ORIGINAL RESEARCH PAPER

Biological Science

TEMPORAL VARIATIONS IN DIATOM COMMUNITIES OF THE ASAN CONSERVATION RESERVE, DEHRADUN, UTTARAKHAND

KEY WORDS: Diatoms, Assemblages, Similarity, Abundance, Dominance.

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ABSTRACT

I examined the temporal changes in diatom assemblages from March 2014 to February 2015 in the Asan Conservation Reserve. The flora consisted of 69 species from 24 genera. Diversity and evenness, both were recorded high during the summer months while low during the winter months. In total six diatom taxa were observed as dominant Achnanthidium minutissimum (Kützing) Czarneck during March, June, July and January, Encyonema minutum (Hilse in Rabh.) D.G. Mann during April, May and November, while Achnanthidium minutissimum var. microcephala (Kützing) Cleve, Navicula cryptocephala Kützing, Cymbella excisa Krammer and Nitzschia clausii Hantzsch during September, October, December and February, respectively. However, the diatom communities were similar only during April-May and June-July and hence varied for major part of the year. SIMPER analysis also indicates less similarity (33.34%) among the communities of different months.

INTRODUCTION

Community is an association of the different species occupying the same habitat in a particular time period [1]. The community is considered to be regulated by local physico-chemical and biotic factors [2]. Although diatom communities are intensely examined in rivers, streams, lake and in ponds but less is known about the communities in wetland systems. In wetlands system diatoms were explored from various regions including India 3, 4, 5, 6, 7 & 8. In India, diatom community in relation to environmental variables have been explored from wetlands of Bangalore [9], study on phytoplankton with relation to physicochemical characteristics in Gulur wetland of Karnataka [10]. From the Himalayan region, studies on the community structure are mostly known from rivers, streams and springs [11, 12, 13, 14]. Therefore, an extension of the knowledge on distribution and composition of benthic diatom communities in wetlands of Himalayan region, recognised as ecologically and functionally important elements of the aquatic ecosystems. Since there are no studies on wetland communities in the Himalayan Gangetic basin, a study was designed to record temporal changes in the diatom communities of the Asan Conservation Reserve, a wetland.

MATERIALS AND METHODS

Study Area

The Asan Conservation Reserve, established in 2005 owing to prominent wintering spot for migrating birds is also known as Dhalipur Lake. This wetland was formed due impoundment of the Asan river for hydropower generation. The wetland belongs to the water-storage reservoir, dam type. The impoundment receives discharge from the Yamuna Canal emerging from the Dakpatthar Barrage. The wetland is situated at latitude 30.44058 N, longitude 77.67256 E and altitude 403 masl, in Doon Valley, Uttarakhand (Fig. 1). Climatic condition of the study area is of north Indian monsoon climate with average rain fall 250 cm. The chief aquatic vegetation of the reservoir comprises of *Eichhornia crassipes Typha elephantine* and *Potomageton pectinatus*. The forested Siwaliks form the left flank while some villages surrounded by agricultural fields form the right flank. Further on the right side, the river Yamuna separates the wetland from the high mountains of lesser Himalaya.

Methods

Diatom samples and their replicates were collected at regular monthly intervals for one year from March 2014 to February 2015 except August. Samples were taken from the depth of 20 cm from water surface by sucking the superficial biofilm on the reservoir bed and preserved in 4% formaldehyde solution. Diatom samples were processed with Sulphuric acid-Potassium dichromate combination to remove the organic matter [25]. The permanent mounts are prepared in Naphrax and further identified with the help of Nikon Trinocular Research Microscope model 80i. To determine the community 350-400 valves were enumerated to species level. Diversity and evenness index were calculated with the help of a software SDR-4.1.2 [15]. SIMPER analysis was used to determine the similarity among community of different months by a software CAP-4.0 [15].

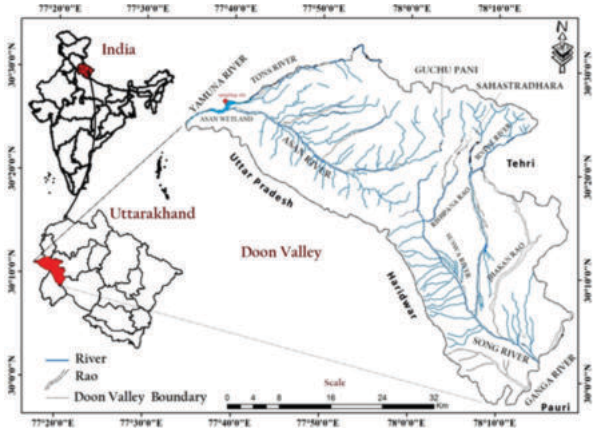

Figure 1: Location of study area in Western Doon Valley

RESULTS AND DISCUSSION

The flora consisted of 69 diatom taxa from 24 genera. Shannon Diversity H ranged from 2.11 (December) to 2.883 (March) and evenness ranged from 0.443 (October) to 0.777 (March). Diversity and evenness, both were recorded high during the summer months while H was low during the winter and E was low in post-monsoon (Fig.2).

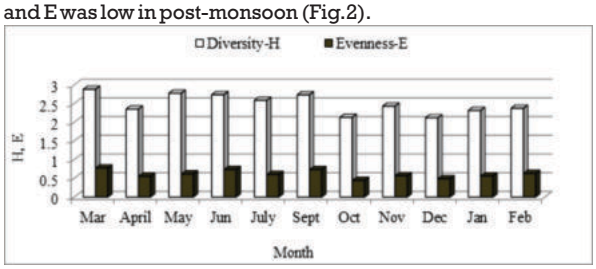

Figure 2: Monthly variations in species diversity H and evenness E, of the diatom communities in the Asan Conservation Reserve

Achnanthidium minutissimum exhibited >10% abundance in seven months but was dominant during 4 months (January, March, June, July). Similary *Encyonema minutum* was dominant for 3 months (April, May, November). Thus these two taxa

dominate the community for 7 months in a year, almost in an alternate fashion suggesting oscillations in nutrients. During other months *Achnanthidium minutissimum* var. *microcephala*, *Navicula cryptocephala, Cymbella excisa* and *Nitzschia clausii* dominate during August, September, October, December and February, respectively (Table 1). Thus the wetland ecosystem lacks stability during and after monsoon resulting in different diatom communities in this period. The composition of the diatom assemblage changed in different seasons in the Honghe wetland also noted in temperate northeast [7].

Table 1: Monthly variation in the relative abundance of dominant (>10%) diatom taxa in the Asan Conservation Reserve

TAXA	M	A	M	J	J	S	O	N	D	J	F
A. biasolettianum				11					12		
A. minutissimum	15		12	15	19			14	26	19	
A. m. var. microcephala		5.8				19					
C. excisa									28	18	13
C. subleptoceros	10	23	14					10			
E. minutum		27	16		12		15	27			
N. cryptocephla							28			16	13
N. microcari				14	17						
N. clausii							12				19
N. modesta											16
N. trivialis							21				
N. cryptotenelloides	11										
N. palea						11					
A. bryophila				10							
C. e. var. procera						10					
C. microcephala		10									

In the wetlands of urbanised Peninsular India the dominant taxa (*G. parvulum*, *Nitzschia palea, N. umbonata, Diadesmis confervacea*, *Cyclotella meneghiniana* and *C. atomus*) reported by Alakananda et al. (2013) were entirely different from the Asan wetland located in rural settings. Unlike the Asan wetland where the dominants varied at monthly intervals (Table 1), the frequent taxa (*Nitzschia constricta, N. palea, N. inconspicua, N. amphibia, Gomphonema parvulum* and *Navicula veneta*) were same in the wetlands of central Italy at all four studied site in all observed seasons; summer, autumn, winter and spring [16].

Distinct diatom communities were recorded in different months (Table 1). The community was similar only during April-May (*E. minutum*, *C. subleptoceros*) and June-July (*A. minutissimum, N. microcari*). The communities varied in the most of the months, suggesting changes in the abiotic conditions, especially in nutrient concentrations from month to month.

SIMPER analysis indicates that throughout the study period average similarity among community of different months was low (33.34%) and reflects occurrence of diverse communities in the study period. *A. minutissimum* exhibited highest average abundance (35.45), average similarity (6.68) and contribution (20.04%) in the community, followed by *N. cryptocephala, E. minutum, C. subleptoceros, C. excisa* and other diatoms of the community.

CONCLUSION

The diatom communities vary temporally month after month even though *A. minutissimum* and *E. minutum* dominate the assemblage in alternation or continuation from January to July suggesting dynamic abiotic conditions as it gets continuous flows from the Asan R. and Yamuna Canal. SIMPER analysis substantiates these observations i.e. the communities are dynamic and not stable except for April-May and June-July.

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