

Study on Distribution and Diversity of Phytoplankton in relation to Physico-chemical Parameters in Joratalab, Bilaspur, Chhatisgarh

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Abstract

The Phytoplankton distribution and diversity was studied with compare to the physico-chemical parameters in Joratalab pond. Joratalab pond is situated at Sarkanda towards the North East of Bilaspur District at the distance of 5 km. This pond is medium size pond and the water of pond is use for domestic purpose like washing, bathing *etc.* A monthly sample was carried out from December 2012 to November 2013 at four different stations. Phytoplanktons of Joratalab is composed of four major groups namely Cyanophyceae, Chlorophyceae, Euglenophyceae and Bacillariophyceae. The density of Phytoplankton showed that the Chlorophyceae are dominated. In the present study the maximum density of phytoplankton recorded in April and minimum is in the month of August. During the investigation period it was observed that the Phytoplankton population density and diversity depends upon the physico-chemical parameters and shown significant correlation with the parameters like temperature, pH, mg, phosphate and D.O.

Limnological investigations on water bodies were generally aimed to assess the water quality and its interaction with biotic and abiotic factors. The role of water in nature is unique not only from the point of human consideration; even the numerous organisms make aquatic medium their habitat. The physical and chemical properties of freshwater bodies are characterized by the climatic, geochemical, geo-morphological and

pollution conditions. The quality of aquatic life depends on the water quality. The requirement of water to all living organisms from microorganism, to man, is a serious challenge today because all water resources are polluted due to unplanned urbanization and industrialization^{17,29,30}. This makes them vulnerable for human impact and changes day by day, measuring which would probably give a clear picture about the pollutions stress on

them^{25,26}. Phytoplankton is natural inhabitant of water bodies. They are regarded as the chief primary producers of any aquatic environment which fix solar energy by the process of photosynthesis, assimilating carbon dioxide to produce carbohydrates, thus serve as an important link between the abiotic factors and the biota in the aquatic system^{4,5,9,10,15,27}.

Study site : Joratalab pond of Sarkanda is situated at South, distance of 5 km from Bilaspur District. It lies at 21° 47' & 23° North latitude & 81° 14' & 83° 15' East latitude. It is medium size pond. The water is utilized for domestic purpose.

Isolation: The phytoplankton population samples are collected monthly from different site of the pond surface. The two methods were used to identify phytoplankton. In first method samples were collected by plankton net of No. 20 silk bolting cloth (Mesh size 0.076 mm). After collecting the plankton

materials were transferred into the glass bottle & preserved in 1% formalin solution. The identification of phytoplankton was done on the basis on their morphological feature, up to the level of species according to literature in the laboratory⁵.

Pond water sampling : Water samples are collected monthly from the pond for physico-chemical analysis in the 2 litre plastic bottle before 9 am. some of the physico-chemical parameter studies were done on the spot, while others were done in laboratory according to American Public Health Association (APHA)², American Water Works Association (AWWA) & Water Pollution Control Federation (WPCF).

In Joratalab pond 40 species of four groups of phytoplanktons were identified in which Chlorophyceae is dominated. Maximum species 2627 were recorded in the month of April and minimum 1176 were recorded in August (Table-1).

Table-1. Phytoplanktons species of Joratalab pond (Dec 2012-Nov 2013)

No	Algal spe.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.
	Cyanophyta												
1	<i>Anabaena</i> sp.	70	65	63	99	108	95	92	82	55	69	72	70
2	<i>Chroococcus</i> sp.	57	54	50	90	95	87	84	76	45	58	65	58
3	<i>Cylindrospermum</i> sp.	41	36	30	53	61	56	53	48	23	40	43	41
4	<i>Gloeotrichia echinulata</i>	30	27	24	42	51	45	42	40	22	38	46	42
5	<i>Microcystis flosaquae</i>	44	43	41	63	75	70	66	64	28	36	47	43
6	<i>Microcystis biformis</i>	43	41	40	61	73	67	63	60	25	34	45	41
7	<i>Nodularia</i> sp.	36	35	32	55	72	69	67	62	28	36	39	37
8	<i>Nostoc carneum</i>	46	44	42	78	92	85	79	75	39	45	52	49
9	<i>Oscillatoria formosa</i>	50	48	47	69	90	85	80	78	37	48	61	59
10	<i>Oscillatoria limosa</i>	47	45	43	65	87	82	79	75	34	45	58	55
11	<i>Plectonema</i> sp.	40	37	35	60	76	67	59	56	23	30	37	34
12	<i>Rivularia haematities</i>	34	32	30	48	63	59	56	53	21	30	37	35
13	<i>Spirulina subsalsa</i>	62	60	59	82	103	95	90	86	45	57	70	66
	Total	600	567	536	865	1046	962	910	855	425	566	672	630

	Chlorophyta												
1	<i>Chlamydomonas globosa</i>	135	129	120	131	170	182	190	143	65	160	163	140
2	<i>Chlorococcum infasion</i>	86	82	80	93	120	130	140	136	55	85	103	95
3	<i>Closterium</i> sp.	40	38	37	48	70	74	79	74	28	48	56	40
4	<i>Gleococcus</i> sp.	35	34	32	43	51	57	67	60	25	35	39	33
5	<i>Hydrodictyon reticulatum</i>	28	27	25	37	46	57	65	55	16	28	34	28
6	<i>Oedogonium</i> sp.	31	30	26	40	47	59	68	48	20	35	40	29
7	<i>Pediastrum oedogonia</i>	30	29	27	43	50	60	70	59	26	39	45	30
8	<i>Spirogyra communis</i>	34	32	30	52	68	84	98	76	30	48	60	45
9	<i>Scendesmus</i> sp.	36	34	32	53	70	87	99	74	28	44	55	40
10	<i>Ulothrix tenerrima</i>	32	30	28	51	64	75	82	64	20	41	46	35
11	<i>Ulothrix zonota</i>	33	31	29	54	65	77	85	66	24	45	51	39
12	<i>Volvox aureus</i>	23	20	18	35	45	57	60	38	15	30	37	35
13	<i>Zygnema pectinatum</i>	33	32	29	45	55	68	80	57	23	40	52	38
	Total :-	576	548	513	725	921	1067	1183	950	375	678	781	627
	Euglenophyta												
1	<i>Euglena gibbosa</i>	47	42	49	52	54	56	59	63	55	66	58	54
2	<i>Euglena viridis</i>	42	38	45	49	51	54	57	61	52	65	53	51
3	<i>Euglena fusca</i>	36	32	39	43	46	49	52	56	48	61	50	47
	Total:-	125	112	133	144	151	159	168	180	155	192	171	152
	Bacillariophyta												
1	<i>Amphora</i> sp.	39	40	42	47	50	45	48	29	20	22	24	26
2	<i>Asterionella formosa</i>	33	35	38	42	45	38	46	33	25	29	32	35
3	<i>Cocconeisplacentula</i> sp.	32	33	35	39	43	36	44	28	16	21	24	26
4	<i>Diatoma vulgare</i>	37	38	40	44	47	41	46	31	22	27	30	32
5	<i>Denticula pelagic</i>	22	24	25	32	36	30	34	25	14	16	18	19
6	<i>Gonphonema parvulum</i>	35	36	37	40	42	35	37	30	17	20	23	24
7	<i>Navicula capitata</i>	40	42	44	48	55	46	50	45	24	28	32	36
8	<i>Pinnularia major</i>	36	38	40	45	50	43	49	45	25	27	29	31
9	<i>Pinularia viridis</i>	33	35	37	41	46	40	45	39	20	22	24	26
10	<i>Synedracapitata</i> sp.	42	44	46	54	60	55	58	54	25	30	34	36
11	<i>Tabelaria</i> sp.	24	25	26	30	33	29	32	29	13	15	18	20
	Total:-	373	390	410	462	507	438	489	388	221	257	288	311

Table-2. Physico - chemical Characteristics of water
(Dec 2012-Nov 2013)

No	Parameters	Dec.	Jan.	Feb.	Mar	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.
1	Temp.(°C)	20.1	19.2	23.1	35.7	36.4	38.7	31.3	28.8	29.2	31.0	30.8	25.8
2	Turbidity (NTU)	95	91	77	40	43	50	64	69	112	124	120	114
3	Conductivity	63	67	69	72	75	73	70	61	55	53	56	60
4	pH	8.7	8.8	9.2	10.1	10.2	10.5	9.4	8.9	7.5	7.7	7.9	8.0
5	Free CO ₂	43.9	43.0	42.9	44.3	49.2	45.3	41.2	40.9	50.0	39.9	36.8	36.3
6	BOD (mg/l)	4.9	5.0	5.1	5.2	5.4	5.3	5.1	5.0	5.4	5.3	5.4	5.5
7	DO (mg/l)	6.6	6.4	6.2	6.0	5.7	5.5	5.3	6.5	8.0	7.6	7.4	7.2
8	Chloride	116	118	120	126	130	134	131	129	115	103	108	110
9	Alkalinity	722	728	737	749	761	790	745	725	698	684	701	710
10	Total Hardness	154	158	162	169	174	180	176	162	155	150	147	143
11	Ca; Hardness	76	91	96	99	105	112	104	99	92	90	87	85
12	Mg. Hardness	78	67	66	70	69	68	72	63	63	60	60	58
13	Nitrate	1.02	1.01	1.00	1.45	1.49	1.60	1.32	1.15	1.06	1.05	1.04	1.03
14	Phosphate	0.74	0.76	0.86	1.19	1.30	1.43	1.20	1.08	0.95	0.98	1.03	1.01

In the investigation of Joratalab pond during the study period of one year (Dec. 2012 to Nov. 2013) a total 40 species of phytoplankton were identified belonging to 13 species of Cyanophyceae (Blue green algae), 13 species of Chlorophyceae (Green algae), 11 species Bacillariophyceae (Diatoms), and 3 species of Euglenophyceae. The four major group of phytoplankton were recorded in Joratalab pond. The population of Bacillariophyceae was high in summer & low in rainy season. Euglenophyceae was low in winter and high in rainy season whereas the Cyanophyceae were minimum in winter and maximum in summer. The population of Chlorophyta was low in winter and high in summer.

Maximum population of Phytoplankton noted at Joratalab pond in summer may be

attributed to maximum sunlight & higher temperature is reported to stimulate growth of aquatic autotrophs^{13,20,24,31} in addition that the water level decrease in summer in India, the Phytoplankton aggregates resulting in their increased population.

The physico- chemical characteristics of water are shown in table 2 from December 2012 to November 2013. pH ranged between 7.5 to 10.5, is also a factor that influences plankton population. The higher pH (alkaline pH) is favorable for the growth of phytoplankton^{3,6,7,8,12}.

Temperature is one of the important determining factors for phytoplankton population & shows positive correlation. During monsoon when the water level is high, phytoplankton

get more distributed & recorded lowest in rainy season because of heavy rainfall, high turbidity, decreased temperature & pH.

The values of Chloride, hardness, phosphate were high in summer when water level minimum and low in rainy season when water level in maximum, due to rainfall^{14, 21, 23, 28}.

Same condition was reported for Nitrate which value is higher in summer & early monsoon period. This condition may be due to decaying of plants, evaporation of water and higher phytoplanktonic production^{3, 9, 16, 18, 22}.

Higher values of dissolved oxygen might be attributed to intense photosynthetic activity of phytoplankton and other green aquatic plants present in these water bodies. Lower values might be due to its utilization during decomposition of organic matter, low photosynthetic rate, respiration by micro and macro – organisms^{1, 4, 11, 19}.

Joratalab pond water supports good diversity and density of phytoplanktons with Chlorophyceae as common group. The physico-chemical parameters shows that water is polluted. The water is utilized for human activities. If care is not taken it can also undergoes deterioration and develop into a deteriorated habitat.

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