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Research Article

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MACROPHYTES AS BIOINDICATOR IN BICHHIYA RIVER, REWA (M.P.), INDIA

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Abstract: The present study was aimed to analyze the macrophytes as bioindicators in Bichhiya River at Rewa. The study was conducted over a period of one year from January 2019 to December 2019 at 3 different sampling stations selected for the purpose in Rewa, a district of Madhya Pradesh, India. The physico-chemical parameters of water such as temperature, pH, DO, BOD, COD, hardness which are most useful for the prediction of distribution of macrophytes were analysed. A sum of 30 species of macrophytes was identified. Presence of macrophytes (1) reflects the nutrients enrichment and organic loading and (2) indicates the water pollution. Abundance and high density of *Ceratophyllum demersum, Nitella hyalina, Chara vulgaris, Potamogeton pectinata* indicated the enrichment of nutrients and high organic loading.

Keywords: Bichhiya River, Bioindicator, Macrophytes, Rewa, Water Quality.

INTRODUCTION

Aquatic macrophytes are group of large macroscopic photosynthetic organisms usually grow with their roots in soil or water. Macrophytes often grow more vigorously where nutrient loading is high. They may be emergent, submerged or floating. They provide habitat to aquatic organisms and also help in maintaining water quality, nutrient cycling and stabilizing river banks. The macrophytes play a pivotal role to make an ecosystem healthy (Banerjee R. *et al.*, (2016). The aquatic communities reflect anthropogenic influence and are very useful to detect and assess the human impacts (Solak *et al.*, 2012). Macrophytes are important components of aquatic ecosystem in terms of biomass production and habitat structuring. These are used to understand the relationship between life forms and environmental and morphometric factors (Akasaka *et al.*, 2010). They also respond to the changes in water quality and are used as bioindicator of pollution (Trishla *et al.*, 2016). Aquatic macrophytes are highly productive creatures having a structuring role in aquatic environments. Macrophytes are not only used as food source for aquatic invertebrates but also act as an efficient accumulator of heavy metals (Chung and Jeng, 1974). They are closely related

with water quality and aquatic biota (Essien *et al.*, 2012) and can be used as agent in bioremediation.

MATERIALS AND METHODS

The Bichhiya River of District Rewa (24°32′N; 81°18′E/ 24.53°N 81.3°E) is a source of fresh water for Rewa district and is one of the main tributary of Beehar River. Bichhiya River originates from Khaira village of Gurh Tehsil and joins in Beehar River behind Rewa fort. Domestic and municipal discharge merges into it at different points.

The present study was conducted over a period of one year from January 2019 to December 2019. Parameters like pH, temperature, were detected at sampling stations while water samples were collected in sterilized containers for remaining parameters and analyzed immediately after reaching in laboratory. The procedure for physico-chemical parameters was followed according to Trivedi and Goyal (1986), APHA (2005). For macrophytes, procedure of Biswas and Calder (2000), Edmondson, (1992) and Adoni (1985) is followed. For study, three sampling stations were selected as S1 (Rajghat), S2 (Akharh ghat) and S3 (Bichhiya Bridge). The identification of macrophytes was done with the help of standard books like Singh *et al.*, (2001).

The experiment was laid down with the following objectives:

- To find out water quality of Bichhiya River, Rewa (M.P.) through the analysis of physico- chemical parameters.
- To study the diversity and abundance of macrophyte species as bioindicator.
- To evaluate the relationship between water quality and macrophytic species diversity.

RESULTS AND DISCUSSION

The water quality parameters were analyzed with the help of samples collected from 3 different sampling stations S1, S2 and S3. Such type of water quality parameters were also described by Datta Munshi, *et al.*, (2006). The result of water quality analysis at three sampling stations of Bichhiya River is shown in table 1.

Temperature: The mean value of water temperature recorded was 20.02°C, 22.5°C, 21.01°C at sampling stations S1, S2 and S3.

Hydrogen ion concentration (pH): The hydrogen ion concentration was determined by pH meter (systronics). The pH of the water samples studied was 7.56, 7.91 and 7.75 at S1, S2 and S3.

Dissolved Oxygen (DO): The value of dissolved oxygen was found 7.25mg/l, 6.71mg/l and 4.3mg/l at S1, S2 and S3. Minimum DO was recorded at S1 at the influx site of municipal drainage. Similar result was shown by Banarjee and Ghosh (2016) for Damodar River.

Total Hardness: The value of total hardness registered in the present study was 190 mg/l, 189 mg/l and 192 mg/l at S1, S2 and S3 stations.

Biological oxygen demand (BOD): The BOD value of water sample under present investigation recorded as 2.0 mg/l, 3.4 mg/l and 4.0 mg/l at S1, S2 and S3 stations.

Chemical oxygen demand (COD): The COD value of studied water samples was recorded as 10.01 mg/l, 12.32 mg/l and 15.21 mg/l at sampling stations S1, S2 and S3

Table 1: Summary of water quality analysis at 3 sampling stations of Bichhiya River.

S. No.	Parameters	Stations			Value range	
		S1	S2	S3	Min	Max
1.	Temperature (^{o}c)	20.02	22.5	21.01	20.02	22.5
2.	pH	7.56	7.91	7.75	7.56	7.91
3.	Hardness (mg/l)	190	189	192	189	192
4.	DO (mg/l)	7.25	6.71	4.31	4.31	7.25
5.	BOD (mg/l)	2.0	3.4	4.0	2.0	4.0
6.	COD (mg/l)	10.01	12.32	15.21	10.01	15.21

Table 2: Macrophytes reported from the River.

S. No.	Name of species	Family	Stations		
			S1	S2	S3
1.	*Alternanthera sessilis*	Amaranthaceae	+	+	+
2.	*Azolla pinnata*	Salviniaceae	+	+	+
3.	*Aponogeton natans*	Aponogetonaceae	+	-	-
4.	*Cyperus rotundus*	Cyperaceae	+	-	+
5.	*Ceratophyllum demersum*	Ceratophyllaceae	+	+	+
6.	*Eupatorium album*	Asteraceae	+	-	-
7.	*Eichhonia crassipes*	Pontederaceae	+	+	+
8.	*Hydrilla verticellata*	Hydrocharitaceae	+	+	+
9.	*Hydrocharis cellulose*	Hydrocharitaceae	+	-	+
10.	*Ipomea aquatica*	Convolulaceae	+	+	+
11.	*Jussiaea repens*	Onagraceae	+	+	+
12.	*Lemna purpusilla*	Lemnaceae	+	+	+
13.	*Marsilea minuta*	Marsileaceae	+	+	+
14	*Myriophyllum spicatum*	Haloragaceae	-	-	+
15.	*Monochoria hastata*	Pontederaceae	-	+	-
16.	*Najas minor*	Hydrocharitaceae	+	-	-
17.	*Nymphea stellata*	Nymphaceae	+	+	+
18.	*Nitella hyalina*	Characeae	+	+	+
19.	*Pistia stratiotes*	Araceae	+	-	+
20.	*Passiflora foetida*	Passifloraceae	+	-	+
21.	*Potamogeton pectinata*	Potamogetonaceae	+	+	+
22.	*Persicaria glabra*	Polygonaceae	+	+	-
23	*Polygonum glabrum*	Polygonaceae	-	+	-

24	*Parthenium hysterophorus*	Asteraceae	+	-	+
25.	*Salvinia auriculata*	Saliviniacee	+	+	+
26	*Spirodela polyrhiza*	Araceae	+	+	+
27.	*Trapa natans*	Trapaceae	+	-	+
28.	*Typha anguistata*	Typhaceae	+	-	-
29.	*Vallisneria spiralis*	Hydrocharitaceae	+	+	+
30.	*Wolffia arrhiza*	Araceae	+	+	+

Macrophytes

A total 30 species of macrophytes were recorded during this entire period of study at 3 stations of Bichhiya River (table 2). Frequent species recorded from sampling stations were *Ceratophyllum demersm, Nitella hyalina, Alternanthera sessilis, Chara vulgaris, Hydrilla verticellata, Potamogeton pectinata, Persicaria glabra, Cyprus rotundus, Typha angustata, Amaranthus spinosus, Lemna perpusilla, Passiflora foetida*. The percentage of aquatic macrophytes reported from Bichhiya River is shown in fig. 1 while relative dominance of different species at different sites is represented in fig. 2. Distribution of various types of macrophytes indicates the quality of water. Change in water quality influences the weed formation and distribution (Jafari and Guanale, 2006). Species indicative of organic enrichment and nutrient loading were *Ceratophyllum demersum, Nitella hyalina, Chara vulgaris, Potamogeton pectinata, Eichhornia crassipes, Lemna perpusilla, Azolla pinnata and Amaranthus spinosus* at sampling stations. The study got support by findings of Uedeme-Naa (2011).

S1- Species which are mostly found in S1 include *Nitella hyalina, Chara vulgaris, Potamogeton pectinata, Hydrilla verticellata, Ceratophyllum demersum, Parthenium hysterphorus, Azolla pinnata, Ipomea aquatica, Eichhornia crassipes*.

S2- Species which are found in S2 station include *Alternanthera sessils, Eichhornia crassipes, Ipomea aquatica, Lemna purpusilla, Najas minor, Nitella hyalina, Salvinia auriculata, wolffia arrhiza, Ceratophyllum demersum*.

S3- Abundant species found in S3 are *Wolffia arrhiza, Lemna purpusilla, Azolla pinnata, Ipomea aquatic, Eichornia crassipes, Vallisneria spiralis, Typha angustata, Trapa natans, Spirodella polyrhiza*.

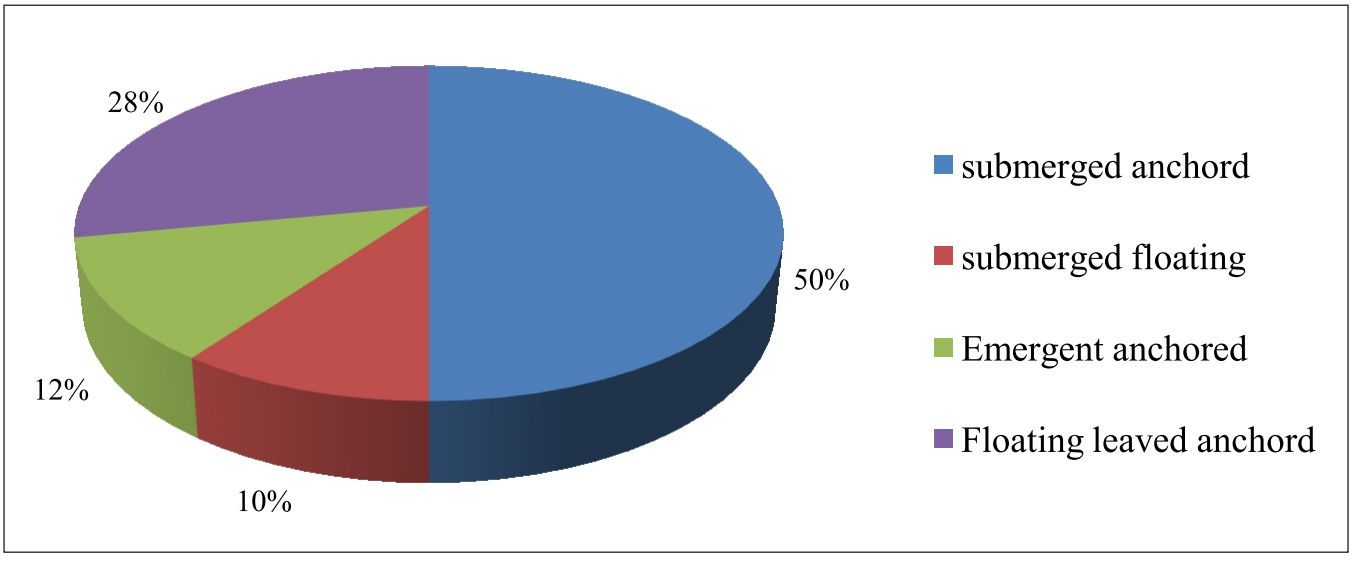

Fig. 1: Percentage of different aquatic macrophytes in Bichhiya River

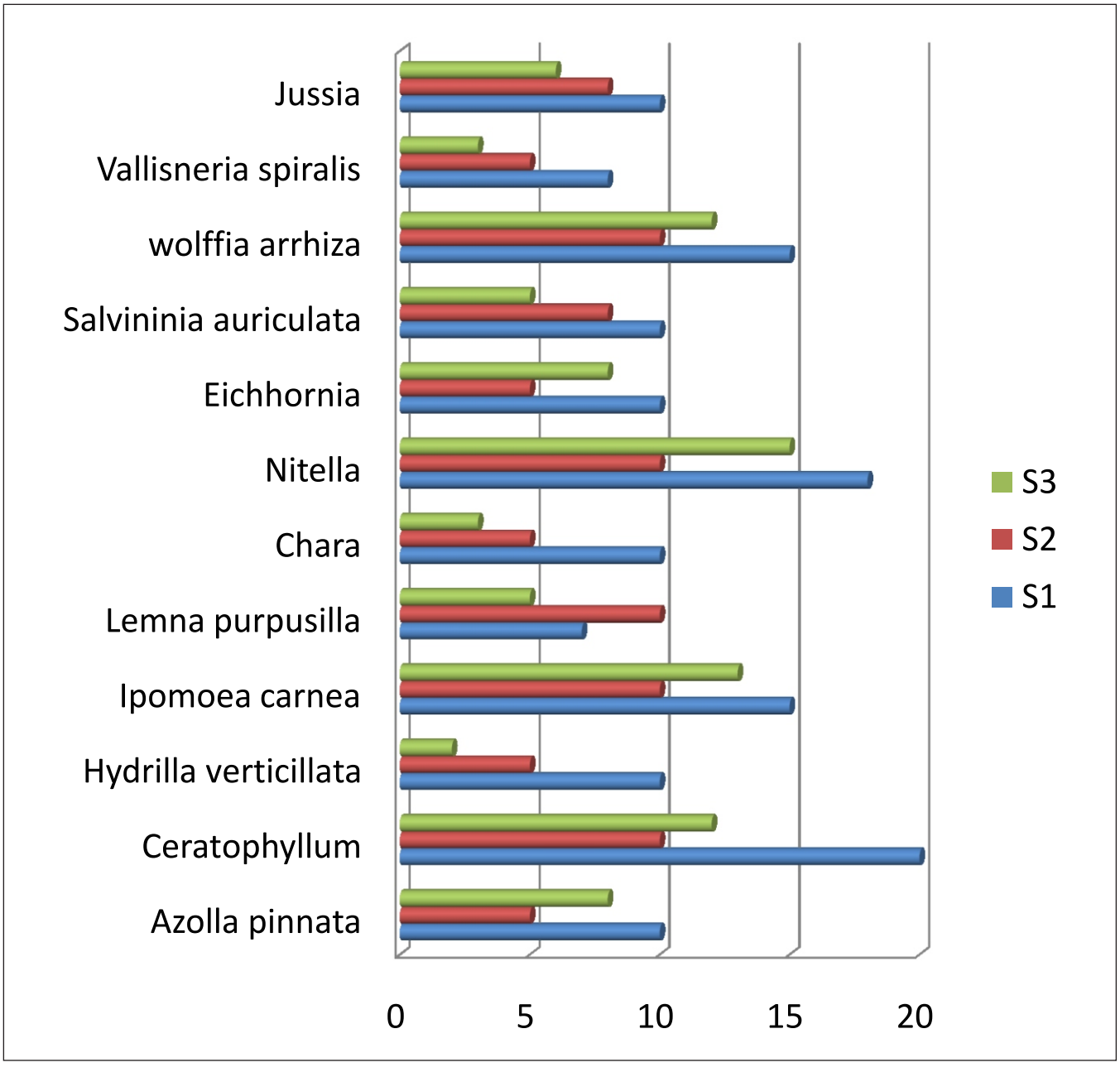

Fig. 2: Dominancy of different species at sampling sites of Bichhiya River.

CONCLUSION

Sampling stations S1, S2 and S3 differ in physico-chemical characteristics of water quality. Abundance and high density of *Ceratophyllum demersum, Nitella hyalina, Chara vulgaris, Potamogeton pectinata* indicate enrichment and high nutrient loading. This is also indicated by BOD and COD parameters.

Nitella hyalina, Lemna purpusilla, Azolla pinnata, Ceratophyllum demersum, Alternanthera sessilis, Hydrilla verticellata, Vallisaneria spiralis, Persicaria glabra were reported as dominant species at sampling stations which are indicators of organic pollution. Authors noticed a diversity and abundance of macrophytes in the river studied. The water studied is rich in nutrients with organic loading. It is most possibly due to influx of discharged domestic sewage which affects the water quality of the river and other aquatic biota. The river water is found suitable for agricultural purposes also. Further more detail study is recommended.

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