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Limnological study of Venna Lake, Mahabaleshwar, Maharashtra, India

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Abstract

Venna lake is one of the well known water reservoir from Western Ghats. It has gained importance as point of tourism and also because of the water supply to the hill station Mahabaleshwar. To know the quality of water and algal growth of this lake, physicochemical and biological parameters like temperature, pH, total alkalinity, dissolved oxygen, free CO_2, total hardness, phosphate, silica and algal biodiversity was carried out monthly from October 2013 to September 2014. Data obtained in this study has shown the correlation between physico-chemical parameters and occurance of algae found therein. Members of Chlorophyceae like Pediastrum, Scenedesmus and Staurastrum showed constant occurance throughout the year while some of the bloom forming algae like Microcystis observed only during summer season, Euglenoids showed presence during winter season.

Keywords: Physico-chemical parameters, Venna lake, limnology, algae.

Introduction

Algae are major component of water bodies. They are primary producers and play crucial role in aquatic ecosystem. They are principal source of food for microfauna, fishes and other aquatic animals. The oxygen generated in photosynthesis support the life of aquatic organisms. Phytoplanktons serve as the indicator of water quality of water body. Algae occur in wide range of aquatic environments like lentic as well as lotic habitat.

There is extensive work on hydrobiological studies on several water bodies in different regions of India. Anilkumar reported fresh water algae of Hassan district, Karnataka state[1]. Comparative study on seasonal changes in phytoplankton community in the Sagar lake is made by Bais et al[2]. Dwinedi and Pandey studied the physicochemical factors and algal diversity of two ponds in Faizabad[3]. Trivedy and Goel reported the chemical and biological methods for water pollution studies from various parts of Maharashtra[4]. Bhosale et al studied seasonal variations of phytoplanktons from selected lakes of Maharashtra[5]. Physicochemical aspects of Mhaswad water reservoir of Satara district is carried out by Lubal et al[6]. Water quality profile of Kas reservoir is studied by Pawar and Sonawane[7].

Present study aim to investigate Physico-chemical parameters and algal flora of the study region and the correlation between physicochemical parameters and occurance of algae.

Material and Methods

A Venna lake is one of the most popular lake from western Maharashtra situated in famous hill station Mahabaleshwar. It lies between Latitude $17^0 55^{'} 0"$ to $73^0 40^{'} 0"$. The lake was constructed by Shri Appa saheb maharaj who was the rular of Satara in 1842. The area of lake is about 113311.98 sq.m. Due to hill region water comes from all high places and gathered in lake. The water of this lake is used for domestic purposes; it is supplied to hill station Mahabaleshwar and for recreation.

The water samples and algal samples were collected monthly intervals from Octobar 2013 to Septeber 2014. The water samples were collected in plastic carboys of 2 liter capacity. The algal samples were collected in sterile plastic bottles with phytoplankton net of mesh 25, diameter of the pore 60 µ .Benthic and floating algal forms were picked up carefully. The physico-chemical parameters like pH, temperature, free CO2, total alkalinity, hardness, orthophosphate and silica of water samples were carried out using standard methods of APHA[8].

Temperature of air and water was measured at ± 0.1°C accuracy by thermometer at the spot. The D.O. was fixed before taking to laboratory and analysed by Modified Wrinkler Azide method. pH was estimated by using pocket pH meter at the spot.

Algal samples were preserved with Lugols iodine solution and observed under microscope. The identification was carried out by using standard literature[9-13].

Results and Discussion

Water samples collected were analyzed for Physico-chemical parameters and results are given in table-1.

pH: pH of all water samples ranges from neutral to alkaline and it is within the permissible limit (pH 6.5-8.5) and drinking water standards.

Temperature: Average water temperature was found to be in the range of 20-30^{o}C during sampling.

Phosphate: It ranged from 0.02 mg/L to 0.23mg/L during the study period.

Silicates: Its value ranged from 1.9 mg/L to 16 mg/L.

D.O.: Dissolved oxygen is an important parameter in assessment of water quality. It reflects physico-chemical and biological processes of water ecosystem. Its depletion is a limiting factor for many aquatic forms. In present study it ranges from 4.4 mg/L to 10 mg/L.

Biological parameters: The details of biological characteristics with respect to algal study are given in table-2. Phytoplanktons or algae are the major inhabitants of water body. They are primary producers which trap the solar energy and convert it into biochemical energy and play an important role in food chain of aquatic ecosystem. Their presence or absences indicate quality of the water body.

The water body under study showed rich variety of algal species. Algal species belonged to four groups-Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae were recorded (table-2).

In September, there were rise in the water level due to good rains however there was no good growth of algal species. The members of Desmidiaceae like *Euastrum, Straurastrum* were observed while Chlorophycean member like *Pandorina* were recorded.

After rains in October, there is maximum alkalinity (32mg/L) and total hardness 50mg/L. Moderately alkaline pH indicate increase in carbonates and bicarbonates which has affected the quality of water. This change in quality of water resulted change in the algal flora. So, Chlorophycean members showed their abundance in October.

Bloom formation by *Microcystis species* was started from April and which become quiet thick in June. This development of algal bloom requires appropriate conditions in water body like low flow of water, still environment, good light penetration and abundant nutrient supply (especially N and P) and low Zooplankton grazing[14]. Our observations were also same as the phosphate concentration was quiet high (0.22 mg/L) and water temperature is also maximum (23-32^{o}C) in March and April.

Abundance of diatoms was observed from January to May as there is significant amount of silica in the study region while the population of diatoms is rare or absent from October to December as there was negligible amount of Silica in water body under study.

Table-1
Physico-chemical characteristics of water from Venna lake

Month	pH	Atm. Temp (^{o}C)	Water Temp (^{o}C)	Free CO2 (mg/L)	Total alklinity (mg/L)	Total hardness (mg/L)	Ortho phosphate (mg/L)	Silica (mg/L)	D.O. (mg/L)
October	8	27	24	8.8	32	50	0.02	0	7
November	6.9	27	24	8.8	8	50	0.02	0	6.8
December	6.9	27	23	17.6	4	25	0.02	5	6
January	7	21	21	13.2	8	25	0. 22	16	4.4
February	7	21	20	11.1	8	25	0. 225	16	4.4
March	7	23	20	11.2	8	25	0. 22	15	4.6
April	7.2	23	20	11	8	25	0. 22	15	4.6
May	8.8	32	30	4.4	12	25	0.23	15	6
June	8	22	25	4.4	6	17.8	0	1.9	5.2
July	7.2	19.8	20.2	13.2	10	25	0	2.1	10.4
August	8.40	20	20.4	13	10.2	14	0	2.0	6.1
September	8.40	20	20.4	17.6	8	14	0.03	2.0	6.1

Table-2
Algal flora of Venna lake

Month	Chlorophyceae (Figure-1)	Cyanophyceae (Figure- 2)	Bacillariophyceae (Figure-2)
October	*Cosmarium moniliforme,Staurastrum circulus, St.leptocladam, St.chaetoceras, St.dickie, Chlorella vulgaris, Spirogyra fennica, Euglena caudate, Scenedesmus obliquus*	*Chrococcus turgidus, Oscillatoria sps.*	*Pinnularia nobilis, Navicula gracilis*
November	*Euastrum.sinuosum, Staurastrum. Avicula, St.chaetoceras, St.furcatum, St.graciole, St.coroniferum, St.sebaldi, Tetraedron trigonum, Chlorella vulgaris,*	*Oscillatoria sps.*	-
December	*Staurastrum furcatum, St.graciole, St.coroniferum, St.sebaldi,*	-	-
January	*Chlorella vulgaris, Chlamydomonas sps., Phacus acuminatus*	-	*Centronella sps.,Astronella sps.,Aulcosira sps.*
February	*Euastrum dubium, Tetraedron sps., Sturastrum quadricauda, St.obliquuus, St.cingulum, St.coroniferum, St.gracile, Chlorella vulgaris, Pediastrum tetras, St.quadricauda, Spirogyra sps.*	-	*Pinnularia sps., Synedra acus var.radians*
March	*Staurastrum cingulum v.obesum*	-	*Navicula gracilis*
April	-	Microcystis flos-aquae (Bloom)	*N. radiosa, Pinnularia nobilis*
May	*Staurastrum oxycanthum, St.pseudopelogicum, Pediastrum sps.*	*Microcystis flos-aquae (Bloom)*	*Melosira grannulata, M.speciesa, Astronella Formosa, Navicula sps.*
June	*Euastrum bidentatum, Ankistrodesmus falcatus, Scenedesmus dimorphus, Scenedesmus sps.*	*Microcystis flos-aquae (Bloom)*	*Melosira grannulata*
July	*Euastrum bidentatum, Scenedesmus dimorphus*	-	*Cymbella sps.*
August	*Euastrum sps., Pediastrum duplex var.clathratum, P.duplex var.genuinum, S.obliquus, P.duplex var gracillimum, S.bijugatus var.alternans.form purvus, S.quadricauda var.quadrispina, S. quadricauda*	-	
September	*Stauratrum longispina, Euastrum dubium, St.pseudopelagicum, St.anatinum, St.gracile, Pandorina morum*	-	*Navicula sps.*

Conclusion

There are several reports on limnological studies of lakes, rivers and dams from plain region. The present study has been focused onto limological study of lake of high altitude with specific environmental associations. Our results will help for assessing the diversity of poorly studied locations from high altitude.

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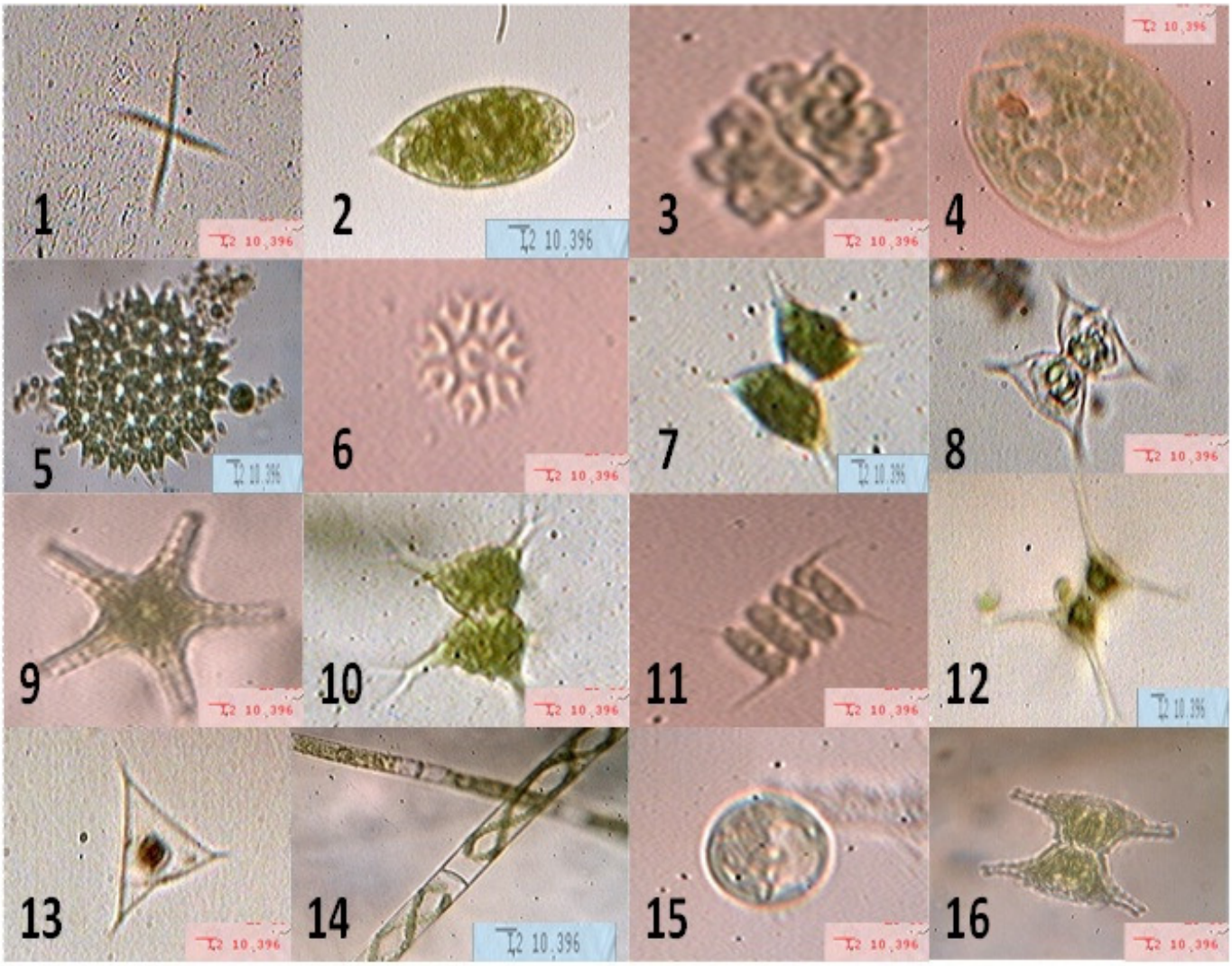

1. Ankistrodesmus falcatus 2.Euglenacaudata 3.Euastrum dubium 4. Phacus acuminatus, 5.Pediastrum duplex, 6.P.tetras, 7.Staurastrum oxycanthum, 8.St.avicula 9.St.coroniferum, 10.St.pseudopelagicum 11.Scenedesmus quadricauda, 12.St. Chaetoceras, 13.Tetraedron trigonum, 14.Spirogyra sps., 15.Chlorella vulgaris, 16.St.gracile

Figure--1
Chlorophyceae members from study area

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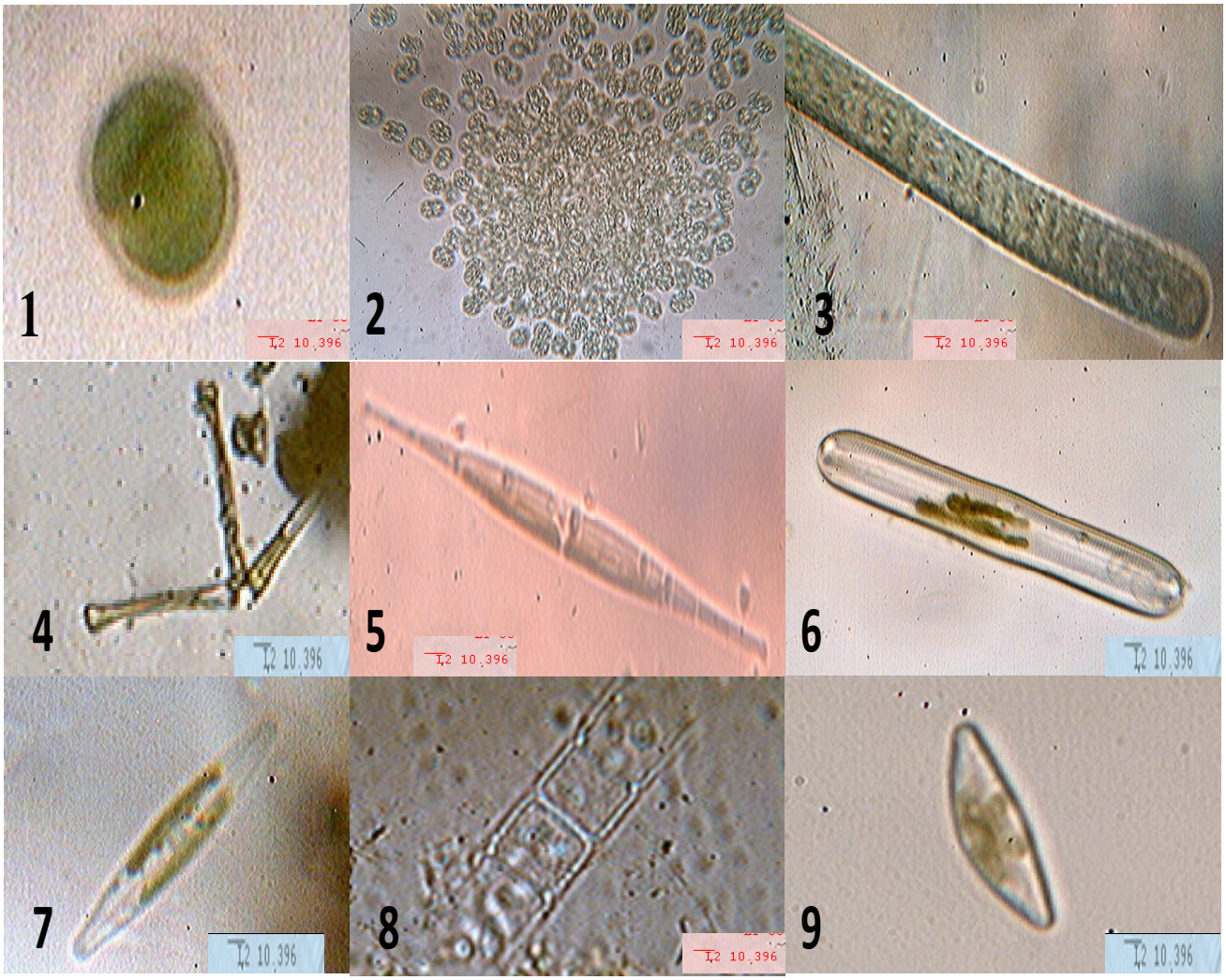

1. Chrococcus turgidus, 2.Microcystis flos-aquae, 3.Ocillatoria decolorata 4.Astronella formosa, 5.Synedra acus, 6.Pinnularia nobilis, 7.Navicula gracilis, 8.Melosira grannulata, 9.Cymbella turgidus

Figure-2
Cyanophyceae and Bacillariophyceae members from study area