International Journal of Botany Studies
ISSN: 2455-541X
Impact Factor: RJIF 5.12
www.botanyjournals.com
Volume 2; Issue 5; September 2017; Page No. 06-11

Physico-chemical parameters of biodiversity of blue green algae in Tapi River of prakasha barrage shahada taluka nandurbar district (M.S.) India

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Abstract
The present paper reports observation on the Cyanophyceaen algalflora of the Tapi river collected from different depths of Prakasha barrage, Shahada Taluka, Nandurbar district, Maharashtra and monthly changes in physical and chemical parameters such as pH, water, temperature, BOD, COD, D.O. , T.D.S. ,Ca, Mg, Al, Na,K,NO_3 , PO_4, SO_4, Cl. In the present study, the results showed as in the aquatic forms are dominated by Cyanophyta members. Total 87 Species are reported. Which belong to class Cyanophyceae. Most domintant species are*Spirulina, Oscillatoria, Phormidium, Lyngbya, Nostoc, Anabaena.* They are analyzed for a period of one year from Oct 2011 to Sept 2012. All parameter are with the permissible limts. The results indicate that water is non polluted and can be used for Domestic purpose and Irrigation.

Keywords: physico-chemical paramter, monthly variation, depth of phytoplankton, tapi river

1. Introduction
Prakasha barrage is important place of Nandurbar District, Maharashtra. In present scenario, there is a wide gap between the demand and of water everywhere in India. A recent UNESCO report indicates that a vast chunk of population in India has no access to safe drinking water and that million people still rely on un-safe water for consumption. Most of the diseases and deaths occurring globally are directly linked to lack of adequate water, sanitation and hygiene. An alga plays an important role in maintaining aquatic ecosystem and forms the base of food chain. Workers have given the taxonomic account of blue green algae. Bhoge, O.N. *et al.* (2005) [4], Kolte and Goyal (1985) [9]. Standing at the bottom level of the chain, phytoplankton's bear a significant importance in respect of their role in aquatic ecosystems and their relations with other organisms at top levels. Phytoplankton are the major primary producer in many aquatic ecosystems and are important food source for other organisms.

2. Material and Methods
From Tapi river a water samples and phytoplanktons were collected manually on monthly basis from October 2011-September 2012 during morning period between 9.00-11.pm. Samples were collected in bottles and polythene bags. Physico-chemical characteristics were determined according to the method of APHA (1985) [2], Trivedy and Goel (1987) [18], Phytoplankton samples were preserved in 4% Formalin and identification was done with the help of Monograph of Cyanphyceae by Desikachary, T.V. (1959) [5]. Physico-chemical characteristics of water along with mean and standard error and phytoplankton forms identified have been given in tables.

2.1 Study area
The study area lies in Maharashtra state in the Shahada Tahsil, district of Nandurbar. The water reservoir is at Prakasha, Sarangkheda [21° 36 N, 74° 24 E] Water resources are utilized for various purposes such as irrigation, domestic use, fish culture.

2.2 Observation Table

Table 1: Diversity of phytoplankton from different depth at Prakasha barrage on Tapi river of Shahada Taluka, Nandurbar District, Maharashtra.

No.	SPECIEC NAME	0-1ft	1-2ft	2-3ft	3-4ft
1	*Microcystis viridis* (A.Br.) Lemm	+	+	-	-
2	*Microcystisflos-aquae* (Wittr.) Kirchner	+	-	-	-
3	*Microcystis elabens* (Breb.)Kutz	+	-	-	-
4	*Chroococcus micrococcus* (Kutz) Rabenth	+	+	-	-
5	*Chroococcus turgidus* (Kutz) Nag	+	+	-	-
6	*Chroococcus cohaerens* (Breb.) Nag	+	-	-	-
7	*Gloeocapsa livida* (carm). Kutz	+	-	-	-
8	*Gloeocapsa stegophila* (Itzigs.) Rabenh.	+	+	+	-
9	*Gloeothece rhodochlamys* Skuja	+	+	+	-

10	*Aphanocapsa littoralis* Hansgirg	+	-	-	-
11	*Aphanocapsa banaresensis* Bharadwaja	+	-	-	-
12	*Aphanocapsa biformis* A.Br	+	+	+	-
13	*Aphanocapsa muscicola* (Menegh.) Wille	+	+	-	-
14	*Merismopedia tenuissima* Lemm	+	+	-	-
15	*Merismopedia punctata* Meven	+	-	-	-
16	*Merismopedia glauca* (Ehrenb.) Nag	+	-	-	-
17	*Dactylococcopsis raphidioides* Hansg	+	+	+	-
18	*Stichosiphon sansibaricus* (Hieron.) Drouet et Daily	+	+	-	-
19	*Myxosarcina burmensis* Sukja	+	+	+	-
20	*Xenococcus kerneri* Hansg	+	+	-	-
21	*Spirulina subsalsa* Oerst. ex Gomont	+	+	+	-
22	*Spirulina labyrinthiformis* (Menegh.) Gomont	+	+	+	+
23	*Spirulina meneghiniana* Zanard. ex Gomont	+	+	+	+
24	*Spirulina subtilissima* Kutz. ex Gomont	+	+	-	-
25	*Oscillatoria nigroviridis* Thwaites ex Gomont	+	+	+	-
26	*Oscillatoria perornata* Skuja	+	-	+	-
27	*Oscillatoria ornate* Kutz. ex Gomont	+	+	-	-
28	*Oscillatoria princeps* Vaucher ex Gomont	+	+	+	-
29	*Oscillatoria chilkensis* Biswas	+	+	-	-
30	*Oscillatoria foreaui* Fremy	+	-	-	-
31	*Oscillatoria tenuis* Ag. ex Gomont	+	+	-	-
32	*Trichodesmium erythraeum* Ehrenberg ex Gomont	+	+	-	-
33	*Phormidium fragile* (Meneghini) Gomont	+	+	+	-
34	*Phormidium molle* (Kutz.) Gomont	+	+	-	-
35	*Phormidium microtomum* Skuja	+	+	+	-
36	*Phormidium tenue* (Menegh.) Gomont	+	+	-	-
37	*Phormidium stagnina* Rao, C.B	+	+	+	-
38	*Phormidium anomala* Rao, C.B	+	+	-	-
39	*Phormidium ambiguum* Gomont	+	+	+	-
40	*Phormidium corium* (Ag.) Gomont	+	+	+	-
41	*Phormidium ceylanicum* Wille	+	+	+	-
42	*Phormidium subfuscum* Kutz. ex Gomont	+	+	+	-
43	*Phormidium lucidum* Kutzing ex Gomont	+	+	-	-
44	*Phormidium autumnale* (Ag.) Gomont	+	+	+	-
45	*Lyngbya gardneri* (Setchell et Gardner) Geitler	+	-	-	-
46	*Lyngbya epiphytica* Hieron	+	-	-	-
47	*Lyngbya holdenii F*orti	+	+	+	-
48	*Lyngbya polysiphoniae* Fremy	+	+	-	-
49	*Lyngbya nordgardhii* Wille	+	+	-	-
50	*Lyngbya birgi Smith*, G.M	+	-	-	-
51	*Lyngbya shackletoni*W. et G.S. Wet	+	-	-	-
52	*Lyngbya kashyapii* Ghose	+	+	-	-
53	*Lyngbya dendrobia* Bruhl et Biswas	+	+	-	-
54	*Lyngbya aestuarii* Liebm. Ex Gomont	+	-	-	-
55	*Lyngbya lutea* (Ag.) Gom	+	-	-	-
56	*Lyngbya porphyrosiphonis* Fremy	+	+	-	-
57	*Lyngbya putealis* Mont. ex Gomont	+	+	-	-
58	*Lyngbya martensiana* Menegh. Ex Gomont	+	+	-	-
59	*Schizothrix lacustris*A. Br. ex Gomont	+	+	-	-
60	*Schizothrix vaginata* (Nag.) Gomont	+	-	-	-
61	*Symploca hydnoides* Kutzing ex Gomont	+	-	-	-
62	*Symploca muscorum* (Ag.) Gomont	+	-	-	-
63	*Symploca cartilaginea* (Mont.) Gomont	+	+	-	-
64	*Cylindrospermum musicola* Kutzing ex Bron. Et Flah	+	+	-	-
65	*Cylindrospermum michailovskoense* Elenkin	+	+	-	-
66	*Nostoc linckia* (Roth) Bornet ex Born. et Flah	+	+	-	-
67	*Nostoc piscinale* Kutzing ex Born. et Flah	+	+	-	-
68	*Nostoc spongiaeforme* Agardh ex Born. et Flah	+	+	-	-
69	*Nostoc carneum* Ag. Ex Bron. et Flsh	+	-	-	-
70	*Nostoc calcicola* Brebisson ex Bron. et Flah	+	-	-	-
71	*Nostoc muscorum* Ag. Ex Bron. et Flah	+	+	-	-
72	*Nostoc verrucosum* Vaucher ex Born. Et Flah	+	+	-	-

73	*Anabaena oryzae*Fritsch	+	+	-	-
74	*Anabaena khannae*Skuja	+	+	-	-
75	*Anabaena fertilissima*Rao, C.B	+	-	-	-
76	*Anabaena ballyganglii*Banerji	+	-	-	-
77	*Anabaena naviculoides Fritsch*	+	+	+	-
78	*Raphidiopsis indica* Singh, R.N.	+	+	-	-
79	*Raphidiopsis mediterranea* Skuja	+	-	-	-
80	*Plectonema notatum* Schmidle	+	-	-	-
81	*Camptylonemopsis iyengarii* Desikachary	+	+	-	-
82	*Scytonema bohneri* Schmidle	+	+	+	-
83	*Fortieaincerta* Skuja	+	+	-	-
84	*Nostochopsis lobatus* Wood em. Geitler	+	+	+	-
85	*Nostochopsis hansgirgi* Schmidle	+	+	-	-
86	*Nostochopsis radians* Bharadwaja	+	-	-	-
87	*Mastigocladopsis jogensis* Iyengar et Desikachary	+	-	-	-

Table 2: Monthly variation of Tapi river water at different stations at Prakasha barrage Dist Nandurbar MS. (2011-12)

	Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
pH	7.46	7.72	7.70	7.52	8.04	7.96	7.58	7.9	7.66	7.30	7.40	7.66
Tem	25.34	23.80	22.92	23.10	24.76	27.86	29.72	30.00	29.44	28.68	28.9	28.32
BOD	35.87	28.89	22.92	27.71	21.17	35.76	34.22	30.3	23.67	17.33	29.89	36.43
COD	47.78	29.63	52.28	70.91	29.1	54.04	41.4	50.55	36.53	31.24	41.82	47.8
D.O.	5.50	5.50	4.86	7.24	6.60	5.96	5.70	5.22	7.02	7.76	5.96	5.18
TDS	399.80	461.40	450.60	488.00	412.00	453.20	402.60	403.40	439.40	677.60	587.40	686.20
Ca	17.76	28.63	28.93	33.39	28.52	27.72	41.63	46.05	33.18	38.43	32.59	36.43
Mg	18.57	36.90	41.90	42.04	48.41	64.82	72.04	79.98	32.68	19.31	18.16	25.40
Al	114.64	116.97	140.58	123.36	114.26	104.61	166.56	181.20	146.40	155.87	174.21	171.42
Na	20.19	23.63	20.04	26.01	26.08	26.52	24.15	25.83	11.01	12.46	12.52	15.96
K	1.60	1.42	1.92	2.10	1.96	2.20	2.32	1.96	1.36	1.22	1.36	1.82
NO3	0.74	0.65	0.72	0.82	1.00	1.05	1.05	1.09	0.74	0.53	0.34	0.74
PO4	0.68	0.91	0.54	0.58	0.43	1.12	0.98	1.14	1.46	2.04	1.46	1.62
SO4	17.26	13.56	15.64	22.42	21.34	25.52	30.08	26.46	17.24	12.80	12.54	13.52
Cl	53.26	65.86	56.39	83.76	63.97	62.23	46.63	71.59	31.29	40.79	18.81	38.17

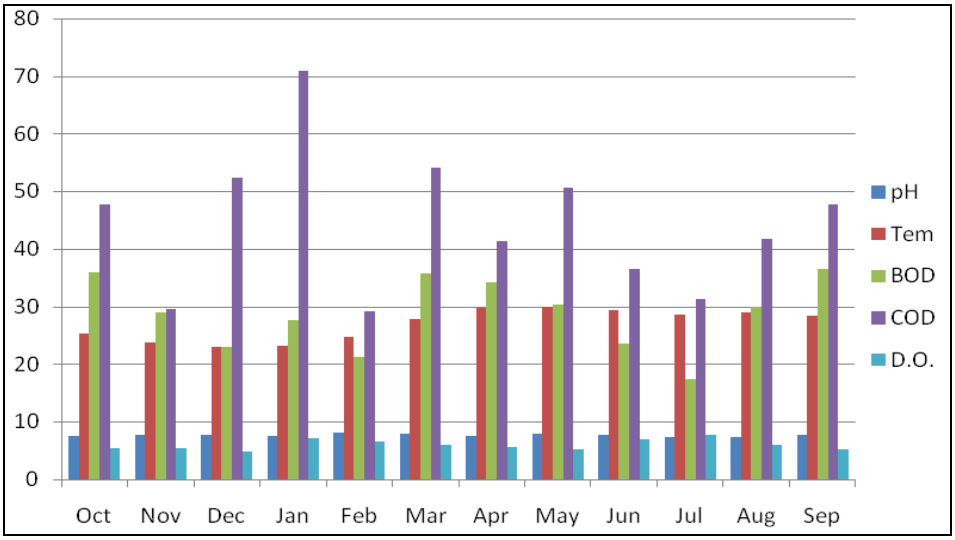

Fig 1: Monthly variation in physico-chemical parameter at Prakasha barrage of Tapi River from Oct 2011 to Sep2012.

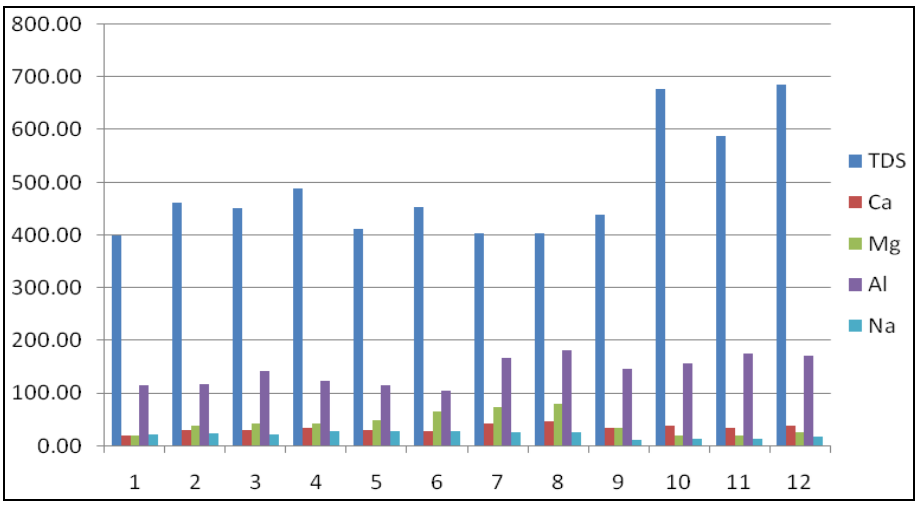

Fig 2: Monthly variation in physico-chemical parameter at Prakasha barrage of Tapi River from Oct 2011 to Sep2012.

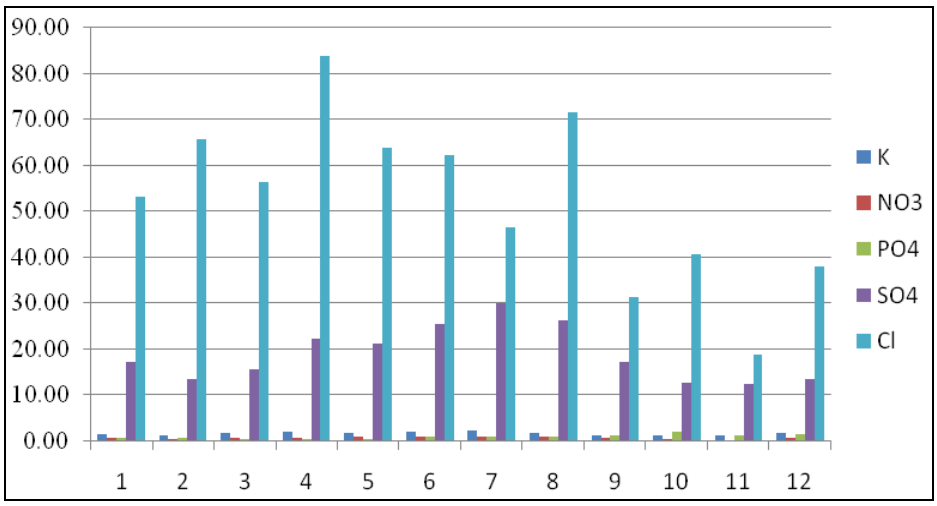

Fig 3: Monthly variation in physico-chemical parameter at Prakasha barrage of Tapi River from Oct 2011 to Sep2012.

3. Result and discussion

Cyanophyta

The study of the phytoplankton samples in Prakash barrage (dam) showed 87 species blue green algae (Table 1.) A total 87 taxa of blue-green algae belonging to 4-Orders, 9-Families, 27 genera were recorded from the river of Tapi. These represented unicellular and colonial, non-heterocyst us filamentous, heterocyst us filamentous, heterotrichous forms. Cyanphyceae considered highly adaptive and colonized even in polluted water at higher temperature. In the present investigation, species are recorded among which *Spirulina, Oscillatoria, Phormidium, Lyngbya, Nostoc, and Anabaena.are* dominant. The statement also supported by Bhat *et al.* (2012) [3], Unni K.S, (1984) [19]. Several workers have reported that higher pH levels are conductive for the growth of blue-green algae (Ragahava Reddy *et al.*, 1980) [16]. Also high organic matter and low Dissolved oxygen content are the favorable attributes for the better growth of cyanophyceae. Munawar (1970) has given similar reports [13].

Physico-Chemical parameters

pH Value

The pH value recorded minimum as 7.9 in the month of May and maximum as 8.04 in February in year 2011-12. Mishra *et al.* (2010) [12] has reported a direct relationship between water, temperature and pH. The lower value of pH is due to dilution of alkaline substances.

Temperature

The temperature recorded minimum in the month of December as 22.9^{o}c and maximum in the month of May as 30.0^{o}c in 2011-2012.

Biological Oxygen demand (B.O.D.)

The minimum value of BOD in month July was 17.33 Mg/L and maximum value in September was 36.24 Mg/L in year 2011-2012. The maximum value of BOD was observed in pre-monsoon period due to the maximum biological affinity at elevated temperature and low in winter. Prasanna, M.B., *et al.* (2010) [15].

Chemical oxygen demand (C.O.D.)

The Chemical oxygen demand recorded minimum in the month Feb was 29.1 mg/L. and maximum in the month January was 70.91 mg/L in year 2011-12.

Dissolved oxygen (D.O.)
The Dissolved oxygen recorded minimum in the month of December was 4.86 mg/L. and maximum in the month of January was 7.76 mg/L. Highest DO was recorded in the January followed by post monsoon. LaskarHafsa Sultana (2009) [11].

Total dissolved solids
The Total dissolved solids recorded minimum in the month of October as 399.80 mg/L. and maximum in the month of September as 686.20 mg/L. Total dissolved solids were found high value in the month September during the study the reduced the algal population. Shiva Kumar & Singh (2009) [17].

Calcium
The Calcium was recorded minimum in the month of October as 17.76 mg/L. and maximum in the month of May as 46.05 mg/L. Calcium is found in greater abundance in all natural water as its main source is weathering of rocks from which its leaches out higher values of this noticed in summer session. Jacklin Jemi R. *et al.* (2011) [7].

Magnesium
The Magnesium was recorded minimum in the month of August 18.16 mg/L. and maximum in the month of May as 79.98 mg/L. Magnesium play an important role in antagonizing the toxic effect of various ions in neutralizing excess acid produced. Munawar (1970) [13].

Alkalinity
The Alkalinity was recorded minimum in the month of March as 104.61 mg/L. and maximum in the month of May as 181.20 mg/L. High values of alkalinity may be attributed to increase in organic decomposition during which carbon dioxide is liberated. Airsang R.V. *et al.*, (2013) [1].

Sodium
The Sodium was recorded minimum in the month of Jun as 11.01 mg/L respectively and maximum Sodium was recorded month March as 26.52 mg/L respectively recorded.

Potassium
The Potassium was recorded minimum in the month of July as 1.22 mg/L. and maximum in the month of 2.32 mg/L.

Nitrate
The Nitrate was recorded minimum in the month of August as 0.34 mg/L. and maximum in the month of May as 1.09 mg/L.

Phosphate
The Phosphate was recorded minimum in the month of December as 0.54 mg/L. and maximum in the month of July as 2.04 mg/L. The main sources of phosphate in aquatic ecosystem are domestic sewage, agricultural effluent in addition to water bodies could greatly stimulate algal growth. Gopinath *et al.* (2014) [6].

Sulphate
The Sulphate was recorded minimum in the month of August as 12.545 mg/L. and maximum in the month of April as 30.08 mg/L.

Chloride
The Chloride was recorded minimum in the month of August as 18.81 mg/L. and maximum in the month of January as 83.07mg/L. Maximum concentration were lower and the minimum concentrations higher than those reported by Kori *et al.*, (2008) [20]., Jahangir *et al.* (2000) [8].
The physico-chemical parameter including, Total hardness, Calcium hardness, Magnesium hardnes, Sulphate, Chloride, show variation in normal range as reported by Pawar *et al.* (2006) [14].
Oscillatoria is generally found in polluted and stagnant water. The abundance of phytoplankton of water was influence by many chemical factors has also been depending upon the interaction among biological factors. Quantitatively fluctuation of total phytoplankton in Cyanophyta was recorded at various depth of phytoplankton is maximum during level of 1-2 ft and 2-3ft and minimum phytoplankton present in water surface 0-1ft. 87 species representing Cyanophyceae were determined during present studies.

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