J. Himalayan Ecol. Sustian. Dev. Vol 3. (2008) **ISSN 0973-7502**

PHYTOSOCIOLOGY OF SUBMERGED MACRO-VEGETATION IN HOKERSAR WETLAND, KASHMIR

Ravinder Kumar, Ashok K. Pandit and Prince Javeed Iqbal
Aquatic Ecology Laboratory, Centre of Research for Development (CORD), University of Kashmir, Srinagar -190006, J&K., India.

ABSTRACT

The present paper highlights the species composition, community architecture and species diversity of submerged macro-vegetation in a highly protected wetland, Hokersar in Kashmir Himalaya. There were significant variations in species composition, frequency, density, abundance and Importance Value Index (IVI) besides the species richness index of submerged community in the wetland. In all 7 species belonging to 5 families were collected. The highest number of species was recorded during summer and autumn as against the lowest obtained during the period of higher water levels in spring, implying that varied species contribution arises under the influence of water depth. A few species contributed much towards the Importance Value Index (IVI) while the others appeared rare to the wetland. The highest species richness was recorded for June and for other months it fluctuated between a narrow range.

Keywords: Submerged macrophytes, comm.-unity architecture, indicator species wetland, Hokersar, Kashmir.

INTRODUCTION

Macrophytes form an important component of freshwater ecosystems for being efficient and prime contributors of primary productivity especially for wetland and shallow lakes wherein the infestation of macro-vegetation is a common phenomenon. Some of the significant earlier contributions to the macrophytic studies of Kashmir lakes and wetlands include Mukherji (1921, 26), Blatter (1927), Coventry (1923), Kachroo (1956), Kaul and Zutshi (1967), Zutshi (1968), Zutshi and Vass (1976), Kak (1978, 1990), Pandit (1980, 84, 92), Kaul and Handoo (1982). Most of these important studies pertain to various ecological features of macrophytes but there are hardly few reports regarding their community character-istics. In recent studies of Pandit (1998, 99, 2002) Zutshi and Gopal (2000), Ravinder *et al.*, (2004) Rather and Pandit (2005), Ravinder and Pandit (2005, 06) and Pandit and Ravinder (2006) attempts have been made to work out quantitative community features of macrophytes in various lakes and wetlands of Kashmir. Despite the healthy efforts of various authors from time to time to deal with various ecological features of macrophytes, most of the studies are restricted to the dominant and sub-dominant classes of macrophytes viz. emergents and floating-leaf types especially in Hokersar wetland. The submerged community which is equally important in determining the structure and functioning of the aquatic ecosystem has received hardly any attention. The present paper, therefore, deals with the quantity community features of submerged vegetation in Hokersar wetland.

STUDY AREA

Hokersar wetland is a perennial, protected wildlife reserve, located at an altitude of 1584 m (a.m.s.l) at about 10km south of Srinagar city on Srinagar-Baramulla National Highway (IA), harbouring about 0.4

million migratory waterfowl during winter. Doodganga stream from east and Sukhnag Nallah from west are its two inlet channels. The water drains out through an outlet channel– the needle gate, having weir and lock system, to regulate the water level especially during winter. The present area of the wetland is 7.5 km^2, having considerably reduced as a result of encroach-ments in the catchment (Fig. 1).

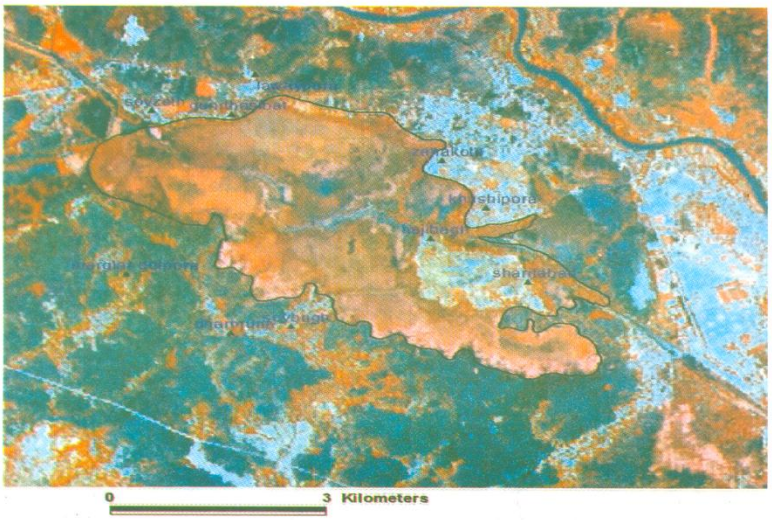

Fig. 1. Satellite image of Hokersar wetland

MATERIAL AND METHODS

Quadrats of definite size 1m^2 were randomly laid at and around various sites covering almost the entire area of the wetland throughout the growing period of macrophytes during 2002. The plants falling in the quadrats were carefully sorted out, counted and listed species-wise to work out various quantitative community features like frequency, density, abundance and Importance Value Index (IVI) after Misra (1968). Species richness was calculated according to Odum *et al.*, 1960.

RESULTS AND DISCUSSION

During the entire period of study seven species of submerged macrophytes, belonging to five families, were recorded from the wetland (Table 1). Structure and species composition of the wetland is purely governed by ecological stresses including flooding, erosion and deposition. Amplitude of water level fluctuations is the main controlling factor (Ravinder and Pandit, 2005).

Table 1. Species composition of submerged macrophytes

S. No.	Family	Recorded representatives
1	Ceratophyllaceae	*Ceratophyllum demersum* Linn.
2	Haloragiaceae	*Myriophyllum spicatum* Linn
3	Hydrocharitaceae	*Hydrilla verticillata.* (L.f.) Royle.
4	Lentibulariaceae,	*Utricularia aurea* Lour
5	Potamogetonaceae	*Potamogeton crispus* Linn. *P. lucens* Linn. *P. pucillus* Roxb.

There were slight variations in the number of species during s· ·ng. However, these variations were insignificant and for the rest of the growing period the species number remained constant which is attributed to the stabilization of water level and stability in the climatic conditions during the middle and the latter part of the growing season.

The data revealed that *Ceratophyllum demersum* was the most frequent species (83.13), followed by *Utricularia aurea* (43.159), *Potamogeton pucillus* (29.547), *Potamogeton crispus* (17.547), *Hydrilla verti-cillata* (14.911), *Potamogeton lucens* (5.231) and *Myriophyllum spicatum* (3.786) in a decreasing order. Among the submergeds the maximum abundance was due to *Ceratophyllum demersum* (10.39), being followed by *Potamo-geton pucillus* (1.930), *Utricularia aurea* (1.930), *Potamogeton crispus* (0.386), *Hydrilla verticillata* (0.269), *Myriophyllum spicatum* (0.126) and decreasing to a minimum of 0.120 for *Potamogeton lucens*

Table 2. Community features of submerged macrophytes (based on mean)

S. No.	Name of the species	Frequency	Abundance	Density
01	*Ceratophyllum demersum*	83.129	10.394	12.169
02	*Hydrilla verticillata*	14.911	0.269	1.651
03	*Myriophyllum spicatum*	3.786	0.126	3.094
04	*Potamogeton crispus*	17.547	0.386	2.056
05	*Potamogeton lucens*	5.231	0.120	2.737
06	*Potamogeton pucillus*	29.547	1.930	4.469
07	*Utricularia aurea*	**43.159**	**1.656**	**3.207**

As for as density is concerned, *Ceratophyllum demersum* again registered the highest value (12.17), followed by *Potamogeton pucillus* (4.469), *Utricularia aurea* (3.207), *Myriophyllum spicatum* (3.094), *Potamogeton lucens* (2.737), *Potamogeton crispus* (2.056) and decreasing to the lowest in *Hydrilla verticillata* (1.651).

Importance Value Index also depicted the similar trend with *Ceratophyllum demersum* recording the highest value (153.4) and *Potamogeton lucens* the lowest (12.8). Other species were the intermediates between the two extremes (Fig. 2).

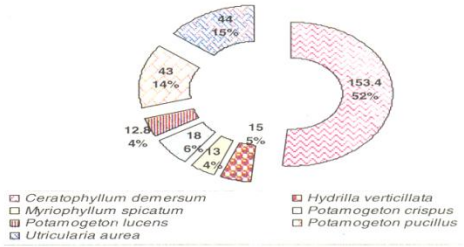

Fig. 2. Importance Value Index of all the recorded species

Fig.3. *Ceratophylum demersum* growing luxuriantly in Hokersar waters

Fig. 4.Comparatively transparent waters promoting the growth of submergeds

The distribution of submerged veget-ation is greatly influenced by turbidity and water depth. Under high turbid water conditions this class of macrophytes is greatly suppressed. Despite greater water transparency, almost all through the year except for a brief period in spring, the most of the area of Hokersar wetland remains covered by floating-leaved vegetation, restricting the solar radiations to reach the under water flora. The dominance of *Ceratophyllum demersum* in the wetland under such conditions points towards the fact that the species is comparatively well adapted to low irradiation, the fact also supported by Wilson (1941) and Van der Valk and Bliss (1971). The significant frequency and density of *Potamogeton pucillus* in the wetland was probably due to moderate water depth (1m) throughout the growing season as has also been advocated by Purohit and Singh (1987) who observed the relation between depth and growth of *Potamogeton* sp, recording the maximum growth rate at 1 m depth. According to the authors the growth decreased with the increasing

depth. Another important factor controlling the distribution of submergeds is efficiency of reproduction. There are many ancient reports regarding the growth of many submerged plants from vegetative propogules e.g. *Potamogeton crispus* (Clos, 1856) and *Hydrilla verticillata* (Mitra (1955, 1960). Another important fact of successful growth of submerged macrophytes like *Ceratophyllum demersum Hydrilla verticillata, Myriophyllum spicatum* and *Potamogeton* spp, is that they utilize nutrients both from sediments and water (Gessner, 1959).

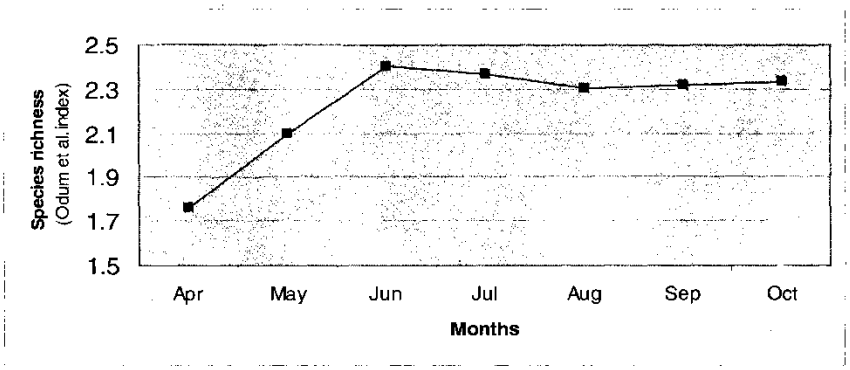

Fig.5. Species richness of submerged macrophytes

Species richness calculated over the entire period revealed highest richness in the month of June as against the lowest in April (Fig.5). The peak values of richness recorded in June and thereafter decline in richness was attributed to the fact that there was a continuous increase in the number of individuals with the total number of species remaining constant as a result of stabilization of water depth and constant favourable conditions in the latter part of the growing season. This lends credence to the fact that only few species are adapted to physical conditions prevalent in the wetland.

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