Distribution of Aquatic Vegetation in Ahansar, a Freshwater Lake in Kashmir Himalaya

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ABSTRACT

Macrophytes inhabiting a small sized rural fresh water lake, Ahansar, in Kashmir Himalaya were investigated during the growing period of seven months lasting from April to October 2002. Monthly surveys were conducted to evaluate major quantitative characteristics of frequency, density, abundance and Importance Value Index (IVI) besides species diversity index. In all 28 species were recorded from the lake. The species depicting significant IVI values were *Nymphoides peltatum* (41.31), *Lemna* spp. (22.62), *Ceratophyllum demersum* (18.53), *Salvinia natans* (18.05), *Phragmites australis* (15.70), *Nymphaea alba* (15.07) and *Nelumbo nucifera* (14.50). The values for Shanon-Weiner species diversity index ($H^{/}$) ranged between 2.66 and 2.96. The lake littorals are extending and, therefore, submerged growth is gradually declining and making more niches available for floating-leaf type and emergent species. The land use practices in the catchment correspond to the shallowing of the lake basin in addition to the autochthonous sedimentation of the dead and decaying macrophytic growth.

Key words: Macrophytes, diversity, Importance Value Index (IVI), Ahansar, Kashmir Himalaya

INTRODUCTION

The fresh water resources of the biosphere are extremely limited and out of the total, less than one percent is surface water in the form of lakes, streams, rivers etc. The valley of Kashmir has been gifted by nature with multitude of fresh waterbodies that have immense socio-economic and ecological importance. Once known for their crystal clear waters, the fresh waterbodies especially lakes are showing signs of eutrophication. The condition is more pronounced in lakes at low elevations (1580 – 1600 m.a.s.l.) because of being in the vicinity of the human habitation. These lakes are evolving at rates manifold more than the natural processes as evidenced by the changes in their physical, chemical and biological characteristics. Macrophytes contribute major portion of primary production in shallow macrophyte dominated lakes and wetlands and, therefore, perform a vital role in determining the structure and functioning of these ecosystems. The expanding human population and changing agricultural practices are the main contributing factors for the degradation of these invaluable natural assets. Any change in

physico-chemical environment is reflected by macrophytes by reacting to these changes in many ways. Though there are many reports available on limnology of Kashmir lakes (Zutshi and Vass, 1971, 1982; Kaul, 1977; Zutshi *et al*., 1980; Pandit, 1999, 2002), except a few reports **(**Kaul and Zutshi, 1967; Kak, 1988; Kaul *et al.*, 1978; Pandit, 1984; Rather and Pandit, 2005; Ravinder and Pandit, 2006), macrophytes have largely been ignored irrespective of being dominant primary producers in the valley lakes of Kashmir. The present study is, therefore, aimed to evaluate a rural freshwater lake on the basis of various community features of macrophytes.

STUDY AREA

The present study was carried out on a small rural valley lake, Ahansar, in Kashmir Himalaya. The lake is situated in the floodplains of River Jhelum about 26 km north-west of Srinagar at an altitude of about 1600 m (a.s.l), and lies within the geographical coordinates of 34° 18′ N latitude and 74° 39′ E longitude. The lake is spread over an area of 0.8 km^2 with a maximum depth of 5.5 m and has its own source of water in the form of springs spread over its basin. Besides, an ephemeral irrigation channel also supplements the water mass during paddy cultivation period. The lake has a permanent outflow channel that joins River Jhelum on its western side. On the basis of its drainage patterns, the lake can be categorized as a "semi-drainage type". The lake catchment is mostly under agricultural practices.

MATERIAL AND METHODS

The study was carried out on monthly basis during the growing period of macrophytes from April to October 2002. Quadrat method was used to study various community features of macrophytes. 50 quadrats of $1m^2$ size were laid randomly covering almost the entire lake area. The macrophytes falling in each quadrat were sorted specieswise and the number of individuals of each species counted to work out frequency, density, abundance and Importance Value Index (Misra, 1968) besides species diversity (Shanon-Weiner, 1949).

RESULTS AND DISCUSSION

The present investigation on Ahansar lake revealed the presence of a total of 28 species of macrophytes (Table 1). The maximum number of 13 species was recorded for the emergents, followed by submergeds (07), rooted floating-leaf type (06) and free-floating type (02). The lake depicted clear zonation of macrophytic vegetation with emergents forming a continuous belt along the periphery of the lake.

Phragmites australis, *Myriophyllum verticillatum* and *Typha angustata* were the dominant species among emergents in terms of frequency of occurrence recording mean frequency values of 36.66, 20.47 and 11.90 respectively. *P. australis* formed almost a continuous belt along the periphery of the lake reaching upto a depth of 2.5m at places,

while all other emergent species showed patchy distribution. *Nymphoides peltatum, Nelumbo nucifera* and *Potamogeton natans* recorded highest mean frequency values of 52.38, 32.38 and 27.57 respectively among rooted floating-leaf types, while *Ceratophyllum demersum* (32.38), *Utricularia aurea* (22.85) and *Hydrilla verticillata* (19.52) dominated the submergeds. The only two free floating species i.e*., Salvinia natans* and *Lemna* spp. depicted almost similar distributional pattern with the mean frequency values of 20.00 and 16.66 respectively. In general, the maximum value for importance value index (IVI) was obtained for *P. australis* (15.70), *N. peltatum* (41.31), *C. demersum* (15.53) and *S. natans* (18.05) among emergents, rooted floating-leaf type, submerged and free floating types respectively.

Table 1: Macrophytic community features (mean values) in Ahansar lake from April-October 2002

S. No.	Species Name	Frequency	Density	Abundance	IVI*
		EMERGENTS			
01	*Alisma plantago aquatica*	2.86	0.04	0.76	1.98
02	*Cyperus defformis*	2.38	0.08	1.43	3.03
03	*Echinocloa crusgalli*	2.86	0.05	0.67	1.60
04	*Eleocharis palustris*	7.62	0.17	1.93	5.03
05	*Hippuris vulgaris*	1.90	0.03	0.86	1.43
06	*Myriophyllum verticillatum*	20.47	0.60	3.07	11.76
07	*Nasturtium officinale*	7.62	0.49	5.38	10.64
08	*Phragmites australis*	36.66	0.73	2.05	15.70
09	*Polygonum amphibium*	5.71	0.15	2.33	4.93
10	*Sagittaria sagittifolia*	9.52	0.25	2.56	6.87
11	*Sparganium ramosum*	9.52	0.34	3.23	8.15
12	*Typha angustata*	11.90	0.24	2.05	6.78
13	*Sium latijugum*	3.33	0.17	3.14	4.90
		FLOATING LEAF TYPES			
14	*Hydrocharis dubia*	6.19	0.20	2.36	5.31
15	*Nelumbo nucifera*	32.38	0.79	2.37	14.50
16	*Nymphaea alba*	20.47	0.91	4.35	15.07
17	*Nymphoides peltatum*	52.38	3.52	7.14	41.31
18	*Potamogeton natans*	27.57	0.62	2.71	13.16
19	*Trapa natans*	6.66	0.21	3.07	6.23
		SUBMERGEDS			
20	*Ceratophyllum demersum*	32.38	1.17	3.70	8.53
21	*Hydrilla verticillata*	19.52	0.48	2.26	9.71
22	*Myriophyllum spicatum*	15.23	0.69	4.19	12.37
23	*Potamogeton crispus*	15.71	0.43	3.09	9.42
24	*P. lucens*	17.14	0.52	3.04	10.79
25	*P. pucilus*	7.14	0.16	2.43	5.46
26	*Utricularia aurea*	22.85	0.83	3.67	14.37
		FREE FLOATING TYPES			
27	*Lemna* spp.	16.66	1.61	9.27	22.62
28	*Salvinia natans*	20.00	1.31	5.37	18.05

* = Importance Value Index

In any aquatic ecosystem, the occurrence and distribution of macrophytes is governed by number of environmental factors. Among these factors, water depth and its periodic fluctuations have been postulated to be most important regulating distribution of both submerged and emergent communities (Zutshi and Gopal, 1990). The lake, being shallow with the maximum depth of 5.5m, has gentle sloppy littorals and hence, supports broad zone of emergent vegetation. The maximum value obtained for Shanon-Weiner species diversity index ($H^{/}$=2.96) in the month of October (Fig. 1) may be due to decrease in water level consequently exposing water saturated littoral areas to be colonized by opportunistic short growing emergent species.

The significant coverage of the reed species like *P australis* and *T angustata* in the lake are indicative of its highly productive status (Hutchinson, 1975). The low abundance of submerged vegetation in the lake corresponds the increased coverage of emergent and rooted floating leaf-type species that have got efficient means of vegetative propagation through underground rhizomes. The decrease in submerged macrophytes has also been reported in various shallow lakes in Denmark as a manifestation of eutrophication (Sand-Jensen *et al*., 2000).

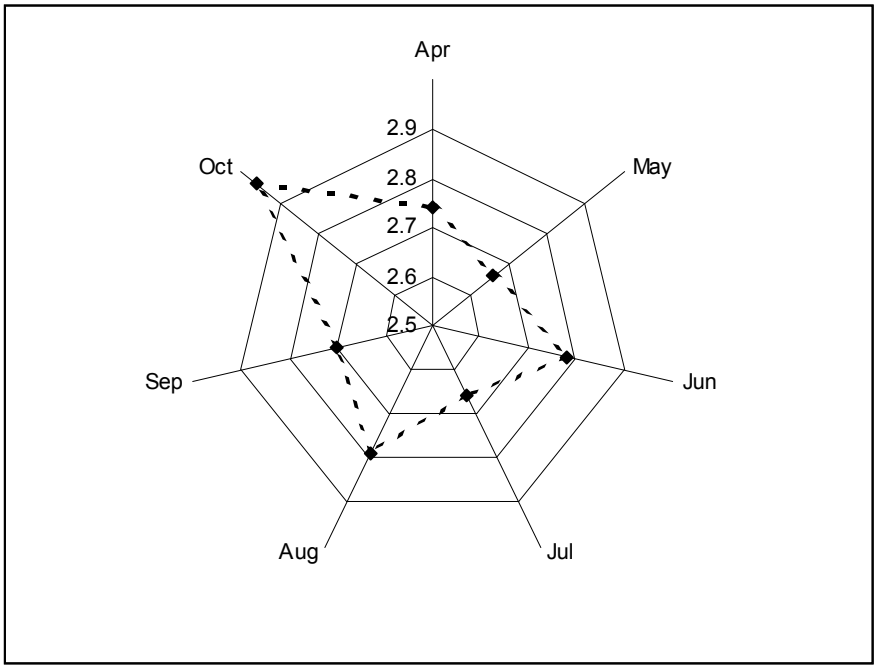

Fig. 1: Monthly variations in species diversity of macrophytes in Ahansar lake

In conclusion it can be inferred from the above discussion that the lake shows complex physiognomy of macrophytes like wetlands. The dominance of rooted-floating-leaf type and emergent species covering major portion of the total lake area are suggestive of its highly evolved and productive status. The decline in the coverage of submergeds is mainly due to gradual shallowing of the lake basin which in turn is the manifestation of land use practices in the catchment and the sedimentation of the autochthonous dead and decaying macrophytic growth.

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