

## Current Status of Macrophytic vegetation in various Freshwater bodies of Kashmir Himalaya

Ashok K. Pandit, G. H. Rather, Shahid A. Wani and J. A. Javeed

Aquatic Ecology Laboratory, Centre of Research for Development, University of Kashmir, Srinagar – 190006, J & K, India

### ABSTRACT

The present ecological survey deals with the macrophytic composition of various freshwater bodies of Kashmir Himalaya. These freshwater bodies are not only situated within different geographical coordinates but are also under varying degrees of anthropogenic impacts. In general, the maximum number of species (30) was recorded for a shallow urban valley lake Dal, while the minimum number of species (22) was recorded for a pine forest lake, Nilnag. The present study depicted significant spatial variations among the macrophytic vegetation of the waterbodies. Comparing the present study with earlier reports, it seems that some of the species recorded earlier are no longer existent while a few new species have made their appearance and opportunistically colonized the habitats.

**Key words:** Macrophytes, Kashmir Himalaya, Dal, Nilnag, Urban Valley lake.

### INTRODUCTION

The valley of Kashmir abounds in a variety of freshwater habitats in the form of lakes, rivers and springs. Besides having numerous socio-economic and ecological values, these freshwater bodies are an important genetic resource in terms of the variety of life-forms. Among the various biotic forms, macrophytes comprise a dominant group of plants especially in shallow lentic systems such as lakes and wetlands, which determine the functioning of these ecosystems. During recent past, the changing human activities in and around these freshwater bodies, due to the opening of terrestrial ecosystems, have not only changed their physical and chemical milieu but their overall biological set up has also been altered to a greater extent. Even though comprehensive ecological studies have been undertaken on various freshwater ecosystems in Kashmir Himalaya from early sixties, only a few reports are available on macrophytes (Kaul and Zutshi, 1967; Kaul *et al.*, 1978; Kaul, 1982; Pandit, 1984, 92, 99; Kak, 1987, 89; Ravinder *et al.*, 2004). It is in this context that the present study was undertaken to have an insight of the diversity of macrophytic vegetation in various freshwater bodies with varying degrees of human interference in their catchment areas and consequently their trophic status.

### STUDY AREA

The present study was carried out on five freshwater lakes in Kashmir Himalaya with their brief description given in Table I.

**Table 1. Description of various lakes under study**

S.No.	Dal	Wular	Manasbal	Ahansar	Nilnag
01	Urban valley lake	Rural valley lake	Rural valley lake	Rural valley lake	Pine forest lake
02	3 km of Srinagar city	3.5 km NW of Srinagar city	2.5 km NW of Srinagar city	2.6 km NW of Srinagar city	40 km south of Srinagar city
03	1584m	1580m	1585m	1585m	2180m
04	11.5 Km <sup>2</sup>	21 Km <sup>2</sup>	2.8 km <sup>2</sup>	0.8 km <sup>2</sup>	0.50km <sup>2</sup>
05	Source of water	Jhelum, Madhumati Nallah and Arin Nallah	Underground springs spread over its basin and ephemeral irrigation channels	Underground springs spread over its basin and Ephemeral irrigation channels	Underground springs and Soipather kul
06	Max. Depth	4m	12.5m	5.5m	6m
07	Outlet	Permanent, Chonti kul and Nallah Amir Khan	Permanent, leaving into river Jhelum	Permanent, leaving into river Jhelum	Nilnag-Buzgoo irrigation channel
08	Anthropogenic impacts	Urbanization, input of municipal wastes, agricultural run-off, tourism, dweeding and vegetable cultivation	Eroachment, agricultural activities, sewage, siltation and <i>Salix</i> plantation	Sewage and effluents from a near by village, land-use practices for vegetable and crop farming and dweeding of submergeds used as mulch.	Agricultural activities, deforestation, dweeding and channelizing the water for irrigation

## MATERIAL AND METHODS

The selected waterbodies were surveyed on monthly basis during 2004. The macrophytes were collected from different lakes from regions excluding marshes and floating gardens by quadrat method. These were sorted and identified up to genus or / species level by adopting standard works (Sculthorpe, 1967; Kaul and Zutshi, 1967; Kak, 1987, 89, and Gopal, 1990).

## RESULTS AND DISCUSSION

Macrophytes comprise an ecologically important biological community of freshwater bodies especially shallow lakes and wetlands. The growth and abundance of macrophytes is governed by a set of environmental factors among which hydrological factors are of prime importance. The aquatic habitats of Kashmir support a rich and varied nature of macrophytic flora. Kaul and Zutshi (1967) reported a total of 117 species of macrophytes belonging to 69 genera and 42 families in various aquatic habitat of Kashmir. Later, Kak (1988) reported a total of 196 species of aquatic angiosperms from various aquatic bodies, marshland and paddy fields of Kashmir.

The present study revealed the presence of a total of 38 species of macrophytes in the open water areas of all the surveyed lakes (Table 2). Even though all the four ecological groups of macrophytes, viz. emergents, rooted floating-leaf types, submergeds and free-floating types were recorded from Dal, Wular, Manasbal and Ahansar lakes; Nilnag lake was, however, devoid of free-floating species. The relative proportion of each group was again different in different biotopes. The maximum number of species (30) was reported from Dal lake as against the minimum number of 22 species, being recorded from the Nilnag lake. In all the lakes, the maximum number of species was recorded for the emergent class with 15 species in Dal, followed by 13 in Ahansar, 12 in Nilnag, 11 in Wular and 9 in Manasbal lake. *Myriophyllum verticillatum*, a pollution tolerant species (Pandit 1984, 92), was reported for the first time from Nilnag lake. Emergents are considered to comprise the most productive communities of macrophytes (Kaul *et al.*, 1978). This implies that the shallow Dal lake is more productive, followed by Ahansar, Nilnag, Wular and Manasbal (being the deepest) as the least productive.

The lakes under study showed a little variations regarding the diversity of rooted floating-leaf types. Thus, the greater number (7) was recorded for Dal lake as against the lowest (4) recorded at Nilnag. Wular, Manasbal and Ahansar were the intermediates between the two extremes. The presence of *Euryale ferox* in the deep Manasbal lake reflects that the lake is not at the critical stage of trophic evolution as the loss of the species in Dal lake has been attributed to the change in environmental complex and accelerated eutrophication (Kaul, 1984). Though Kundangar and Zutshi (1987) reported *Trapa natans*, *Potamogeton pucillus* and *P. crispus* as very common macrophytes in Ahansar lake, yet during the present investigation these species were noticed with insignificant coverages, indicating the species losing their ground due to the shallowing of the lake coupled with

**Table 2. List of macrophyte species recorded from the investigated lakes during 2004**

S.No.		Dal	Wular	Manasbal	Ahansar	Nilnag
<b>Emergents Species</b>						
01	<i>Alisma plantago-aquatica</i>	p	p	r	r	r
02	<i>Bidens cinnua</i>	-	-	r	-	r
03	<i>Carex sp.</i>	p	p	-	-	P
04	<i>Cyperus deiformis</i>	p	-	r	p	P
05	<i>Echinocharis palustris</i>	-	-	-	p	-
06	<i>Echinochloa crusgalli</i>	p	p	-	p	P
07	<i>Hippuris vulgaris</i>	-	-	-	r	-
08	<i>Lycopus europas</i>	p	-	-	-	-
09	<i>Myriophyllum verticillatum</i>	p	p	-	p	r
10	<i>Nasturtium officinale</i>	p	p	p	p	P
11	<i>Pteragmites australis</i>	p	p	p	d	P
12	<i>Polygonum hydropiper</i>	p	-	-	-	-
13	<i>Polygonum amphibium</i>	p	p	-	p	d
14	<i>Sagittaria sagittifolia</i>	p	p	r	p	-
15	<i>Scirpus triquetar</i>	-	-	r	-	-
16	<i>Stum latijugum</i>	p	-	p	p	P
17	<i>Sparganium ramosum</i>	p	p	-	p	P
18	<i>Typha angustata</i>	p	p	p	-p	P
<b>Routed floating-leaf type</b>						
19	<i>Euryale ferox</i>	-	-	p	-	-
20	<i>Hydrocharis dubia</i>	p	p	-	p	-
21	<i>Marsilea quadrifolia</i>	-	-	r	-	d
22	<i>Nelumbo nucifera</i>	d	p	d	d	-
23	<i>Nymphaea alba</i>	p	p	-	d	-
24	<i>Nymphaea sp.</i>	p	-	-	-	-
25	<i>Nymphaoides peltatum</i>	d	d	d	d	d
26	<i>Potamogeton natans</i>	p	p	p	p	d
27	<i>Tropea natans</i>	d	d	p	p	p
<b>Submerged</b>						
28	<i>Ceratophyllum demersum</i>	d	d	d	d	d
29	<i>Hydrilla verticillata</i>	d	p	d	p	-
30	<i>Myriophyllum spicatum</i>	d	p	d	d	d
31	<i>Najas graminea</i>	r	-	-	-	r
32	<i>Potamogeton crispus</i>	p	p	p	p	p
33	<i>Potamogeton lucens</i>	d	p	d	d	p
34	<i>Potamogeton pucillus</i>	p	p	p	r	-
35	<i>Utricularia aurea</i>	-	-	-	d	-
<b>Free-floating</b>						
36	<i>Azolla sp.</i>	d	p	-	-	-
37	<i>Lemna spp.</i>	d	d	p	d	-
38	<i>Salvinia natans</i>	d	d	p	d	-

d = dominant, p = present, r = rare and - = absent

a great decrease in transparency.

The most striking features of the present survey was the presence of *Euryale ferox* only in the Manasbal lake and the absence of *Nymphaea alba* from Nilnag lake reported earlier by Blatter (1927) and Kaul *et al.*, (1980), while as *Euryale ferox* reported by Mukerjee (1921) has also lost its existence from Dal lake, though Pandit (1992) recorded the presence of a few individuals of the plant behind Nehru park in the Gagribal basin.

The submerged community was almost uniformly represented in all the waterbodies with six species each in Dal, Wular and Manasbal lakes, five in Nilnag and seven in Ahansar lake. Among various factors which affect the distribution of submerged macrophytes, water depth (Spence, 1967) and transparency (Sculthorpe, 1967) are considered to be of more significance. The maximum coverage of submergeds, forming dense meadows, in Manasbal lake reflect the high transparency of the lake waters. Besides, low coverage of emergents and free-floating species in the lake due to limited littoral zone also contribute to high density of submergeds which otherwise would intercept incoming solar radiation and, therefore, giving a shading effect. *Chara* reported earlier by Mukerjee (1921) to form dense carpet in the Dal lake, is no longer found in the lake. Further *Chara fragilis*, *Nitella acuminata*, *N. dispersa* and *Nitellopsis obtusa* reported earlier from deep Manasbal lake (Mukerjee, 1926), are no longer existent. Likewise *Potamogeton perfoliatus* reported in Nilnag by Blatter (1927), has also lost its existence from the lake.

While among free-floating forms *Lemna* spp. and *Salvinia natans* were the regular representatives of all the lakes, except Nilnag, the presence of *Azolla* spp. reported for the first time in Dal and Wular lakes is a noteworthy feature. The presence of *Azolla* sp. with its profused growth, due to its great potential of nitrogen fixation, in these lakes has eaten up the vitals of other free floating species thus posing a great challenge to the lake environment in general and ecologists in particular.

In conclusion, it can be inferred that all the lakes (pine forest and valley lakes) are heavily infested with macrophytes with varying species composition and coverage. Among the lakes, Manasbal lake seems to be least productive as regards the growth and abundance of emergents while Dal, Wular, Ahansar and Nilnag are comparatively more productive. Further the absence of free-floating species from Nilnag reflect its low pollution level while the maximum contribution by emergents in the lake may be attributed to the extension of its shallow littoral zone with silty sediment texture. However, the emergence of *Myriophyllum verticillatum* during the recent years reflects that the lake is undergoing trophic evolution.

#### ACKNOWLEDGEMENTS

Thanks are due to Prof. A.R. Yousuf, Director CORD, for providing necessary facilities. The

second author is also thankful to CSIR, New Delhi for providing financial assistance in the form of JRF. The authors are also thankful to Showkat Subhan Mir and Kawnsar-Ul-Yaqoob, research scholars of the centre for their help in the field work.

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