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Studies on macrophytic diversity of Victoria Lake, Lohardaga (Jharkhand) with special reference to its water quality

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Abstract- The growth of aquatic and semi-aquatic plants depends on the water quality of the water body. Increase in the number of invasive plants reduces the number of macrophytic species which inhabits the growth of native species in the water bodies. The present paper deals with the physicochemical analysis of water and the presence of macrophytes at Bada Talab (popularly known as Victoria Lake), Lohardaga. The comparative study of the number of macrophytic species available in the pond in the year 2009 and 2016 was done in the present work. It was found that there was a decrease in the number of aquatic and semi-aquatic flora in the pond during the past seven years.

Key words: Invasive, Macrophytic, Physicochemical characteristics of water, Victoria lake, Lohardaga

INTRODUCTION

Water is one of the most valuable natural resource on earth^{1,2}. 71 % of our earth is covered with water. 97 % of the global water is present in seas and oceans. Only 1 % of the available fresh water is present in ponds, lakes, rivers and swamps³⁻⁵. There are various kinds of surface water sources present on the earth. Some of them include ponds, lakes, rivers, streams, seas, oceans etc. A pond is a small, shallow standing water body whereas a lake is a relatively large body of slow moving or standing water body that occupies an inland basin of appreciable size⁶.

Ponds and lakes are a habitat of many aquatic and semi-aquatic flora⁷. A large number of aquatic diversities are found in the lakes and ponds ranging from microscopic to macroscopic level.

Lohardaga, the bauxite city of Jharkhand is situated between 23°30' N to 23°40' N latitudes and 84°40' E to 84°50' E longitudes^{8,9}. There are many ponds in Lohardaga. Bara Talab (popularly known as Victoria Lake) is the largest pond there. Some other ponds such as Bauli Talab (Temple pond), Thakurain Talab, Bucha Talab, Chotka Bauli Talab etc. are also present there. Most of the ponds in the district are perennial fish ponds. Victoria Lake is known for fishery activities especially net fishing and rod fishing. It is quite

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a large pond covering an area of over 17 acres. Various types of aquatic and semi-aquatic flora are found in the pond^{10,11}.

Aquatic plants are classified into various categories including floating hydrophytes which include free floating plants, attached hydrophytes with floating shoots, attached hydrophytes with floating leaves as well as submerged hydrophytes. The submerged hydrophytes always remain under water surface and are categorized as suspended

submerged hydrophytes and attached submerged hydrophytes beside emergent hydrophytes and wet land hydrophytes (helophytes)¹²⁻¹⁴.

Studies on macrophytic diversity of the pond indicate the decline in the number of macrophytic species over the past 10 years. In the year 2009, there were 32 species isolated in the pond which reduced to 20 in the year 2016. The reduction in number can be attributed to increase in the number of invasive species¹⁵.



Fig. 1- Satellite Image of Victoria Lake (Bara Talab), Lohardaga (Source : Google maps)



Fig. 2- Image of Victoria Lake (Bara Talab), Lohardaga

OBJECTIVES

The main objectives of the present study were:

- To analyze the water quality of the pond
- To study the macrophytic diversity during different seasons- pre-monsoon, monsoon and post monsoon
- To correlate the macrophytic diversity with water quality
- To compare the number of macrophytic species of the previous study and the present study.

MATERIALS & METHODS

For collection of water, plastic bottles of 1 L size were used. Water samples were collected from the pond during three consecutive seasons i.e. pre-monsoon (April to June), monsoon (July to September), and post monsoon season (October to December) of the year 2016. Samples were stored according to the preservation procedure following AS/NZS 5667.1:1998. Those parameters such as temperature (air and water), water depth, transparency, pH which could have changed during the due course of time were analyzed at the sampling sites. Total hardness, calcium hardness, magnesium hardness, total suspended solids (TSS), dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), nitrate, sulphate, phosphate, chloride, silicate, iron, zinc and fluoride concentrations of water samples were analyzed in the Environmental Sciences Laboratory, CMPDI, Ranchi. The analysis was done by the standard methods given by National Environmental Engineering Research Institute (NEERI, 1986)¹⁵ and (APHA,1992)¹⁶. The data after analysis were tabulated and compared with maximum tolerance limits.

For the study and survey of various aquatic and semi aquatic macrophytic species, the study area was visited thrice in every season to collect the plants in flowering and fruiting stages. Utmost care was taken during collection of the plant specimen as they lose their characters soon while they are taken out of the water. During field work, important characters like habit, color of the plants, height of the plants, and association of the plants with other plants were noted down. Plants were pressed in the field herbarium press. Some plants were also kept in dilute solution of formalin. Just after returning from the field, the plants were studied in the laboratory on the very same day. The field numbers were verified, flowers dissected

and the plants were identified with the help of local floras. After specific identification and study, the plants were dried and pressed under heavy herbarium press. Before pressing, the plants were poisoned in 2% saturated solution of mercuric chloride in rectified spirit. The specimens after drying were mounted with the help of synthetic resin adhesive and thread on the herbarium sheets of standard size (41.6 x 29.5). The plants are listed as per the classification system of Bentham & Hooker (1862-1883)¹⁷.

RESULTS & DISCUSSION

Table 1- Water Quality Parameters and Their Reported Values during 2016

Parameters	Pre-Monsoon	Monsoon	Post-Monsoon
Air Temperature (°C)	35.00	30.00	22.00
Water Temperature (°C)	33.00	26.50	21.50
Water Depth (cm)	130.85	152.70	142.20
Transparency (cm)	32.46	26.44	30.48
pH	7.30	7.70	7.40
Total Hardness (ppm)	58.40	50.70	42.50
Calcium Hardness (ppm)	32.00	36.20	30.70
Magnesium Hardness (ppm)	26.40	14.50	11.80
TSS (mg/L)	32.00	37.00	38.00
D.O (mg/L)	4.70	3.10	2.40
B.O.D (mg/L)	12.30	11.70	10.90
C.O.D (mg/L)	9.50	7.10	6.40
Nitrate (mg/L)	2.70	1.50	2.30
Phosphate (mg/L)	0.25	0.20	0.18
Sulphate (mg/L)	40.00	47.00	38.00
Chloride (mg/L)	35.00	27.00	29.00
Silicate (mg/L)	1.37	1.27	0.97
Iron (mg/L)	0.25	0.31	0.12
Zinc (mg/L)	0.001	0.002	0.002
Fluoride (mg/L)	0.70	0.50	0.65

Table 2. Comparison of Aquatic Flora of Victoria Lake during 2009 and 2016

S.No.	2009	2016
1	<i>Nelumbo nucifera</i> Gaertn. [Nelumbonaceae]	<i>Nelumbo nucifera</i> Gaertn. [Nelumbonaceae]
2	<i>Elydra fluctuans</i> DC. [Asteraceae]	<i>Elydra fluctuans</i> DC. [Asteraceae]
3	<i>Nymphoides indica</i> (L.) Kuntze [Menyanthaceae]	<i>Nymphoides indica</i> (L.) Kuntze [Menyanthaceae]
4	<i>Polygonum gracilius</i> (Ledeb.) Klokov. [Polygonaceae]	<i>Polygonum gracilius</i> (Ledeb.) Klokov. [Polygonaceae]
5	<i>Ceratophyllum demersum</i> L. [Ceratophyllaceae]	<i>Ceratophyllum demersum</i> L. [Ceratophyllaceae]
6	<i>Hydrilla verticillata</i> (L.f.) Royle [Hydrocharitaceae]	<i>Hydrilla verticillata</i> (L.f.) Royle [Hydrocharitaceae]
7	<i>Vallisneria spiralis</i> L. [Hydrocharitaceae]	-
8	<i>Ottelia alismoides</i> (L.) Pers. [Hydrocharitaceae]	-
9	<i>Spirodela polyrrhiza</i> (L.) Schleid. [Araceae]	<i>Spirodela polyrrhiza</i> (L.) Schleid. [Araceae]
10	<i>Aponogeton natans</i> (L.) Engl. & K. Krause [Aponogetonaceae]	-
11	<i>Ranunculus sceleratus</i> L. [Ranunculaceae]	<i>Ranunculus sceleratus</i> L. [Ranunculaceae]
12	<i>Nymphaea nouchali</i> Burm. f. [Nymphaeaceae]	-
13	<i>Nymphaea stellata</i> Willd. [Nymphaeaceae]	<i>Nymphaea stellata</i> Willd. [Nymphaeaceae]
14	<i>Oxalis corniculata</i> L. [Oxalidaceae]	<i>Oxalis corniculata</i> L. [Oxalidaceae]
15	<i>Rotala rotundifolia</i> (Buch.-Ham.exRoxb.) Koehne [Lythraceae]	-
16	<i>Ludwigia adscendens</i> (L.) H. Hara [Onagraceae]	<i>Ludwigia adscendens</i> (L.) H. Hara [Onagraceae]
17	<i>Ludwigia perennis</i> L. [Onagraceae]	<i>Ludwigia perennis</i> L. [Onagraceae]
18	<i>Oldenlandia corymbosa</i> L. [Rubiaceae]	<i>Oldenlandia acorymbosa</i> L. [Rubiaceae]
19	<i>Eclipta prostrata</i> (L.) L. [Asteraceae]	-
20	<i>Hygrophila auriculata</i> (Schumach.) Heine [Acanthaceae]	<i>Hygrophila auriculata</i> (Schumach.) Heine [Acanthaceae]
21	<i>Alternanthera philoxeroides</i> (Mart.) Griseb. [Amaranthaceae]	<i>Alternanthera philoxeroides</i> (Mart.) Griseb. [Amaranthaceae]
22	<i>Alternanthera sessilis</i> (L.) R. Br. ex DC. [Amaranthaceae]	<i>Alternanthera sessilis</i> (L.) R. Br. ex DC. [Amaranthaceae]
23	<i>Commelina benghalensis</i> L. [Commelinaceae]	-
24	<i>Murdannia spirata</i> (L.) G. Bruckn. [Commelinaceae]	-
25	<i>Murdannia nudiflora</i> (L.) Brenen [Commelinaceae]	-
26	<i>Colocasia esculenta</i> (L.) Schott [Araceae]	<i>Colocasia esculenta</i> (L.) Schott [Araceae]
27	<i>Cyperus dubius</i> Rottb. [Cyperaceae]	<i>Cyperus dubius</i> Rottb. [Cyperaceae]
28	<i>Rhynchospora colorata</i> (L.) H. Pfeiff. [Cyperaceae]	-
29	<i>Kyllingia brevifolia</i> Rottb. Hassk. [Cyperaceae]	-
30	<i>Cyperus rotundus</i> L. [Cyperaceae]	<i>Cyperus rotundus</i> L. [Cyperaceae]
31	<i>Cyperus iria</i> L. [Cyperaceae]	-
32	<i>Cyperus difformis</i> L. [Cyperaceae]	<i>Cyperus difformis</i> L. [Cyperaceae]

The physicochemical parameters of water of Victoria Lake revealed that the concentrations of all the parameters were within their permissible limit during all three seasons of 2016. The water quality of the lake was desirable for growth of macrophytes.

It was observed that there is a decline in the number of macrophytic species in 2016 as compared to 2009. It was also found that the number of invasive plants in the pond had increased during the past seven years. The increase in the number of invasive plant species has

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suppressed the growth of aquatic and semi-aquatic flora of Bara Talab. A total of 32 species were reported during 2009 but during 2016 it got reduced to 20 species.

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