

## AN ECOLOGICAL STUDY OF CHLOROCOCCALES IN THE INLAND FISHERY

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During the study of algal flora and ecology, the total number of Chlorococcales/lit. was counted, every month, in relation to some physico-chemical factors of a fish pond at Anjale, Dist. Jalgaon, Maharashtra. The species of 18 genera were collected and their peak of dominance was observed when pH and DO were maximum and temperature was moderate and other factors show little significance. Chlorococcales were maximum during winter and minimum in rainy season.

**Keywords :** Chlorococcales; Ecology; Fish pond; Maharashtra.

### Introduction

In the present study, algal flora and certain physico-chemical parameters of a fish pond at Anjale (20° 5' 30" N. lat. and 75° 45' 15" E. long.) in Jalgaon District of Maharashtra were studied. Periodicity and abundance of algal groups were also studied. It has been observed that with algae, members of Chlorococcales were abundant. Some physicochemical factors were responsible for their abundance. Number of workers<sup>1-13</sup> have shown relationship between Chlorococcales and physio-chemical factors. Though extensive ecological studies have been carried out in India, not much work has been done so far in North Maharashtra except Nandan<sup>14</sup> therefore the present work was undertaken.

### Material and Methods

Water samples were collected between 7.30 - 8.30 am at monthly intervals from Jan., 1999- Dec., 2000. They were analysed for various physico-chemical parameter (Table 1) in laboratory according to the methods of Trivedy and Goel<sup>15</sup>. For the study of abundance of Chlorococcales one litre of water samples was separately collected once in a month. The samples concentrate was made up to 20 ml with 4% formalin. The total number of Chlorococcales present in this 20 ml of water were then identified, counted and the total number of Chlorococcales/lit. was counted by using Lackey's drop method.

### Results and Discussion

10 physico-chemical parameters and total number of Chlorococcales/lit. are given in Table 1. The range of the parameters is as : water temp. 17.6 - 30.1 °C, pH 7.8-9.3, DO 6.66 - 10.3 mg/l, hardness 220 - 292 mg/l, calcium 16.03-23.24 mg/l, COD 120 - 200 mg/l, EC 1.032 - 2.107 m. mhos/cm, TDS 1010 - 1340 mg/l, nitrate 0.47 - 1.08 mg/l, and phosphate 0.135-0.440 mg/l. Total number of Chlorococcales was 53332-693316/lit.

The species of 18 genera which were encountered in the present study are as : *Schroederia*, *Golenkinia*, *Golenkinipsis Characium*, *Pedrastrum*, *Chlorella*, *Tetraedron*, *Chodatella*, *Ocystis*, *Dictyosphaerium*, *Ankistrodesmus*, *Nephrochlamys*, *Kirchneriella*, *Coelastrum*, *Crucigenia*, *Tetrastum*, *Franceia* &

*Scenedesmus* mainly to from the bulk of the population.

Various workers studied the periodicity and abundance of Chlorococcales in different water bodies. Singh<sup>16</sup> observed two peaks one in June & the other in December; Philipose<sup>3</sup> recorded that the Chlorococcales were rich during the month of June to September; Shashikant and Kachroo<sup>17</sup> also recorded more species from December to March and totally absent in February; Grover *et al.*<sup>9</sup> noticed maximum growth in March; Jyoti *et al.*<sup>11</sup> marked luxuriant growth in August and September; Tarar & Bodkhe<sup>12</sup> have observed growth round the year but comparatively more growth was observed from January to May and November and December; Sharma *et al.*<sup>13</sup> noticed maximum growth during the month of October.

From the Table 1 it is clear that the Chlorococcales as a whole were maximum in February, 1999 and March, 2000 and minimum in August, 1999 and 2000. The total number of Chlorococcales in a pond increases progressively from winter to early summers. With the advent of rainy season the abundance decreases due to disappearance of few members of Chlorococcales. This may be due to reduced light intensity as a consequence of cloudy weather, reduction of light penetration as a result of turbid water and water diluted by rain.

The water temperature in the fish pond varies from 17.6 - 30.1. The minimum temp. was observed in the month of December, 2000 & the maximum in June, 1999. The total number of Chlorococcales was found to be maximum in February, 1999 and March, 2000 when water temp. range was 23-25°C.

Zafar<sup>5</sup>, Rao<sup>18</sup> and Nandan<sup>14</sup> noted that high temp. favours the growth of Chlorococcales, Philipose<sup>3</sup> observed that Chlorococcales can grow with in wide range of 19°C-37°C, Singh<sup>16</sup> has reported dense population at moderate temp., (17°C - 32°C). This view was also supported by other workers<sup>8, 11, 13</sup>. The present study also agrees with them and the presence of maximum number of Chlorococcales (693316/l) the temp. was in moderate range (23-25°C).

The pH of the pond water was alkaline

Table 1. Physico-chemical data and total number of Chlorococcales from fish pond. (Jan., 1999-Dec., 2000)

Sr. No.	Parameters	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1.	Water temp °C	18.2	23.2	24.5	25.2	29.5	30.1	28.5	27.5	27.9	27.3	24.4	20.2
	2000	20.5	25.1	24.3	25.9	26.8	29.7	28.2	29.1	27.5	26.9	23.8	17.6
2.	pH	9.2	9.2	8.9	8.3	8.2	7.8	7.8	7.9	8.0	8.3	8.8	9.0
	2000	8.8	9.2	8.8	8.6	8.3	8.1	8.3	8.2	8.4	8.4	9.3	9.2
3.	DO mg/l.	8.69	9.09	8.48	8.28	7.27	6.87	6.66	8.08	8.28	8.69	9.3	9.09
	2000	8.68	9.89	8.28	8.08	7.68	7.07	6.66	7.68	8.08	8.28	9.49	10.3
4.	Hardness mg/l.	262	264	270	280	292	282	272	260	260	258	252	240
	2000	234	220	265	274	270	278	266	262	238	256	234	240
5.	Calcium mg/l.	17.63	18.44	20.04	21.64	23.24	20.04	17.63	19.23	20.04	18.44	21.64	16.83
	2000	19.23	19.23	20.04	19.23	18.03	16.83	16.03	16.83	18.43	16.33	21.64	19.24
6.	COD mg/l.	200	192	200	180	192	152	128	156	140	180	192	196
	2000	200	200	192	180	168	156	120	140	156	180	196	192
7.	E.C. m.mhos/cm.	2.107	2.048	1.928	1.937	1.893	1.887	1.886	1.851	1.814	1.802	1.843	1.975
	2000	2.02	1.947	1.919	1.917	1.926	1.879	1.931	1.793	1.750	1.632	1.757	1.752
8.	TDS ng/l.	1240	1340	1210	1170	1200	1290	1330	1310	1160	1270	1150	1160
	2000	1290	1220	1190	1130	1210	1230	1150	1070	1030	1050	1090	1010
9.	Nitrate mg/l.	0.65	0.78	0.73	0.69	0.68	0.62	1.08	1.0	1.08	0.92	0.73	0.87
	2000	0.47	0.65	0.61	0.61	0.56	0.56	1.00	0.87	1.08	0.82	0.69	0.60
10.	Phosphate mg/l.	0.300	0.300	0.265	0.230	0.190	0.230	0.250	0.330	0.360	0.340	0.360	0.300
	2000	0.285	0.265	0.245	0.175	0.135	0.180	0.285	0.360	0.440	0.380	0.310	0.260
11.	Abundance/lit..	479988	639984	533320	373324	426656	159996	106664	53332	106664	213328	479988	533320
	2000	533320	586652	693316	426656	373324	246660	159996	53332	106664	159996	373324	479988

throughout the year. The seasonal variation of pH in pond water shows a narrow range, between 7.8 - 9.3. Majority of workers have recorded that Chlorococcales species are alkaline water loving. Singh<sup>16</sup> has observed higher values of pH (8-9.5) in Ramgarh and Suraha Tal, Uttar Pradesh; Zafar<sup>5</sup> has collected Chlorococcales in the pH range 9.2 to 10.5 in ponds & lakes in Hyderabad; Grover *et al.*<sup>9</sup> have reported the pH range, 7.8-9.6 in Heeran pond, Ludhiana; Patel *et al.*<sup>10</sup> noted pH range, 6-9 in fish farm Lingda, Gujarat; Jyothi *et al.*<sup>11</sup> observed pH rang 8.3 - 8.6 in ponds of Hyderabad city; Nandan<sup>14</sup> has noted pH range, 7.2-8.5 in Mukti fish pond, Dhule; Trar & Bodkhe<sup>12</sup> noted pH range, 7.4 - 8.5 in ponds and lakes of Nagpur city; Sharma *et al.*<sup>13</sup> observed Chlorococcales in the pH range, 8.3-8.6 in Mahal lake, Jaipur; Philipose<sup>2</sup> recorded higher percentage of Chlorococcales in slightly acidic (pH 6.3-6.9) as well as in alkaline water (pH7.4-8.4). From the above record, it is clear that the numbers of Chlorococcales can survive within a wide range of pH (6-10.5). However, the pH of the fish pond was maximum when the temp. was moderate. The maximum number of Chlorococcales was observed when the temp. was moderate and pH were near to maximum.

The effect of pH in the distribution of Chlorococcales in the present ponds appears to be closely correlated to that to DO. The presence of high pH and DO during winter can be correlated with abundance to Chlorococcales. High pH normally associated with photosynthetic activity, high value of DO (8.7-10.3 mg/l) indicated more algal growth. These findings are in agreement with other workers<sup>1,4,5,11,12,14,19</sup>.

The exact relationship between the chemical constituents of water and the distribution of Chlorococcales is not yet clearly established. Gonzalves and Joshi<sup>20</sup> marked luxuriant growth of Chlorococcales in water having paucity of calcium, Zafar<sup>5</sup> and Mohiuddin<sup>7</sup> observed that calcium deficiency favours the growth of Chlorococcales, Rao<sup>1,18</sup> observed that both calcium rich and calcium poor water were favourable for the occurrence and growth of Chlorococcales. In the present fish pond maximum number of Chlorococcales occurred when calcium content was moderate in range (18.44-1923 mg/l) No correlation was found between calcium contents and the taxa of Chlorococcales.

Philipose<sup>3</sup> and Sharma *et al.*<sup>13</sup> suggested that certain Chlorococcales can thrive well in water that are rich in nitrate rather than phosphate. Singh<sup>6</sup> recorded a dense population of Chlorococcales during periods of low concentration of nitrate and phosphate. In the present study nitrate and phosphae were always present in considerable quantities in a fish pond so that they do not seem to constitute a limiting factor, but permit continued growth.

Similar observation was made by Ganapati<sup>21</sup>.

Hosmani and Bharati<sup>22</sup> stated that, Chlorococcales occur in all waters & it is difficult to contribute their behaviour to any one particular factor.

In the present study Chlorococcales were found to be abundant from winter to early summer (November - April) When temp. was moderate with well oxygenated alkaline water. Phosphate, nitrate and calcium were always present in considerable quantities. The other factors were fluctuating without showing any correlation in the distribution of Chlorococcales.

#### Acknowledgement

We are thankful to the Principal, Dhanaji Nana Mahavidyalaya, Faizpur and Head, Dept. of Botany for providing laboratory facilities. One of us (DAK) is thankful to UGC, New Delhi for the award of TRF.

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