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STUDIES ON DIATOM SPECTRUM OF PONDS AND RIVER IN DARBHANGA

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Abstract

Darbhanga (26.1542° N, 85.8918° E) is an important city of North Bihar, India. Diatom spectrum of five experimental sites, three of the river Bagmati and two of the ponds at Darbhanga were studied during two consecutive years. A total of 54 species of diatoms belonging to 22 genera were observed.

Keyword: Darbhanga, Bagmati, Harahi, Ganga Sagar, Diatom

Introduction :

The diatoms are one of the largest and ecologically most significant groups on Earth. They are members of the algal class Bacillariophyceae. Due to beautiful patterns on the silicified cell walls, the Diatoms are known as the jewels of the plant kingdom. Diatoms are unicellular but show a huge variety of shapes with many attractive and symmetrical patterns.

The role of Diatoms in the aquatic system has been well recognized. Diatoms seem to be a smaller component in the aquatic ecosystem if compared with other components such as physical, chemical and other biological part but it plays an important role in the ecosystem. They are able to respond rapidly to environmental variations. On that basis they are being increasingly used to assess water quality as indicator of the trophic and ecological status of aquatic systems. The relation between diatoms and environmental variables is strong and quantifiable making diatoms appropriate quantitative indicators of ecological conditions in lotic systems (Pan *et al.*, 1996; Oliveira *et al.*, 2001). Similarly, Diatoms represent outstanding bio-indicators for different degrees of pollution. They provide excellent indicators of water quality, especially with widespread increase in eutrophication (Descy and Coste, 1991; Oliveira *et al.*, 2001; Lobo *et al.*, 2004 a,b,c,d, 2006; Hermany *et al.*, 2006; Salomoni *et al.*, 2008). Biological monitoring is now viewed as an ideal means by which progress towards integrated water resources management can be monitored in that it provides a summary of conditions prevailing in the aquatic ecosystems. Biological monitoring is now an important branch of applied ecology (Passy, 2007, Dalu *et al.*, 2016). Diatoms respond rapidly to changes in environmental conditions and it is a cost-effective method to assess anthropogenic impacts and health status of aquatic ecosystems (Dalu *et al.*, 2016).

Literature show that little work has been done on the diatoms found in Bihar including Darbhanga. Darbhanga is an important city of North Bihar. The river Bagmati passes through the city. Darbhanga is famous for the mass culture of fish and Makhana. The city has many freshwater ponds. Apart from the work of the author on the diatoms at Darbhanga, there is no proper and systematic study of on the diatoms of Darbhanga. Therefore, this project was prepared to identify the diatoms found in the water bodies in Darbhanga. To determine the water quality of different bodies in Darbhanga, species diversity index based on diatoms have also been studied.

Materials and Methods

In the present study, diatoms of Darbhanga, Bihar were studied with respect of lotic and lentic water bodies. The three sites of the river Bagmati i.e., 1. near Mabbi, 2. under the bridge at Shobhankarpur, 3. near Ekmi and two ponds i.e., 1. Ganga Sagar pond at Marwari College and 2. Harahi pond at Railway Station were selected for study. Water samples were collected from these five sampling sites in the season of summer, rain and winter from August 2018-19.

Identification of the diatoms was mainly based on the works of Gandhi (1958,1961,1967), Prescott(1962,1964), Palmer(1980), Barberand Hayworth (1981), Sarode and Kamat (1984), Jha (1985), Round *et al.* (1990), Kelly (2000) and Bellingr and Sigee (2010).

Observation :

During the observation period, a total of 54 species of diatoms belonging to 22 genera were observed. List of all the diatom species observed is given in the Table 1.

It is evident from the Table 1 that among them, 47 types of taxa at Site I, 48 at Site II, 37 at Site III, 33 at Pond II were found, in which 21 types of genera at Site I and II, 17 at Site III, 15 at Pond I and 14 at Pond II were recognised. It is observed that *Actinella punctata, Diatoma anceps, Gomphonema lanuolatus, Achnanthes microcephala, Neidium dubium, Diplonesis oblengilla, Navicula graciloides, Navicula lucidula, Pleurosigma spencerri, Gyrosigma scalpoidens, Sauroneis ancepts, Nitzschia clostenium, Nitzschia frustalum, Surirela ovate, Cylindotheca gracilis and Cymbella tumida* were present in the river but never found in pond during the course of investigation.

Table 1 : List of diatoms observed (+present, -not observed)

S. No.	Name of taxon	Sampling Station			Pond - I	Pond - II
		River				
		Site I	Site II	Site III		
1	*Cyclotella glomerata* Bachman	+	+	+	+	+
2	*Melosira granulate* (Her.) Ralfs	+	+	+	+	+
3	*M. varians* Ag.	+	+	+	+	+
4	*Fragilaria capucina* Desm.	+	+	+	+	+
5	*F.intermedia* Grun.	-	+	+	+	-
6	*Diatoma anceps* (Her.) Kirchn.	+	+	+	-	-
7	*Synedra acus* Kuetz.	+	+	+	+	+
8	*S. pulchella* Ralfs ex Kuetz.	+	+	-	-	+
9	*S.ulna (Nitz.)* Her.	+	+	+	+	+
10	*Enuotia formica* A.Berg	+	+	+	+	+
11	*Actinella punctata* Lewis	+	+	+	-	-
12	*Gomphonema acuminatum* Ehr.	+	+	+	+	+
13	*G.augur* Ehr.	+	+	+	+	+
14	*G. lanceolatum* Ehr.	+	+	+	-	-
15	*G.sphaerophorum* Ehr	+	+	+	+	+
16	*Achnanthes affinis* Grun.	+	+	+	+	+
17	*A.microcephala* (Kuetz.) Grun.	+	+	-	-	-
18	*Cocconeis placentula* Ehr.	-	+	+	+	+
19	*Neidium dubium* (Ehr.) Cl.	-	+	+	+	+
20	*Pinnularia biceps* Greg.	+	+	-	-	-
21	*P. interrupta* W. Smith.	+	+	+	+	+
22	*P. molaris* Grun.	+	-	-	-	+
23	*Diploneis oblongella* (Neg.Ex. Kutz.) Cl.	+	+	+	+	+
24	*Navicula anglica* Grun.	+	+	-	-	-
25	*N. cari* Ehr.	+	+	+	+	+

S. No.	Name of taxon	Sampling Station			Pond – I	Pond - II
		River				
		Site I	Site II	Site III		
26	*N. cuspidate* Kuetz.	+	+	+	+	+
27	*N. graciloides* May	+	+	+	+	+
28	*N. lucidula* Grun.	+	-	-	-	-
29	*N. microcephala* Grun.	+	-	-	-	-
30	*N. minura* (Cl.) Cl.	-	+	-	-	-
31	*N. mutica* Kuetz.	+	+	-	-	-
32	*N.pygmaea* Kuetz.	+	+	+	+	+
33	*Pleurosigma spencerii* S. Sm..	+	+	+	+	+
34	*Gyrosigma acuminatum* (Kuetz.)Rabh.	+	-	-	-	-
35	*G. attenuatum (*Kuetz.) Rabh.	+	+	+	+	-
36	*G. scalpoides* (Rabh.) Cl.	-	-	+	+	+
37	*Stauroneis anceps* Ehr.	+	+	-	-	-
38	*Amphora ovalis* Kuetz.	+	+	-	-	-
39	*Nitzschia affinis* Grun.	+	+	+	+	+
40	*N. apiculate* (Greg.) Grun.	+	+	+	+	+
41	*N.capitellate* Hustedt	+	+	+	+	+
42	*N. closterium* W. Smith	+	+	-	+	+
43	*N. frustulum* (Kuetz.) Grun.	+	+	-	-	-
44	*N. mocrocephala* Grum.	-	-	+	-	-
45	*N. obtuse* W. Smith.	-	-	-	-	+
46	*N. palea* (Kuetz.) W. Smith.	-	-	+	+	+
47	*Surirella angusta* Kuetz.	+	+	+	+	+
48	*S. linearis* W. Smith.	+	+	+	+	+
49	*S. ovalis* Breb.	+	+	+	+	+
50	*S. ovata* Kutz.	-	+	+	+	+
51	*Cylindrotheca gracilis* (Breb.)Grun.	-	+	-	-	-
52	*Cymbella aspera* (Ehr.) Cl.	+	+	+	+	+
53	*C. tumida* (Breb.) V.H.	+	+	-	-	-
54	*C.turgida* (Greg.) Cl.	+	+	-	+	-

Discussion

In the present study a sum of 54 taxa of 22 genera of diatoms, as listed in the Table 1, were recognised from river and pond water during the course of investigation at Darbhanga. It is also evident from the Table 4.1 that among them, 47 types of taxa at Site I, 48 at Site II, 37 at Site III, 31 at Pond I and 33 at Pond II were found, in which 21 types of genera at Site I and II, 17 at Site III, 15 at Pond I and 14 at Pond II were recognised. It is also noted that *Nitzschi microcephela* was never found in river but present in the Pond II only. Similarly,*Actinella punctata, Diatoma anceps,Cyclotella meneghiniana,Gomphonema lanuolatus, Achnanthes microcephala, Neidium dubium, Diploneis oblengilla, Navicula graciloides, Navicula lucidula,Pleurosigma spencerri, Gyrosigma scalpoidens, Sauroneis ancepts, Nitzschia clostenium, Nitzschia frustalum, Surirela ovata, Cylindotheca gracilis and Cymbella tumida* were present in the river but never found in pond during the course of investigation.

Pareek *et al.* (2011) have reported twenty-four taxa of eleven genera of diatoms from a water body, natural pond (Kund) at Jaipur. Williams (1985) has transafered Diatoma anceps to Meridion. Interestingly, this species also has a strong tendency to occur in running water (Round et al. 1990), which is also evident in the present study where Diatoma anceps was found only in river water.

Dominance of the algal flora by the diatoms species in fresh water has been reported by Venkateswarlu and Sampath Kumar (1982), Sankaran (1984), Bhatt *et al.*.(1985), Descy *et al.* (1987) Manikya Reddy and Venkateswarlu (1987) and Shrivastava and Sen (1987). Both the clean water and pollution tolerant species of algae where found at different stations.However the distribution of these algae was not very specific. The clean water forms, although present in abundance at the unpolluted sites, where also present at the polluted sites. Similarly, the pollution tolerant forms were found not only at the polluted sites but at the apparently unpolluted sites as well, but they generally exhibited abundance at the polluted sites. As per Parmers list , in the present work 12 genera of diatoms tolerant to organic pollution were identified which are given below in order of decreasing tolerance: *Nitzschia, Navicula, Synedra, Melosira, Gomphonema, Cyclotella, Fragilaria, Surirella, Cymbella, Diatona, Achnanthes,* and *Pinnularia*. These diatoms appear to be of considerable significance as a source of fish food. Some taste and order have been reported due to growth of diatoms (Sigworth,1957). Some diatoms are rich in vitamin A and B (Gupta and Shrivastava, 1964) and may play important role for mankind.

Conclusion

Out of 54 species of diatoms observed, species of *Actinella punctata, Diatoma anceps, Gomphonema lanuolatus, Achnanthes microcephala, Neidium dubium, Diplonesis oblengilla, Navicula graciloides, Navicula lucidula, Pleurosigma spencerri, Gyrosigma scalpoidens, Sauroneis ancepts, Nitzschia clostenium, Nitzschia frustalum, Surirela ovate, Cylindotheca gracilis and Cymbella tumida* were present in the river but never found in pond during the course of investigation.

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