



Diversity and distribution of phytoplankton in malhania dam

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Abstract

The existing study used to be to recognize the diversity and distribution pattern of microalgae in fresh water system represented by using an open Malhania dam. A whole of 73 species of phytoplanktons have been recognized from distinctive corporations at some point of March 2018 to February 2019. Among the identified phytoplankton species Cyanophyceae (36.99%) fashioned the dominant group, observed by means of Chlorophyceae (38.36%), Bacillariophyceae (19.17%) and Euglenophyceae (5.48%). The fluctuations in the physico-chemical parameters like pH, temperature, EC, DO, BOD, COD, turbidity, alkalinity, hardness, nitrate, silicate, phosphate and had been additionally been monitored. The result affords a primary documentation of the phytoplankton community and its variety and basic appreciation of hydrological variables in the pond ecosystem.

Keywords: phytoplankton diversity, malhania dam, physico-chemical parameter

1. Introduction

Malhania dam is situated in Dewargaon. According to Census 2011 information the location code or village code of Dewargaon village is 437475. Dewargaon village is located in Pendra Road Gorella Tehsil of Bilaspur district in Chhattisgarh, India. It is situated 6 km away from sub-district headquarter Gaurella and 115km away from district headquarter Bilaspur. As per 2009 stats, Dewargaon is the gram panchayat of Dewargaon village. The total geographical area of village is 1416.28 hectares. Dewargaon has a total population of 3,227 peoples. There are about 757 houses in Dewargaon village. Gaurella is nearest town to Dewargaon which is approximately 6km away.

The present aquatic body "Malhaniya dam" was constructed in the year 2002 on local nala of Dewargaon of Pendra road district Bilaspur. It is situated 22°-45'-20" latitude and 81°-96'-36" longitude. The height of the dam is 21.8 mt. and length 2700 mts. Mainly the water of this dam is used for irrigation and fish culturing. These freshwater communities are extraordinarily sensitive to environmental variations. It has been observed that periodicity and the distinction of phytoplanktonic populations depends on the environmental conditions. Therefore phytoplankton and some other macrophyte may be more useful bioindicators than other aquatic organism (Tunzi, 1972; Chiandan and Vighi, 1974 and Cluis *et al.* 1988)^[1-3]. Phytoplankton consists of several heaps of microalgae belonged to Chlorophyta (green algae), Cyanophyta (blue green algae), Bacillariophyta (diatoms), Euglenophyta (pigmented flagellate or phytoflagellated) etc. They reply rapidly to environmental changes and are used to check the ecological repute of water body.

Phytoplankton variety and succession in small man-made ponds are largely ignored. In the current find out about a try

has been made to assess the range of phytoplankton and their distribution and fluctuations in the hydrological variables in an Malhania dam.

2. Materials and Method

During the study duration from April, 2018 to March, 2019, sub-surface water samples had been accumulated in the iodine dealt with double stoppers plastic bottles in the morning hours of the day, from the south side Spill outlet station of Malhania dam. All collections have been made between 7.30 am to 9.30 am. for the duration of the study period. Phytoplankton samples have been amassed with the aid of filtering pond water thru plankton net with 25 µm mesh size. The filtrate was right now preserved in 4% formaldehyde. The phytoplankton samples had been located absolutely underneath microscope and have been identified with the help of standard literature (Fritsch, 1935; Desikachary, 1959 and Anand, 1998)^[4-6], and additionally analyzed few physico-chemical parameters as per widespread methods (APHA, 2005)^[7].

3. Results and Discussion

Phytoplankton in the synthetic cemented open fresh water pond was represented through four classes of algae *viz.* Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae. In the pond 73 species of phytoplankton participants had been identified amongst these Cyanophyceae consists of 27 species accompanied by using Chlorophyceae 28 species, Bacillariophyceae recorded 14 species and Euglenophyceae reported four species. Smart contribution of phytoplankton corporations are proven in Fig 1. Diversity of phytoplankton during the study period has been given in Table 1.

Table 1: List of phytoplankton identified from Malhania dam (March 2018 - February 2019)

S.No.	Classes	Species	%age	
1.	Euglenophyceae	<i>Euglena gracilis</i> Mallisch	4	5.48
		<i>Euglena sanguine</i> Ehrenberg,		
		<i>Phacus curvicauda</i> Swir. Skz.		
		<i>Phacus orbicularis</i>		
2.	Chlorophyceae	<i>Ankistrodesmus falcatus</i> (Corda.)	28	38.36
		<i>Chlorella vulgaris</i> Bayernick		
		<i>Chlorococcum humicola</i> (Nageli) Rabenhorst		
		<i>Cladophora glomerata</i> (L.) Kutzin		
		<i>Closterium acerosum</i> (Schrank.) Ehr.		
		<i>Closterium ehrenbergii</i> (Menegh.) ex Ralfs.		
		<i>Closterium incurvum</i> Brebisson		
		<i>Coelastrum indicum</i> Turner		
		<i>Cosmarium auriculatum</i> Reinsch		
		<i>Cosmarium granatum</i> Brebisson ex Ralfs		
		<i>Cosmarium pyramidatum</i> Brebisson ex Ralfs		
		<i>Cosmarium turgidum</i> Ralfs		
		<i>Crucigenia quadrata</i> Morren		
		<i>Crucigenia tetrapedia</i> Kirchner		
		<i>Euastrum spinulosum</i> Nordstedt		
		<i>Gleocystis gigas</i> (Kutzin) Lagerheim,		
		<i>Hydrodictyon reticulatum</i> (L) Bory,		
		<i>Oedogonium sp.</i> , <i>Oocystis elliptica</i> West,		
		<i>Pediastrum angulosum</i> (Ehr.) Menegh,		
		<i>Pediastrum duplex</i> Lagerheim,		
		<i>Pediastrum tetras</i> (Ehr.) Ralfs.,		
		<i>Scenedesmus armatus</i> (Chodat),		
		<i>Scenedesmus bijugatus</i> Kuetz.,		
		<i>Scenedesmus dimorphus</i> ,		
		<i>Selenastrum gracile</i> Reinsch,		
		<i>Spirogyra longata</i> (Vaucher) Kutzin,		
		<i>Staurastrum gracile</i> Ralfs ex Ralfs,		
		<i>Ulothrix zonata</i> (Kuetz),		
3.	Bacillariophyceae	<i>Amphora ovalis</i> Kuetz	14	19.17
		<i>Amphora veneta</i> Kutzin,		
		<i>Cymbella lanceolata</i> Breb,		
		<i>Fragilaria intermedia</i> (Grun.),		
		<i>Gomphonema gracile</i> Ehrenberg,		
		<i>Gomphonema parvulum</i> (Kutzin) Kutzin,		
		<i>Gyrosigma rautenbachiae</i> Cholnoky,		
		<i>Melosira varians</i> C.Agardh,		
		<i>Navicula cuspidate</i> Kuetz,		
		<i>Navicula radiosa</i> Kuetz.,		
		<i>Pinnularia simplex</i> Ehr.,		
		<i>Pinnularia viridis</i> (Nitzsch),		
		<i>Suriella elegans</i> Her,		
		<i>Synedra ulna</i> (Nitzsch.) Ehr.		
4.	Cyanophyceae	<i>Anabaena orientalis</i> S.C.Dixit,	27	36.99
		<i>Aphanocapsa bififormis</i> A.Br.,		
		<i>Aphanothece sp.</i> ,		
		<i>Arthrospira platensis</i> (Nordstedt) Gomont,		
		<i>Chroococcus minutus</i> (Kuetz) Nag.		
		<i>Chroococcus tenax</i> (Kirchn) Hieron,		
		<i>Chroococcus turgidus</i> (Kuetz) Nag,		
		<i>Eucapsis minuta</i> Fritsch,		
		<i>Gomphosphaeria aponina</i> Kuetz.,		
		<i>Lynghya spiralis</i> Geitler,		
		<i>Merismopedia elegans</i> Lemm,		
		<i>Merismopedia minima</i> Beck.,		
		<i>Merismopedia punctata</i> Meyen,		
		<i>Nostoc commune</i> Vaucher ex Born. Et Flah.,		
		<i>Nostoc muscorum</i> Ag.,		
		<i>Nostoc punctiforme</i> Hariot,		
		<i>Oscillatoria curviceps</i> C. Agardh ex Gomont,		
		<i>Oscillatoria formosa</i> Bory ex Gomont,		
		<i>Oscillatoria limosa</i> Ag. Ex Gomont,		
		<i>Oscillatoria princeps</i> Vaucher ex Gomont,		
<i>Oscillatoria subbrevis</i> Schmidle,				
<i>Oscillatoria tenuis</i> Ag. ex Gomont,				
<i>Phormidium fragile</i> (Meneghini) Gomont,				

		<i>Phormidium inundatum</i> Kutzing ex Gomont,		
		<i>Phormidium tenue</i> Gomont,		
		<i>Rivularia aquatica</i> De Wilde.,		
		<i>Spirulina</i> sp.		
			73	100

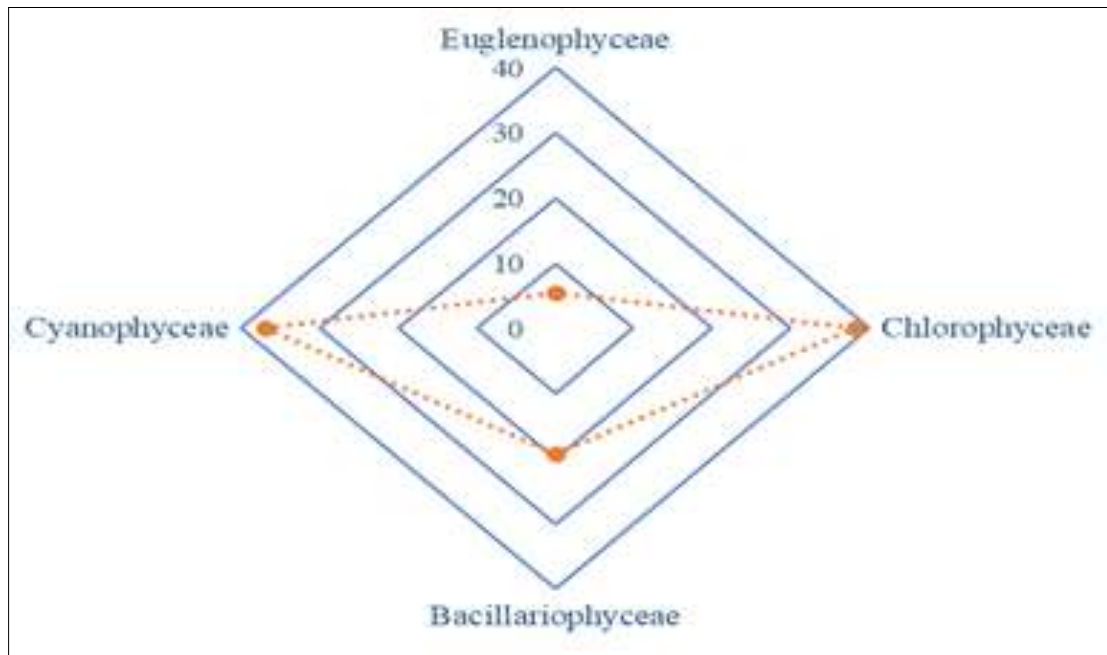


Fig 1: percentage contribution of phytoplankton malhania dam (March 2018-february 2019)

Cyanophyceae members contributed most diversity in the pond (Table 1) and have been the most dominant category for the duration of the months of October to February, it contributed about 39% of the complete phytoplankton population (Fig.1). Genus like Chroococcus, Oscillatoria, Merismopedia, Anabaena, Nostoc, Aphanocapsa, Arthrospira, Phormidium, Rivularia, Lyngbya, Anabaenopsis, Aphanothece and Spirulina have been recorded. Chlorophyceae was once the most sizeable crew of phytoplankton contributing 38.56% from the whole phytoplankton population. Chlorophyceae range used to be very best at some stage in the months of rainy season i.e., from June to September. This type used to be represented by Ankistrodesmus, Chlorococcum, Cladophora, Closterium, Cosmarium, Crucigenia, Euastrum, Gleocystis, Hydrodictyon, Oedogonium, Pediastrum and Scenedesmus. In the case of Bacillariophyceae 19.17% of phytoplanktons were in this group. Among the diatoms Amphora, Cymbella, Fragilaria, Gomphonema, Gyrosigma, Melosira, Navicula, Pinnularia, Suriella and Synedra have been found. Euglenophyceae contributed minimal of 5.48% phytoplankton. Throughout the find out about this group used to be broadly speaking represented by way of Euglena and Phacus. The annual mean fee and trendy deviation of the physico-chemical parameters of water recorded from Malhania dam is introduced in Table 2 and the month-to-month variants had been shown in Fig. 2. The water was once located mild green in shade to dark green in color for

the duration of the direction of study. Temperature recorded in the Malhania dam water was once 19.5±12.02°C, the place as the pH of water used to be discovered nearly impartial at some stage in the study duration (8.0±1.07). Electric conductivity recorded from the cemented pond was 565.5±371.23µm hos/cm. Nutrients like phosphate, chloride and sulphate have been discovered correspondingly in 2.5±2.86mg/l, 47.9±42.38mg/l and 33.4±40.46mg/l. Total hardness and whole alkalinity recorded was once 227.5±146.36 mg/l and 259.5±188.8mg/l. In present learn about DO, BOD and COD values had been recorded as 9.0±10.18mg/l, 11.7±14.64mg/l and 53.9±62.58mg/l respectively.

Table 2: Physico-chemical parameters (Mean ±SD) of Malhania dam during the study period.

S.No.	Parameters	Minimum	Maximum	Average	SD
1.	Temperature (°C)	11	28	19.5	12.02
3.	pH	7.23	8.74	8.0	1.07
4.	Conductivity (µhos/Sec.)	303	828	565.5	371.23
7.	Phosphate (mg/L)	0.45	4.5	2.5	2.86
8.	Chloride (mg/L)	17.98	77.91	47.9	42.38
9.	Sulphate (mg/l)	4.78	62	33.4	40.46
10.	Total hardness (mg/L)	124	331	227.5	146.37
11.	Total alkalinity (mg/L)	126	393	259.5	188.80
12.	DO (mg/L)	1.8	16.2	9.0	10.18
13.	BOD (mg/L)	1.3	22	11.7	14.64
14.	COD (mg/L)	9.6	98.1	53.9	62.58

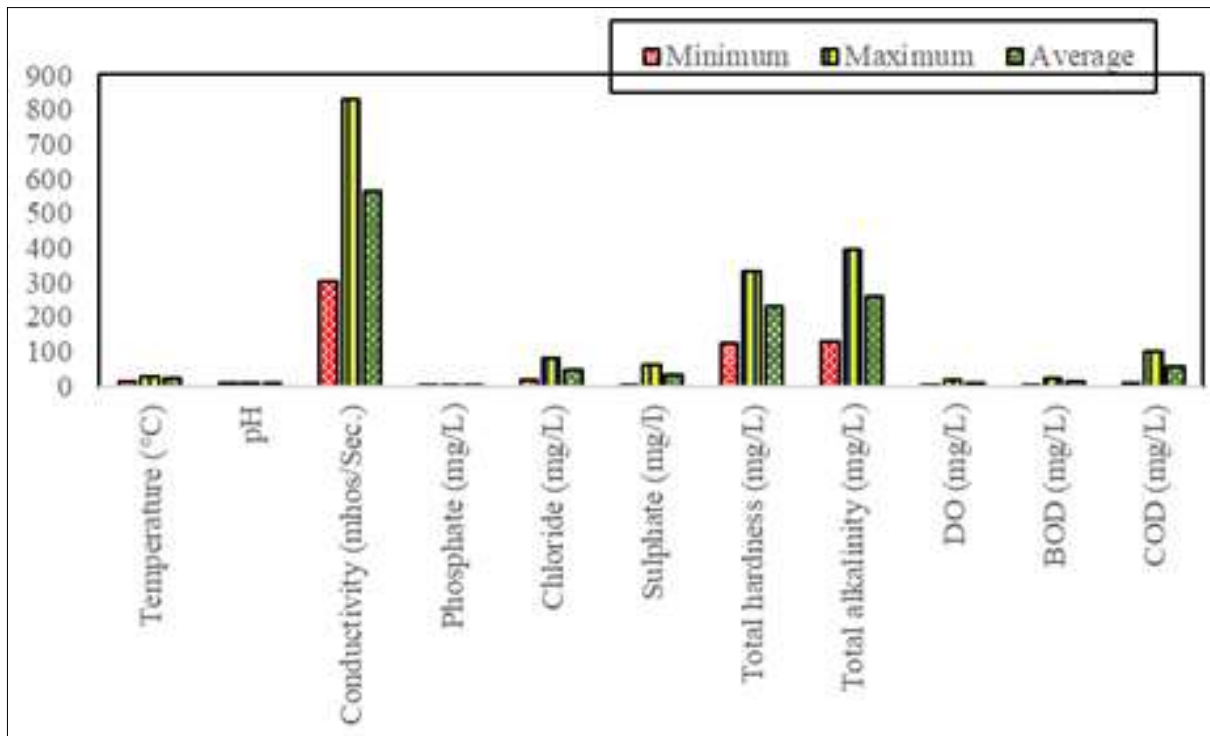


Fig 2: Monthly variation in physico-chemical parameters of malthania dam during the study period

Discussion

Phytoplankton are sensitive to the environmental modifications and their distribution varies drastically with recognize to seasons, water best and nutrient concentrations (Ganai *et al.*, 2010) [8]. Planktonic communities are influenced with the aid of the prevailing physico-chemical parameters and these decide their abundance, prevalence and seasonal variations.

In the existing investigation, 4 group of algae *viz.* Chlorophyta, Cyanophyta, Bacillariophyta and Euglenophyta were identified. Similar to the current investigation Devi and Singara (2007) [9], Gopinath and Ajit (2014) [10] and Ansari *et al.* (2015) [11] have said four algal businesses in their studies. In existing study algal taxa Cyanophyceae and Chlorophyceae dominated as in contrast to other companies of algae. The seasonally distribution of algal diversity indicates dominance nature as Chlorophyceae > Cyanophyceae > Bacillariophyceae > Euglenophyceae. Among the 4 groups, Cyanophyceae participants dominated and in the past observation of Hudder (1995) [12], Hujare (2008) [13] and Joseph (2012) [14] additionally pointed out the equal in their studies.

Cyanophyceae group contributed 36.99% of total phytoplankton (Fig. 2). Ganai, *et al.* (2010) [8] suggested that higher value of nutrients favored the growth of Cyanophyceae. Cyanophyceae members were recorded higher during the months of October to May. In the present study maximum population of blue green algae was observed during the months when the temperature was recorded higher.

In present investigation two peaks of the Chlorophyceae were recorded one of greater magnitude in April and the other of lower magnitude in December. During rainy season their percentage composition was significantly low. These observations do not concede with those of Flint (1949) [15] and Green (1976) [16].

In present work there were good supplies of nitrate during the month of February to May (Fig. 3) and have higher

growth of diatoms (Fig.1). Birge and Juday (1911) [17] found a direct relation between the dissolved silica in the upper layer and the growth of diatoms. Pearsall (1932) [18] also observed a direct correlation between the diatom periodicity and silicates dissolved in the water bodies.

Euglenophyceae was reported maximum during the months were temperature and nitrate values were noted higher. Previous studies on freshwater environment showed that higher temperature and nitrate concentration favours the growth of euglenoids (Jasprica *et al.*, 2006) [19]. The high temperature, chloride, TDS, and BOD might have played an important role in growth and development of Euglenophyceae (Jayabhaye, (2010) [27] and Ansari *et al.*, 2015) [11].

In the present study the values of physico-chemical parameters fluctuates greatly during different months. This may be due to various physico-chemical factors which are modifying the diversity of phytoplankton. Devika *et al.* (2006) [20] suggests that physico-chemical conditions had a direct relationship on phytoplankton diversity in aquatic ecosystem. The pH, dissolved oxygen, alkalinity and dissolved nutrients are important for phytoplankton production (Bais and Agarwal, 1990) [21]. Ashok *et al.* (2015) [22] observed that DO possess an indirect relation with temperature. The solubility of oxygen, or its ability to dissolve in water, decreases as the water's temperature increase. EC is a numerical expression of the ability of an aqueous solution to carry electric current. EC is an indication of extent of salinity in the pond water samples. The phosphate showed lower values during July to December but there was an increase in phosphate concentration during January to May. Nitrate content also showed increased values from January to May. Rana (2016) [26] also made similar observations in their study.

The phytoplankton diversity is largely influenced by interaction of a number of physico-chemical and biological factors acting simultaneously. According to Harikrishnan *et al.* (1999) [23], the maintenance of a healthy aquatic

ecosystem depends on physico-chemical and biological diversity of the ecosystem. From the present observation it is difficult to point out any single factor which is responsible for the fluctuations and abundance in plankton community. In India, diversity of phytoplankton in different freshwater water bodies along with their physico-chemical characteristics were studied by various scholars (Prashad, *et al.* 1985; Sharma, *et al.* 2009; Rana, 2016) [24-26]. The present study reveals that variation in the abundance of plankton is explained with abiotic factors. Thus it may be noted that the density of phytoplankton is dependent on different abiotic factors either directly or indirectly.

4. Conclusion

The present study provides an insight into the distribution, abundance, diversity and ecology of phytoplankton in an Malhania dam. From the results, it is evident that the ecological conditions of pond support a rich diversity of algal flora. Phytoplankton of only four groups namely Cyanophyceae, Chlorophyceae, Euglenophyceae and Bacillariophyceae were recorded. Results indicated that the values of physico-chemical parameters were responsible for the diverse group of phytoplankton in cemented pond.

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