



Phytoplankton Diversity in Perennial Reservoirs of Dry Tahsils of Sangli District, Maharashtra, India

Alaka A. Patil and Niranjana Chavan*

Department of Botany, Padmabhushan Dr. Vasantraodada Patil Mahavidyalaya, Tasgaon-416 312, Maharashtra, India

*Department of Botany, Shivaji University, Kolhapur-416 004, Maharashtra, India

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ABSTRACT

Diversity of phytoplankton in three perennial reservoirs of Sidhewadi, Borgaon and Binal of Sangli district was studied during two consecutive years (August 2006 to July 2008). The phytoplankton diversity was represented by Chlorophyceae, Cyanophyceae, Bacillariophyceae, Euglenophyceae and Dinophyceae. The present study reports the dominance of the group Chlorophyceae. The diversity of phytoplankton was mainly influenced by seasonal conditions and anthropogenic activities in the reservoir. The maximum diversity was recorded during summer and minimum during rainy season.

INTRODUCTION

In aquatic ecosystems, phytoplankton play an important role of primary producers. They have a unique ability to fix inorganic carbon to build up organic substances through primary production. Phytoplankton are the basic links in the food chain of aquatic ecosystems.

In present investigation, the phytoplankton diversity of the three reservoirs, Sidhewadi reservoir from Tasgaon tahsil, Borgaon reservoir from Kavathe Mahankal tahsil and Binal reservoir from Jath tahsil of Sangli district have been undertaken to obtain the baseline data. Basically, these reservoirs have been constructed by the State Government for irrigation purpose. Currently these are used for washing, bathing and fishing activity by nearby villagers.

MATERIALS AND METHODS

The phytoplankton samples were collected monthly from three sampling sites of each reservoir for two consecutive years (August 2006 to July 2008) by filtering 100 litres of surface water through plankton net made up of bolting silk No. 125. These concentrated samples were preserved by adding 4 % formalin and 1 mL of Lugol's iodine solution.

Phytoplankton were identified by following APHA (2005), Fritsch (1944), Bongale & Bharati (1978) and Prescott (1982).

RESULTS AND DISCUSSION

The phytoplankton community on which whole aquatic

population depends is largely influenced by the interaction of number of physico-chemical factors (Jana 1973, Sankala et al. 1981).

Sidhewadi reservoir: The Chlorophyceae was represented by 13 genera and 20 species. *Pediastrum simplex* and *Scenedesmus quadricauda* were present throughout the study period and *Tetraspora gelatinosa* was present only during summer (Table 1). The Cyanophyceae members were represented by 11 species of 6 genera. *Anabaena* sp. was present throughout the study period. The Bacillariophyceae was observed in 4 genera and 5 species. *Euglena acus* was present only during rainy and winter seasons. Dinophyceae was represented by 2 genera and 3 species.

In this reservoir maximum numbers of species were reported during rainy season (32, 27) and the minimum numbers during winter (15, 15) of both the years of study period.

Borgaon reservoir: In Chlorophyceae 11 genera were recorded containing 17 species. The Cyanophyceae was represented by 5 genera and 5 species in which *Oscillatoria* sp. was continuously present during the whole study period. Bacillariophyceae was represented by 4 species, which were not uniformly present during study period. Euglenophyceae was represented only by *Euglena acus* which was present during rainy and winter season. Dinophyceae was represented by 3 species (Table 2).

Higher numbers of species were recorded during summer (24, 25) and lower numbers in the rainy season (11, 11).

Binal reservoir: The Chlorophyceae was dominant group

Table 1: Seasonal variation in phytoplankton species in Sidhewadi reservoir.

Sr. No.	Name of the species	Rainy		Winte		Summer	
		Iyr	IIyr	Iyr	IIyr	Iyr	IIyr
Chlorophyceae							
1	<i>Sperocystis</i> sp.	+	+	+	-	-	+
2	<i>Pediastrum biradiatum</i>	+	+	-	-	+	+
3	<i>Pediastrum simplex</i>	+	+	+	+	+	+
4	<i>Pediastrum tetras</i>	+	+	-	-	+	+
5	<i>Westella botryoides</i>	+	+	+	+	+	-
6	<i>Scenedesmus quadricauda</i>	+	+	+	+	+	+
7	<i>Scenedesmus acuminatus</i>	+	+	+	-	+	+
8	<i>Ankistrodesmus spiralis</i>	+	+	-	-	+	+
9	<i>Zygnema</i> sp.	+	+	-	+	+	+
10	<i>Volvox</i> sp.	+	+	-	-	-	+
11	<i>Chlorococcum humicola</i>	+	+	+	-	+	+
12	<i>Tetraspora gelatinosa</i>	-	-	-	-	+	+
13	<i>Palmella mucosa</i>	+	+	+	-	+	-
14	<i>Kirchneriella obesa</i>	+	+	-	+	-	+
15	<i>Spirogyra</i> sp.	+	+	-	-	+	-
16	<i>Cosmarium depressum</i>	+	+	-	-	-	+
17	<i>Cosmarium tetraphthalmun</i>	+	+	-	+	-	+
Cyanophyceae							
18	<i>Chorococcus dispersus</i>	+	+	+	+	-	+
19	<i>Chorococcus limneticus</i>	+	+	-	-	+	+
20	<i>Chorococcus turgidus</i>	+	-	-	-	+	-
21	<i>Merismopedia tenuissima</i>	+	+	+	-	-	+
22	<i>Merismopedia Trolleri</i>	+	+	-	-	+	-
23	<i>Anabaena</i> sp.	+	+	+	+	+	+
24	<i>Lyngbya aestuaril</i>	+	+	+	+	-	+
25	<i>Lyngbya</i> sp.	-	+	-	-	+	+
26	<i>Oscillatiria</i> sp.	+	-	-	+	+	+
27	<i>Phormidium</i> sp.	+	+	-	-	+	+
Bacillariophyceae							
28	<i>Cocconeis</i> sp.	+	-	-	-	-	+
29	<i>Gomphonema</i> sp.	+	-	+	+	-	-
30	<i>Melosira granulata</i>	+	-	+	+	-	+
31	<i>Melosira varians</i>	+	+	-	-	+	+
32	<i>Navicula</i> sp.	+	-	-	-	+	+
Euglenophyceae							
33	<i>Euglena acus</i>	+	+	+	+	-	-
Dinophyceae							
34	<i>Ceratium.hirundinella</i>	-	-	+	+	+	+
35	<i>Ceratium carolinianum</i>	-	-	-	+	+	+

represented by 16 genera and 24 species where, *Chlorella ellipsoidae* was present continuously throughout the study period (Table 3).

Cyanophyceae showed 8 genera and 13 species. *Microcystis* sp. occurred continuously during all seasons of study period. *Spirulina major* and *Cylindrospermum minimum* were present only during summer of both the years. Bacillariophyceae was reported with 3 genera and 4 species, and Euglenophyceae with only *Euglena acus*. Dinophyceae was recorded with 2 species of *Ceratium*.

The seasonal trend of occurrence of total phytoplankton was recorded as summer > winter > rainy, except Sidhewadi

Table 2: Seasonal variation in phytoplankton species in Borgaon reservoir.

Sr. No.	Name of the species	Rainy		Winte		Summer	
		Iyr	IIyr	Iyr	IIyr	Iyr	IIyr
Chlorophyceae							
1	<i>Sperocystis</i> spp.	-	-	-	-	+	+
2	<i>Pediastrum biradiatum</i>	-	-	+	+	+	+
3	<i>Pediastrum duplex</i>	+	+	-	-	+	+
4	<i>Pediastrum simplex</i>	+	+	-	-	+	+
5	<i>Pediastrum tetras</i>	-	-	-	-	+	+
6	<i>Tetraedron muticum</i>	-	-	+	+	+	+
7	<i>Scenedesmus quadricauda</i>	+	-	+	+	+	-
8	<i>Scenedesmus acuminatus</i>	+	+	-	-	-	+
9	<i>Tetrastrum triangularae</i>	-	-	-	+	+	+
10	<i>Chlorococcum humicola</i>	-	+	-	+	+	-
11	<i>Tetraspora gelatinosa</i>	-	-	-	-	+	+
12	<i>Microspora</i> sp.	-	+	+	-	+	+
13	<i>Palmella mucosa</i>	+	+	-	-	+	+
14	<i>Asterococcus superbus</i>	-	-	+	+	+	+
15	<i>Dinobryon sociale</i>	-	-	+	-	+	+
Cyanophyceae							
16	<i>Anabaena</i> sp.	-	-	+	+	+	+
17	<i>Gloeocapsa aeruginosa</i>	-	-	-	+	+	+
18	<i>Oscillatiria</i> sp.	+	+	+	+	+	+
19	<i>Cylindrospermum</i> sp.	-	-	-	+	-	+
20	<i>Microcystis</i> sp.	+	+	-	+	-	+
Bacillariophyceae							
21	<i>Cocconeis</i> sp.	+	-	-	-	+	+
22	<i>Gomphonema</i> sp.	-	-	+	+	+	+
23	<i>Navicula</i> sp.	-	-	+	+	+	+
24	<i>Cyclotella comta</i>	+	+	-	-	+	+
Euglenophyceae							
25	<i>Euglena acus</i>	+	+	+	+	-	-
Dinophyceae							
26	<i>Ceratium. hirundinella</i>	-	-	+	+	+	+
27	<i>Ceratium carolinianum</i>	-	-	-	+	+	+
28	<i>Peridinium polonicum</i>	+	+	-	-	+	+
	Total	11	11	12	16	24	25

reservoir. The summer maxima and rainy minima can be attributed to higher temperature and light.

Higher phytoplankton in summer season has been reported by Sreenivasan et al. (1974) in some tropical lakes. Bharadwaja (1940) also pointed out that the temperature and light as factors responsible for higher phytoplankton population. Mustafa & Zubair (1997) recorded minimum number of phytoplankton in monsoon months. Besides temperature, high pH during summer may be one of the important factors responsible for summer maxima of phytoplankton (Venkateshwaralu 1969). Verma et al. (2001) and Tripathi & Pandey (1990) have recorded similar observation. Pundhir & Rana (2002) have reported Chlorophyceae as dominant group. Maximum phytoplankton were recorded during summer and minimum during monsoon which is similar to present findings.

The Chlorophyceae was found to be dominant over other

Table 3: Seasonal variation in phytoplankton species in Biral reservoir.

Sr. No.	Name of the species	Rainy		Winte		Summer	
		Iyr	Ilyr	Iyr	Ilyr	Iyr	Ilyr
Chlorophyceae							
1	<i>Sperocystis</i> sp.	+	-	+	+	+	+
2	<i>Pediastrum biradiatum</i>	-	-	+	-	+	+
3	<i>Pediastrum. duplex</i>	-	+	+	-	+	+
4	<i>Pediastrum tetras</i>	+	+	-	+	+	+
5	<i>Dictyosphaerium pulchellum</i>	+	+	-	-	+	+
6	<i>Westella botryoides</i>	+	+	-	+	-	+
7	<i>Scenedesmus quadricauda</i>	+	+	-	-	+	+
8	<i>Scenedesmus acuminatus</i>	-	+	+	-	+	+
9	<i>Ankistrodesmus falcatus</i>	+	+	-	-	-	+
10	<i>Zygnema</i> sp.	+	-	+	+	+	+
11	<i>Chlorella ellipsoidae</i>	+	+	+	+	+	+
12	<i>Chlorella vulgaris</i>	+	+	+	-	+	+
13	<i>Chlorococcum humicola</i>	-	+	+	-	+	+
14	<i>Microspora</i> sp.	+	-	-	-	+	+
15	<i>Tellingia granulata</i>	+	-	-	-	+	+
16	<i>Haematococcus lacustris</i>	-	-	-	-	+	+
17	<i>Asterococcus superbus</i>	-	+	-	-	+	+
18	<i>Kirchneriella obesa</i>	-	+	-	-	-	-
19	<i>Spirogyra</i> sp.	+	+	+	-	-	+
20	<i>Cosmarium depressum</i>	+	-	-	+	+	-
21	<i>Cosmarium tetraphthalmun</i>	-	-	-	-	+	+
Cyanophyceae							
22	<i>Chorococcus dispersus</i>	+	+	-	-	+	+
23	<i>Chorococcus limneticus</i>	-	+	-	-	+	+
24	<i>Chorococcus turgidus</i>	-	+	-	-	+	-
25	<i>Merismopedia tenuissima</i>	-	+	+	-	-	+
26	<i>Merismopedia elegans</i>	+	+	-	-	+	+
27	<i>Anabaena</i> sp.	+	+	+	-	+	+
28	<i>Lyngbya aestuaril</i>	-	-	-	+	+	+
29	<i>Lyngbya</i> sp.	-	+	-	+	+	+
30	<i>Oscillatiria</i> sp.	-	-	+	+	+	+
31	<i>Spirulina major</i>	-	-	-	-	+	+
32	<i>Cylindrospermum</i> sp.	-	-	-	-	+	+
33	<i>Microcystis</i> sp.	+	+	+	+	+	+
Bacillariophyceae							
34	<i>Cymbella</i> sp.	+	-	-	+	+	+
35	<i>Melosira granulata</i>	+	+	+	-	+	+
36	<i>Melosira varians</i>	+	-	-	-	+	+
37	<i>Cyclotella comta</i>	-	+	-	-	+	+
Euglenophyceae							
38	<i>Euglena acus</i>	+	+	+	-	-	-
Dinophyceae							
39	<i>Ceratium hirundinella</i>	-	-	+	+	+	+
40	<i>Ceratium carolinianum</i>	-	-	-	+	+	+
	Total	21	24	16	13	34	36

groups. Goel et al. (1988) and Vijaya Bhaskar et al. (2009) have reported the highest species diversity of Chlorophyceae in freshwater bodies of south west Maharashtra. Veerendra et al. (2006) have reported total 34 species of phytoplankton having Chlorophyceae with 13 species, Bacillariophyceae with 11 species, Cyanophyceae with 7 and Euglenophyceae with 3 species.

The data on physico-chemical characteristics are given

in Table 4. Significant positive correlation between Chlorophyceae and alkalinity was observed by Mathew et al. (2007). Bhosale et al. (2010) have reported dominance of Chlorophyceae members in the lakes of Kolhapur city and in water bodies of Kavathe Mahankal tahsil. It holds true for the present study.

The excess of carbon dioxide during rainy season coincides generally with decrease in population of phytoplankton. Similar observations have been made by Pundhir & Rana (2002), Das & Srivastava (1956) and Rana (1991, 1996).

Algal abundance was noted during summer and its declining state during rainy season due to turbidity, current velocity, water runoff causing dilution effect, loss of water through outlet and fluctuating water level. Similar observations were reported by Tiwari (2004) and Jadhav & Chavan (2009).

Phillipose (1960) mentioned that diatoms are usually abundant in alkaline water. All reservoirs were found to be alkaline during summer.

The study revealed that factors such as temperature, rainfall, transparency, alkalinity, total nitrogen and total phosphorus play an important role in fluctuating the plankton population.

CONCLUSION

Based on the present investigation, it can be concluded that there is seasonal variation in the diversity of phytoplankton. Diversity is also affected by anthropogenic activities.

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Table 4: Range of physico-chemical characteristics in the three reservoirs.

Parameters	Sidhewadi	Borsgaon	Birnal
Air temperature (°C)	26.4 - 37.6	28.5 - 37.4	29.1 - 37.6
Water temperature (°C)	22.2 - 31.1	23.3 - 32.4	24.7 - 32.3
Dissolved oxygen (mg/L)	4.19 - 7.29	4.21 - 9.37	4.14 - 8.57
Free carbon dioxide (mg/L)	0.23 - 3.37	0.1 - 2.33	0.1 - 2.33
Total alkalinity (mg/L)	142.6 - 458.0	117.67 - 282.67	112.33 - 356.0
Total hardness (mg/L)	116.33 - 393.0	236.0 - 387.33	206.67 - 380.0
Calcium (mg/L)	39.29 - 58.53	31.36 - 45.52	35.5 - 48.4
Magnesium (mg/L)	21.94 - 33.30	12.11 - 19.72	16.57 - 23.13
Chlorides (mg/L)	36.45 - 58.52	23.09 - 43.81	22.12 - 44.71
TDS (mg/L)	341.33 - 824.67	268.33 - 971.33	268.33 - 631.67
Total nitrogen (mg/L)	3.28 - 19.67	2.13 - 15.25	3.40 - 12.03
Total phosphorus (mg/L)	0.004 - 0.086	0.001 - 0.091	0.054 - 0.545

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