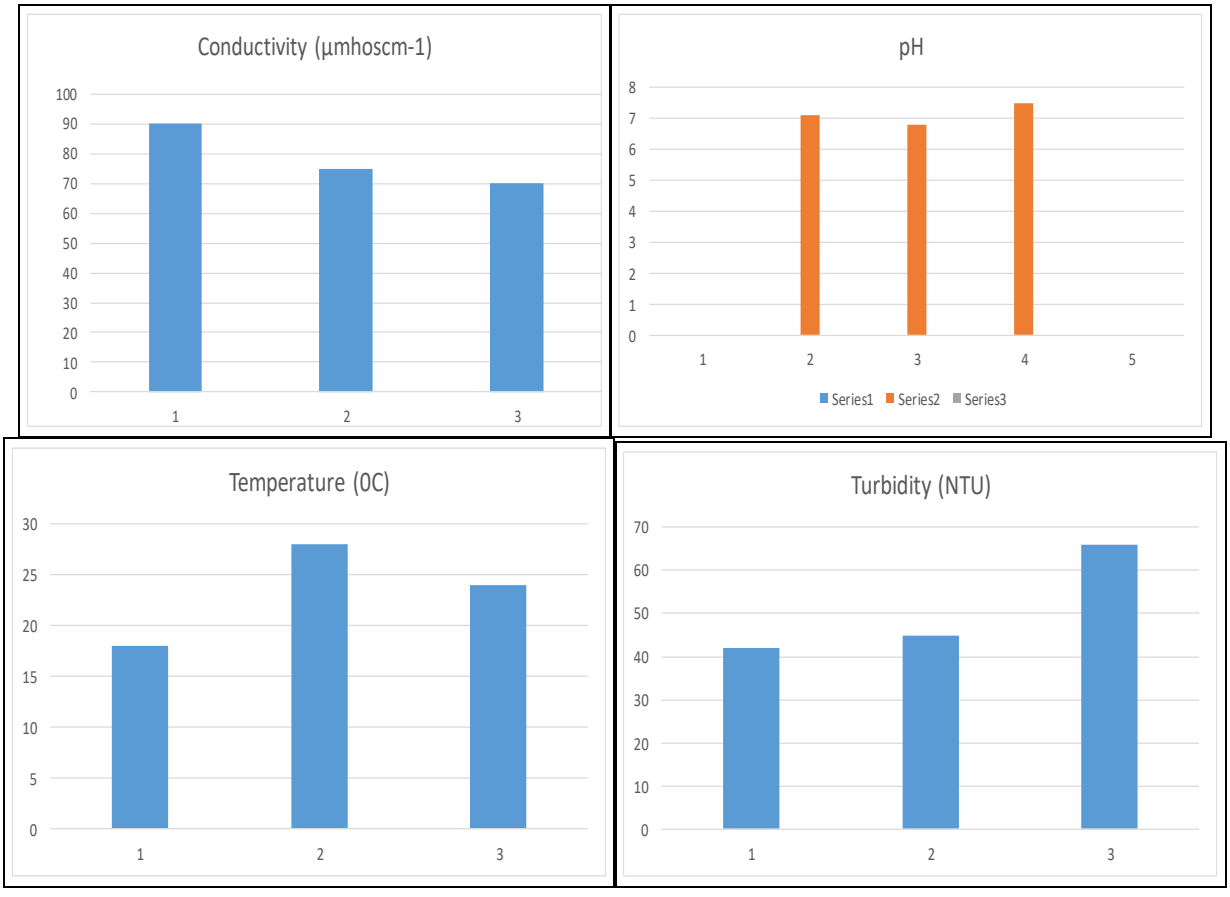
Chlorophyceae	Cyanophyceae	Bacillariophyceae
Oedogonium *Hydrodictyon* *Spirogyra* *Cosmarium* *Mougeotia* *Cosmarium* *Closterium* *Chlorococcum* *Scenedesmus*	*Chroococcus* *Oscillatoria* *Lyngbya* *Anabaena*	*Pinnularia* *Navicula* *Phacus* *Synedra* *Pennales*

Table 1:- Algal flora records of River Narmada in Mandla district in all the seasons [Summer,Winter and Rainy] during the course of study

Seasonal parameters	**Winter**	**Summer**	**Rainy**
pH	7.1	6.8	7.5
Conductivity ($\mu mhoscm^{-1}$)	90	75	70
Temperature (^0C)	18	28	24
Turbidity (NTU)	42	45	66
DO_2 (mgl^{-1})	14	12	8.0
TDS (mgl^{-1})	33.33	222	190

Table 2:- Physico-chemical analysis records [in average mean value] of River Narmada at Mandla district in all the seasons [Rainy, Winter and Summer]during the course of study



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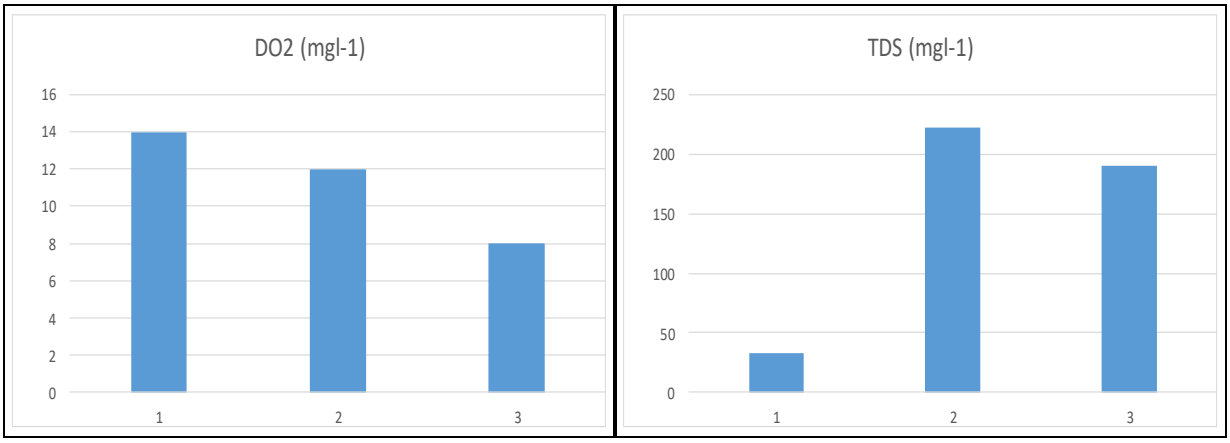

Fig 1

IV. CONCLUSION

The algal diversity of Mandla district consisted of three major classes Cyanophycae, Chlorophycae, and Bacillariophyceae and the water environment do play a defined role in their distribution. The occurence of green algae is relatively greater than blue green algae and diatoms.

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