Diatoms Community Structure In Relation To Physico-Chemical Factors in Yercaud Lake, Salem District, Tamil Nadu, India

R. Venkatachalapathy, G. Nandhakumar, P. Karthikeyan

Abstract- Diatoms are likely to natural conditions in lake and their distribution is mainly governed by the physicochemical composition of the water. Monitoring of water quality with regards to physicochemical parameter is insufficient. Organic indicators of water quality monitoring urbanized during the recent years have served as excellent tools in the area of water pollution studies. Among all the algae, fresh water diatoms are the most commonly used indicators of the conditions of water. Several diatom indices are tested for rivers in other countries, but have not been used for lake water systems. Diatom monitoring studies in India have suffered given that their recognition is difficult and extensive reporting is not accessible mostly. . Diatoms and water samples were collected in 10 locations during summer season (May 2012). As a result the study aims at applying some of the diatom indices to monitor fresh water lakes of Yercaud city. Three water quality indices and sixteen water chemistry variables were analyzed. 21 diatom species are identified. They are as follows: Amphora ovalis, Bacillaria paxillife, Cyclotella atomus, Cyclotella stelligera, Cymbella tumida, Eunotia curvate, Eunotia pectinalis, Fragilaria rumpens, Frustulia megaliesmontana, Gomphonema lanceolatum, Gomphonema Parvulum, Gomphonema undulatum, Navicula ryhnchocephala, Navicula virudila. Navicula sigmatifera, Nitzschia microcephala, Nitzschia obtuse, Nitzschia palea, Pinnularia boreanis, syndera ulna, Tabularia tabulate. Fresh water diatoms indices can be applied in water quality monitoring of lakes. Changes in the Diatom of large temperate freshwater lakes have long been recognised as providing a good indicator of the trophic status and environmental quality of the system. To assess the relative importance of environmental influences on diatom assemblages good lake. In this paper we deals with the current status of the diatom of a Yercaud lake make comparisons with diatoms community structure in relation to physico-chemical factors. Among the physical and chemical variables measured, water pollution, particularly organic contamination and eutrophication, measured from pH, electrical conductivity and total ionic concentration, respectively, appeared to be one of the most important environmental factors determining the composition and structure of species associations in the area studied.

Key words: Freshwater lakes, Environmental quality, Physico-chemical factors.

I. INTRODUCTION

Diatoms (Phylum Bacillariophyta) fossils (siliceous frustules) in macrophyts are good indicators of pH, salt content, and eutrophication (Battarbee, 1984). Diatoms are found in all aquatic habitats and species preferences can be used to make predictions about current and past conditions (Lowe, 1974). Because of their wide dispersion, diatoms reflect the quality of the water in lakes and streams. Diatoms are also the primary food for many invertebrates and vertebrates (Davis and Norton, 1978). Diatoms are microscopic algae that occur in both freshwater and marine environments. They have a siliceous shell, or frustule, consisting of two valves, that are generally preserved in sediments. They occur in a variety of habitats; for instance, there are planktonic diatoms that grow in open water, epiphytic diatoms that grow on plants and macroalgae and epipelic diatoms that grow on sediments. Diatoms are particularly useful as environmental indicators because many species have a narrow range of environmental conditions that are optimal for growth and survival, and diatom populations respond rapidly to environmental change (Dixit *et al.* 1992).

II. MATERIALS AND METHODS

A. Study area

Yercaud is a hill station near Salem, Tamil Nadu, and India in the Servarayan range (anglicized as Shevaroys) of hills in the Eastern Ghats. It is at an altitude of 1,500 metres (4,920 feet) from mean sea level. The town gets its name from the lake located at its center in Tamil "Yeri" means "lake" and "Kaadu" means "forest". Yercaud is known for coffee plantations and orange groves. The highest point in Yercaud is the Servarayan temple, which is situated at a height of 5326 feet. Hence the Yercaud hill area is called Shevaroy Hills. It is also called "Ooty of the Poor". The climate of Yercaud is a moderate one. The maximum temperature is 167.6°F and minimum is 66°F. During winter, the hill is covered by mist and looks beautiful.

Figure 1. A view of Study area in Yercaud Lake

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220

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B. Geography

The range Yercaud situated is Archaeon plutonic rocks of charnokite series and these have weathered into the rugged masses of hills. There are three routes up to the hills, the Shevaroys range is covered with green grasses, and has not any considerable growth of forests.

C. Climate

The climate of Yercaud is moderate. Winters are fairly mild, starting in September and ending in December. During winter, the hills are covered in mist. Winters range from 12°C to 25°C, and Summers from 16°C to 30°C. Rainfall is 1500–2000 mm. The coffee bushes blossom in April and offer a spectacular view. The climate is also particularly pleasant.

A total of ten samples are collected from the lake sites. These sites were located in from different part of the lake like water inlet, outlet, middle and surrounding parts of the island with the help paddle boats. Diatoms samples are collected from the macrophytes and lake water. After initial observation, materials are fixed in Formalin solution (0.5%) to immobilize the cells. Each sample is assigned with a voucher number along with the collection.

D. Laboratory analysis

Sub-samples of the diatom suspensions were cleaned to remove organic material using wet combustion with concentrated HNO_3 and cleaned using 30% H_2O_2 mounted in Naphrax (Stoermer *et al.,* 1995). Identification of diatoms was carried out using taxonomic guides (Gandhi, 1957 1959a, 1959b, 1961, 1962, 1967; Karthick *et al.,* 2008). The final 'cleared' diatom samples – an ash coloured material is mounted in a mounting medium e.g. Napthrax with a refractive index close to 1.7 and placed on a hotplate until the solvent in the medium evaporates. The slide is cooled immediately, by removing from the hotplate. The diatom slide thus obtained is permanent. The diatoms cleaned cells in permanent slides are observed under 40X and photographed using black and white for best results or by digital photography. The water samples are analyzed by Tamilnadu water supply and drainage board district water testing laboratory in Salem.

E. Species Distribution

Diatoms are unicellular phytoplankton with cell walls made of silica. They lived in both fresh water and saltwater. Diatoms are a type of algae. Their cell walls are made of silica (glass) This unique structure preserves their shape, and makes them excellent species to study the condition of lakes over time. The presence or absence of certain diatoms can help us understand the history of the particular lake.

From the 10 samples collected and analyzed in the study area, a total number of 21 diatom species are identified. They are as follows: *Amphora* ovalis, Bacillaria paxillife, Cyclotella atomus, Cyclotella stelligera, Cymbella tumida, Eunotia curvate, Eunotia pectinalis, Fragilaria rumpens, Frustulia megaliesmontana, Gomphonema lanceolatum, Gomphonema Parvulum, Gomphonema undulatum, Navicula ryhnchocephala, Navicula virudila. Navicula sigmatifera, Nitzschia microcephala, Nitzschia obtuse, Nitzschia palea, Pinnularia boreanis, syndera ulna, Tabularia tabulate.

III. RESULT AND DISCUSSION

Among the species found in the study area, the species belong to genera *Navicula, Gomphonema, Nitzcshia, Pinnularia* are reported and associated with relatively clean to less polluted waters. The Similar results were reported by Round (1991) from Brazil; Biggs and Kilroy (2000) from New Zealand; Potapova and Charles (2003) from US rivers. These species are reported from less polluted, tolerant and associated with natural substrates i.e. Macrophytes. The species such as *Navicula sigmatifera*, *Navicula virudila* and *Gomphonema undulatum, Pinnularia boreanis* are most dominant species and associated with relatively clean to less pollute water i.e.Yercaud lake.

However, the species like *Nitzschia palea*, *Gomphonema parvulum* are found to be tolerant of organic pollution to sewage effluent effect at lake inlet. *Gomphonema parvulum* occurs as dominant species in polluted in lake. This may be because of discharge of effluents and untreated sewage into the lake. Abundance and diversity of species such as *Navicula sigmatifera* and *Navicula virudila* indicate that the middle and outlet portion of the lake.

IV. CONCLUSION

Among the physical and chemical variables measured, water pollution, particularly organic contamination and eutrophication, determined from pH, electrical conductivity and concentration ionic, respectively, were the most important environmental factors determining the composition and structure of the species associations in the study area. It may be concluded that the density diatom is defendant on abiotic factor either directly are indirectly. Diatom communities and the use of diatom indices yield significant results in lake water quality monitoring in India. It can be concluded that, although the lakes are at a wide distance apart, many diatom communities in them have similar environmental tolerances. Water chemistry variables are closely related to diatom indices, which is an indication that diatoms can be used as indicators of organic and anthropogenic pollution. In order to achieve this, identification and preparation of taxonomic list of diatom flora of Indian waters needs to be stressed.

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The physicochemical analysis of samples from inlet, outlet, middle of the lake is given below:

| Parameters/ Locations	Outlet	Inlet	Middle
Odour	Earthy	Algae	Algae
Turbidity NT UNITS	16	12	15
TDS mg/ lit	179	186	188
Ec micromoho/cm	256	266	269
pH	7.55	7.46	7.38
Total alkalinity	108	116	120
Total hardness	96	104	112
Calcium	19	21	21
Magnesium	8	9	9
Sodium	21	23	23
Potassium	2	2	2
Iron	0.5	0.3	0.5
Nitrate	1	1	1
Chloride	16	16	16
Fluoride	0.2	0.2	0.2
Sulphate	1	1	1

Table 1. Physical and chemical parameters in Yercaud lake

Plate 1
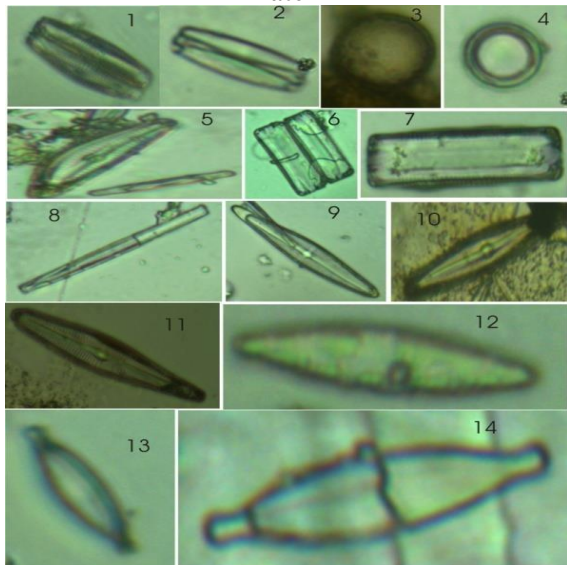
1. Amphora ovalis, 2. Bacillaria paxillifer, 3. Cyclotella atomus, 4. Cyclotella stelligera, 5. Cymbella tumida, 6. Eunotia curvate, 7. Eunotia pectinalis, 8. Fragilaria rumpens, 9. Frustulia megaliesmontana, 10. Gomphonema lanceolatum, 11. Gomphonema Parvulum, 12. Gomphonema undulatum, 13. Navicula ryhnchocephala, 14. Navicula virudila. (40X)

Plate 2
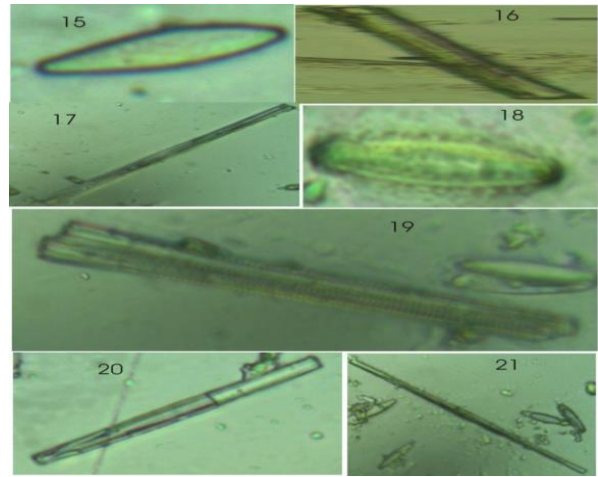
15. Navicula sigmatifera, 16. Nitzschia microcephala, 17. Nitzschia obtuse, 18. Nitzschia palea, 19. Pinnularia boreanis, 20. syndera ulna, 21. Tabularia tabulate. (40X)

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