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Limnologial Studies of Thermal Power Station Parali (Vaijanath) in The Marathwada Region of Maharashtra

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A B S T R A C T

While working on algal taxonomy of Beed district in the Marathwada region of Maharashtra, during January 2006 to December 2008.Diffrent habitats were selected as study area like pools, ponds, cisterns, lakes, streams, streamlets, rivers, polluted water passages, puddles ,nursery ponds, dripping rocks and the moist soils. Apart from these habitats, the author came across one more interesting habitat i.e. Thermal power station of Parli city. Seasonal study was carried out from March 2009 to February 2010, to analyses 7 physico chemical parameters of water and the relative abundance of various filamentous forms have been encountered from the canal, clarifier and cooling pond of thermal power station. The diversity of fresh water algae was abundant in canal, clarifier and cooling pond of power station. A total of 77 taxa under19 genera were belonged to chlorophyceae (44)Euglenophyceae(23), Bascillariophyceae (19) and cyanophyceae (33),but the presentpaper deals only with filamentous forms of chlorophyceae and cyanophyceaen algae, while alkaline pH, higher amount of calcium, magnesium observed, at alkaline pH and higher amount of calcium, magnesium and hardness showed the good growth of algae..

Keywords: Thermal power station, canal, clarifier and cooling pond, limnology algae.

1. Introduction

The algal life is widely spread in the aquatic environment and the water plays an important role in their growth. Study of biological and physic-chemicalcharacteristics from the thermal power station is needed to explain mainly with the relationship between algae and the environment. Review of literature reveals that, studies on algal taxonomy in abroad and in India have been done extensively by many research workers. In Maharashtra tremendous work has been done on algal taxonomy by various workers, but in the Marathwada region of Maharashtra except few reports (Ashtekar 1980, Kamble 2008, Andhale 2008, Talekar 2009) very rare attention has been paid towards algal taxonomy, limnology although the climatic conditions of Marathwada region are most suitable to grow algae luxuriantly and in diverse form, therefore to fulfill this lacuna, it has been decided to work on algal taxonomy and limnology of thermal power station of Parli of Beed district, in the Marathwada region of Maharashtra.

2. Materials and Methods

The seasonal algae and the water samples were collected from cooling pond, canal and clarifier of thermal power station during March 2009 to February 2010.All the necessary precautions were taken during sample collection (Welch, 1948).

3. Field work

The algal samples were collected for the period of one year from March 2009 to February 2010. The algal collections were made regularly from various habitats (above cited) .Acid washed collection bottles were used for the collection of algal samples. Floating, planktonic, submerged, attached epiphytic algal samples were collected separately in collection bottles. Field note book was maintained in which the color of the algae, habit, habitat and dates of

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collection were noted, the pH of the water of the collection spots was recorded by studying at least three samples of water from three different places of the collection spots.

4. Laboratory work

On return to the laboratory from field, the collections were carefully observed under the light microscope and important points were noted. All collections were preserved in 4% commercial formalin added with 5% glycerin. Generally 5 to 10 random temporary mounts were made from each collection for microscopic observations. Camera lucida diagrams of these algae have been drawn by mirror type of camera lucida. Identification of algal taxa was performed by referring to the standard literature on algae. The systems of classification followed here is substantially that of Smith (1951, 1955), Prescott (1951), Philipose (1967),Geitler (1932) and Desikachary (1959). Randhawa (1959) Scott and Prescott (1961), Kriegar and Gerloff (1965), Taxonomic account of all identified algal taxa were made for the two groups of algae viz.Chlorophyeae and Cyanophyceae.
Water has been filtered through Whatman filter paper No.1.Filtered water has been used for water analysis and pH, PA, TA, Hardness Calcium, Chloride and Magnesium has been analyzed on the same day by Trivedi and Goel (1986).

5. Results and Discussions

The results of the investigation are subdivided into two sub sections i.e. A) Physico chemical analysis of canal, clarifier and cooling pond water of thermal power station and B) Phycological characterization of canal, clarifier and cooling pond of the thermal power station.

A) Physico-chemical analysis of canal, clarifier and cooling pond water of thermal power station:

The water was assessed by using seven physico-chemical parameters like pH, phenolphthalein alkalinity, Total alkalinity, Hardness, Calcium, Magnesium and Chloride.

pH: In water pH is an important factor for physico-chemical and biological characterization. The Low pH values reduced the growth of algae and high pH increased the algal abundance in aquatic environment. A minimum value of pH was 7.80noted during monsoon season in canal and maximum value of pH 8.92 recorded in cooling pond outlet in the months of summer (Table-1).The chlorophycean and blue green members were encountered in the months of winter at high pH (8.40 to 8.50) in the canal and clarifier water during the period of investigation. While only the members of blue green algae were observed at high pH during the summer periods in cooling ponds. The high pH (alkaline pH) is promoting the algal abundance in aquatic environment (Mc.Combie,1953;George,1961;Presscot and Vinayard ,1965;Nazeen,1980;Rawal and Gajaria,2004). Pearsall (1930) and Zafar (1966) recorded that the pH of the water is depend upon the quantities of calcium, carbonate and bicarbonate. The alkaline pH favours the growth of chlorophyceae (Gonzalves and Joshi, 1966 and Zafar, 1964a.) While the Gerloff et.al. (1952) and Vyas (1968) have been recorded that the high pH favoured the blue green algae (cyanophyceae) group. In the present research work high pH and rich growth of cyanophyceae have been observed in the cooling pond.

Phenolphthalein alkalinity (PA) and Total alkalinity (TA):

The total alkalinity is generally due to the presence of carbonate, bicarbonate and hydroxide ions. The higher rate of carbon assimilation leads to the presence of Phenolphthalein alkalinity in the water. It was noticed that during the monsoon season of canal water and throughout the year of clarifier water Phenolphthalein alkalinity was absent but the maximum value was found during winter in cooling pond inlet(28.0) and outlet(29.0) (Table-1).The lowest total alkalinity 82.0 mg/gm. was noted in clarifier during the monsoon periods and the highest value of total alkalinity (TA) was236.0 mg/gm. measured in cooling pond inlet during winter(Table-1).In the present investigation chlorophycean and cyanophycean members were encountered in monsoon at lowest phenolphthalein alkalinity in canal water but at highest phenolphthalein alkalinitythe members of chlorophyceae and cyanophyceae have been observed during winter period in cooling pond of thermal power station. It was also noticed that less or nil phenolphthalein alkalinity (PA) favoured the growth of chlorophycean members in monsoon periods. No significant relation was found between phenolphthalein alkalinity and total alkality in present investigation. Hazzelwood and Parkar (1961) also observed negative correlation between phytoplankton with phenolphthalein alkalinity and total alkality.Pearsalland Lind (1962) state that the alkalinity does not appear to contribute directly the metabolism of algae.*Cladophora, Rhizoclonium, Lyngbya* and *Oscillatoria* have been observed with luxuriant and diversified growth in the month of summers in (cooling pond and canal only) and in clarifier good growth of cyanophycean members were recorded during winter periods.

Hardness (TH):

In general the water hardness from 50 to 150ppm is considered as moderate quality of water, 150 to 300 ppm hardness as hard water and above 300 ppm is a very hard quality. A minimum value of hardness (TH) was 88.0 Mg/gm. noted in monsoon season in canal and maximum value of 226.0 Mg/gm. was recorded in cooling pond inlet and outlet during the periods of summer (Table-1) means water was moderate to hard in thermal power station system (canal, clarifier and cooling pond).Pennack (1955) recorded relationship between cyanophycean and hardness of water.Shrinivasan (1970) observed that low alkalinity, low hardness and low calcium favours the growth of phytoplankton.

Calcium (Ca):

The calcium ions are very important for aquatic life. Boyd (1973) recorded that the 2-25 ppm calcium favoured the growth of aquatic algal weeds viz.*Pithophora* sp.*Chara* sp, *Hydrodictyon* sp. and *Rhizoclonium* sp. In the present investigation minimum value of Calcium was 52 Mg/gm. noted during monsoon season in canal and 140.0 Mg/gm. of maximum value was observed in cooling pond inlet during summer period (Table-1).Higher amount of calcium contents showed the luxuriant growth of *Rhizoclonium,Pithophora,Oscillatoria,Lyngbya,and Cladophora,the* results are agreed with Boyd(1973).

Magnesium (Mg):

In the present study a minimum value of Mg was 23 Mg/gm. noted during monsoon season and maximum value of 98.0 Mg/gm. recorded in cooling pond outlet in the periods of summer (Table-1).The Magnesium value of water and good growth of chlorophycean members like

Ulothrix,Oedogonium,Mougeotia,Spirogyara,Zygnema and the cyanophycean members like *Oscillatoria,Rhizoclonium,Pithophora, Phormidium,Lyngbya, and Cladophora* were found abundant in summer season. Magnesium is the most abundant ion in the fresh water and absolutely essential for chlorophyll and other plants (Ansari and Prakash, 2000).

Chloride (Cl):

A minimum of chloride was10 Mg/gm. noted in monsoon periods and it was observed that maximum value is 34.0 Mg/gm. from the outlet of cooling water pond during the summers (Table-1).The temperature and chloride correlation ship have been observed by many workers and observed that increased the temperature increased the chloride contents of water (Zafar,1964,Gonzalves and Joshi,1966,Munawar,1970,Rawal and Gajaria,2004).The Chloride contents of the thermal power stations water was high in the summer during the study period, which indicates that during the summer the water evaporation is more due to the temperature.

B) Phycological characterization of canal, clarifier and cooling water pond of thermal power station:

The diversity of fresh water algae was abundant in canal, clarifier and cooling pond of thermal power station. A total of 77 taxa under19 genera were belonged to chlorophyceae (44)cyanophyceae (33) (Table -2.)

Canal:

A total of 58 taxa were recorded from the canal, of which 22 taxa belonged to cyanophyceae and 36 taxa were belonged to chlorophyceaeduring the present investigation. The species *Oscillatoria, Phormidium, Lyngbya*were found throughout the investigation period. The species of *Oedogonium,Mougeotia, Spirogyra, Zygnema and Rhizoclonium* were found during the monsoon and winter seasons.

Clarifier:

A total of 56 taxa were recorded from the clarifier, of which 25 taxa belonged to cyanophyceae and 31 belonged to chlorophyceaenduring the present investigation. The species of *Oscillatoria, Phormidium, Lyngbya, Raphidiopsis, Aulosira and Scytonema were found dominant under cyanophyceae*, while *a*mong the chlorophycean the species of*Oedogonium, Mougeotia and Spirogyra* were dominant.

Cooling Pond:

A total of 44 taxa were recorded from the cooling pond, of which 28 taxa belonged to cyanophyceae and 16 taxa belonged to chlorophyceae during the present investigation. The species of *Oscillatoria, Phormidium, Lyngbya, Raphidiopsis, Aulosira and Scytonema were found dominant under* cyanophyceae,while *a*mong the chlorophyceae the species of *Cladophora, Oedogonium*, and*Spirogyra* were dominant.

Table-1: Physico-Chemical Characterization of Thermal power station:

Parameters	**CANAL**			**CLARIFIER**			**COOLING POND**					
							Inlet			**Outlet**		
	M	**W**	**S**	**M**	**W**	**S**	**M**	**W**	**S**	**M**	**W**	**S**
pH	7.80	8.50	8.45	7.80	8.40	8.20	8.82	8.88	8.90	8.80	8.85	8.92
PA	0.00	6.00	7.00	0.00	0.00	0.00	16.0	28.0	23.0	15.0	29.0	18.0
TA	91.0	138.0	146.0	82.0	128.0	132.0	150.0	236.	222.0	170.0	234.0	236.0
TH	88.0	126.0	132.0	120.0	128.0	132.0	143.0	180.0	226.0	140.0	188.0	226.0
Ca	52.0	58.0	66.0	68.0	78.0	92.0	102.0	110.0	140.0	110.0	120.0	132.0
Mg	23.0	42.0	56.0	38.0	42.0	56.0	74.0	71.0	89.0	52.0	76.0	98.0
Cl	12.0	15.0	23.0	10.0	19.0	23.0	20.0	22.0	32.0	26.0	28.0	34.0

(Where, M=Monsoon=Winter, S=Summer)

Table-2: List of Algal forms encountered from Thermal Power Station:

SR.NO.	**Name of the algae**	**CANAL**			**CLARIFIER**			**COOLING POND**		
		M	**W**	**S**	**M**	**W**	**S**	**M**	**W**	**S**
	Cyanophyceae									
1	*Oscillatoria annae* van Goor	+	+	+	-	+	+	-	-	+
2	*Oscillatoria animalis* Ag.Ex Gomont	+	-	+	-	+	+	-	+	+
3	*Oscillatoria boryana* Bory Ex.Gomont	-	-	+	+	+	+	-	-	-
4	*Oscillatoria brevis* (Kutz.) Gomont	-	-	+	+	+	+	-	-	+
5	*Oscillatoria chlorina* Kutz.Ex.Gomont	+	+	+	-	-	-	+	+	+
6	*Oscillatoria chilkensis* Biswas	-	-	-	+	+	+	+	+	+
7	*Oscillatoria curviceps* Ag.Ex.Gomont	+	+	+	-	-	+	-	-	+
8	*Oscillatoria limosa* Ag.Ex.Gomont	-	-	-	+	+	+	+	+	+

9	*Oscillatoria proboscidea* Gomont.	+	+	+	-	+	+	+	+	+
10	*Oscillatoria princeps* Vaucher Ex.Gomont	+	+	+	-	-	-	+	+	+
11	*Oscillatoria subbrevis* Schmidle	-	+	+	-	+	+	-	+	+
12	*Oscillatoria tenius* Ag.Ex.Gomont	-	-	-	+	+	+	-	-	-
13	*Phormidium africanum* Lemm.	-	-	-	+	+	+	-	-	+
14	*Phormidium fragile*(Meneg.)Gomont	-	+	+	+	+	+	-	-	-
15	*Phormidium incrustatum* (Nag.) Gomont	+	+	+	-	-	-	+	+	+
16	*Phormidium laminosum* Gomont	-	-	-	+	+	+	+	-	+
17	*Phormidium mucosum* Gardner	+	-	-	-	+	+	-	-	-
18	*Phormidium orientale* West,G.S.	-	+	+	-	-	-	+	+	+
19	*Lyngbya allorgei* Fremy	-	-	-	-	-	-	+	+	+
20	*Lyngbya birgei* Smith	+	-	-	-	-	+	+	+	+
21	*Lyngbya contorta* Lemm.	-	-	-	+	+	+	+	-	-
22	*Lyngbya martensiana* Meneg.Ex.Gom.	-	-	+	+	+	+	+	+	-
23	*Lygbya nigra* Ag.Ex.Gomont	+	-	-	-	-	+	+	-	-
24	*Lyngbya putealis* Mont.Ex.Gomont	-	-	-	-	-	+	+	+	+
25	*Lyngbya semiplena* Ag.Ex.Gomont	-	+	-	+	-	-	+	+	+
26	*Schizothrix penicillata* (Kutz) Gomont	-	-	+	+	-	-	-	+	+
27	*Symploca thermalis* (Kutz) Gomont	+	+	-	-	-	+	+	+	-
28	*Microcoleus lacustris* Gardner	+	+	+	-	-	-	+	+	+
29	*Raphidiopsis indica* Sing,R.N.	-	-	-	+	+	+	+	+	+
30	*Aulosira prolifica* Bhardwaja	+	+	+	+	+	+	-	-	-
31	*Anabaena constricta* (Szafar) Geitlers	-	-	-	-	+	+	+	+	+
32	*Scytonema simplex* Bhardwaja	+	-	-	+	+	+	+	-	-
33	*Calothrix braunii* Bornet et Flahault	-	-	-	-	-	-	+	+	+
	Chlorophyceae:									
34	*Ulothrix moniliformis* Kutz.	+	+	+	+	+	-	-	-	-
35	*Ulothrix oscillarina* Kutz.	+	+	-	-	+	+	-	-	-
36	*Cladophora crispata* (Roth) Kuetz.	-	-	-	+	+	+	-	-	-
37	*Cladophora fracta* (Dilw) Kutz.	-	+	+	+	+	+	+	-	-
38	*Cladophoraglomerata*Kutz.	-	-	-	+	+	+	+	-	-
39	*Cladophora insignis* AgardhEx.Kutz.	-	+	-	+	+	+	-	-	-
40	*Oedogonium aerolatum* Lagerheim.	+	+	+	+	+	+	-	-	-
41	*Oedogoniumbiformae* (Nordist) Hirn.	+	+	+	-	-	-	-	-	-
42	*Oedogoniumclavum*Wittrock	+	-	+	-	+	-	-	+	-
43	*Oedogoniumcarolinianum*Tiffany	+	+	+	-	-	-	-	-	-
44	*Oedogoniumcrassun* (Hass.) Witt.	-	-	+	+	+	+	-	-	-
45	*Oedogoniumgunnii*Wittrock	-	+	+	-	-	-	+	+	+
46	*Oedogoniumintermedium*Wittrock	+	+	+	-	+	+	+	+	-
47	*Oedogoniumlatiusculum* Tiffany	-	+	+	+	+	-	-	-	+
48	*Oedogoniumplusiosporum*Wittrock	+	+	+	-	+	+	-	-	-
49	*Oedogoniumpisanum*Wittrock	+	+	+	-	-	-	-	-	-
50	*Mougeotiaabnormis*Kisselew	+	+	+	+	-	-	-	+	+
51	*Mougeotiaangusta*(Hassal) Kirch.	+	+	-	-	-	-	-	-	-
52	*Mougeotiaelegantula*Wittrock	-	-	-	+	+	+	-	-	-
53	*Mougeotiafloridana*Transeau	+	+	+	+	-	-	-	-	-
54	*Mougeotiarecurva* (Hassal) De Toni	+	+	-	-	-	-	-	-	-
55	*Mougeotiaquandrangulata*Hassal	+	+	+	+	-	-	+	+	+
56	*Spirogyaraaequinoctalis* West	-	-	-	+	+	+	-	+	+
57	*Spirogyra biformis*Jao	-	-	+	+	+	-	-	-	-
58	*Spirogyaracommunis* (Hassal) Kutz.	-	+	+	-	-	-	+	-	-
59	*Spirogyra ellipsospora*Transeau	-	+	+	+	-	+	+	-	-
60	*Spirogyra flaviatilis*Hilse	-	+	+	-	+	+	+	-	-
61	*Spirogyra gracillis* (Hassal) Kutz.	-	-	-	+	+	+	-	-	-
62	*Spirogyara hyaline* Clave	-	+	+	-	-	+	-	+	+

63	*Spirogyra incostans* Collins.	+	-	-	-	-	-	-	+	+
64	*Spirogyra pratensis*Transeau	-	-	-	-	+	+	-	+	+
65	*Spirogyra skujae*Randhawa	-	-	-	+	+	-	-	-	-
66	*Zygnemacyanosporum*Clavae	+	+	+	-	-	-	-	-	-
67	*Zygnemachlaybeospermum*Hansgirg	-	-	+	+	+	-	-	-	-
68	*Zygnemapectinatum*Agardh,C.A.	+	-	-	-	--	-	-	+	+
69	*Zygnemasynadelphum*Skuja	-	-	-	+	+	+	-	-	-
70	*Rhizocloniumcrassipellitum* West	+	+	+	+	+	+	-	-	-
71	*Rhizocloniumfontanum*Kutz.	+	+	+	-	-	-	-	-	-
72	*Rhizocloniumhookeri*Kuetzing	-	+	+	+	+	+	-	-	-
73	*Rhizocloniumheirohlyphicum*Ag.Kut	+	+	+	+	+	-	-	-	-
74	*Pithophoraaqualis*Wittrock	+	+	+	+	-	-	-	-	-
75	*Pithophoraoedogonia* (Mont.) Witt.	-	+	+		+	-	-	-	-
76	*Pithophoravaria*Wille	+	+	+	-	-	-	-	-	-
77	*Pithophorazelleri*Wittrock.	+	+	+	-	+	+	-	-	-

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