PRIMARY PRODUCTIVITY OF DOMINANT MACROPHYTES IN HOKERSAR, A PERENNIAL WETLAND IN KASHMIR HIMALAYA

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ABSTRACT

Hokersar wetland of Kashmir falls in western Himalaya having a temperate climate with comparatively low air temperature, high humidity and moderate rainfall. The wetland has dense macrophytic vegetation with most of the species rare to the wetland. The year long investigations during 2002 revealed that emergent vegetation dominated in primary productivity and floating-leaf type vegetation was sub-dominant. It was further established that the plant habit, shoot density, spatial leaf arrangement, the growing season, exposure of radiation receptive organs and plant height are the factors that directly affect the standing crop accumulations.

Keywords: Productivity, macrophytes, wetland, biomass, Hokersar, Kashmir.

INTRODUCTION

All freshwater ecosystems have the macrophytes as an integral component especially the wetland ecosystems which are highly infested with the macro-vegetation forming an important source of energy for subsequent trophic levels and sustaining greater number of food chains and complex food webs on account of larger areas of mud-water interface compared to other freshwater ecosystems. Internationally great emphasis is laid upon the wetland conservation based on evaluation of primary productivity of these ecosystems. In Kashmir very little attention has been given to the estimation of primary productivity of macrophytes (Kaul, 1971; Kaul *et al.,* 1972, 1978; Kaul and Vass, 1973; Handoo and Kaul, 1981; Kaul, S. 1982; Pandit and Ravinder 2006). The present paper, therefore, aims to collate the base line data on primary productivity of various dominant macrophytes of Hokersar wetland

STUDY AREA

Hokersar, a protected, perennial wetland spread over an area of 7.5 km^2, at about 10 km south of Srinagar, at an altitude of 1584m (a.m.s.l.) between the geographical coordinates of 34° 5′ - 34° 6′ N latitude and 74° 8′ – 74° 12′ E longitude on Srinagar-Baramulla National Highway (NH 1A), harbours about 0.4 million migratory waterfowl during winter. The wetland is fed by two streams-Doodhganga (from east) and Sukhnag Nallah (from west). The single outlet has a weir and lock system, the Needle gate, which regulates its water especially during winter. There are about twelve villages with a population of about 80,000 people in its immediate catchment mostly depending upon agriculture and having livestock as well.

MATERIAL AND METHODS

An estimation of net primary productivity was done by harvest method. The macrophytes falling in randomly laid quadrats were brought to the laboratory in polythene bags, washed to render them free of mud, debris and encrustaceans, etc. The primary productivity for each species was measured according to the procedures described by Milner and Huges (1968).

RESULTS AND DISCUSSION

Out of a total of 46 species (belonging to 27 families and 41 genera), only 14 species (belonging to 13 families) were dominant in the wetland and hence considered for the estimation of primary productivity (Table 1). The data reveals that emergent vegetation is productively more efficient compared to other life-form classes which may be attributed to the fact that emergent macrophytes are highly opportunistic colonizers (Zutshi and Vass, 1976) for having evolved to develop perennating organs like bulbs, rhizomes etc., buried deep under the sediment (Gopal, 1994). These macrophytes, on the onset of favourable conditions after severe colds and low solar radiations of winters, sprout well in the early part of spring from their perennating organs which surpass the unfavourable conditions of the chilling temperatures quite easily. The frequent floods and the consequent silt depositions in last few decades have resulted in fast development of emergent communities in the wetland (Pandit, 1992). Further more, emergent communities flourish well in alkaline soils with pH of 7.2 – 8.0, a fact also advocated by Ramakrishnan (1965).

In general, highest carbon fixation capacity was recorded for *Typha angustata* (6.110 g/m^2/day), followed by *Phragmites australis (4.121* g/m^2/day), *Sparganium ramosum (*1.981 g/m^2/day), *Ranunculus lingua (*1.967 g/m^2/day), *Nymphaea alba (*1.241 g/m^2/day), *Menyanthese trifoliata (*0.631 g/m^2/day) and *Ceratophyllum demersum (*0.318 g/m^2/day) The lowest productivity among the analysed species was registered for *Lemna* spp. *(*0.005 g/m^2/day).

Table 1: Macrophytic production in Hokarsar wetland

S. No	Name of the species	Part taken	Period	g/m^2/day	g/plant/ day
1.	*Phragmites australis*	Above ground	April-Oct.2002	4.121	0.2991
2.	*Sparganium ramosum*	-do-	-do-	1.981	0.1679
3.	*Typha angustata*	-do-	-do-	6.110	0.5850
4.	*Ranunculus lingua*	-do-	-do-	1.967	0.225
5.	*Menyanthese trifoliata*	Whole plant	-do-	0.631	0.0993
6.	*Myriophyllum verticillatum*	-do-	-do-	0.236	0.0501
7.	*Sagittaria sagittifolia*	-do-	-do-	0.103	0.0383
8.	*Trapa natans*	-do-	-do-	0.483	0.1283
9.	*Nymphaea alba*	Leaf lamina	-do-	1.241	0.168
10.	*Nymphoides peltatum*	-do-	-do-	0.087	0.0018
11.	*Salvinia natans*	Whole plant	-do-	0.047	0.0035
12.	*Lemna* spp.	-do-	May-August 2002	0.005	0.00008
13.	*Ceratophyllum demersum*	-do-	April-Oct. 2002	0.318	0.0149
14.	*Potamogeton pucillus*	-do-	-do	0.121	0.070

Among the floating-leaf type species the highest primary productivity was estimated for *Nymphaea alba* (1.241 g/m^2/day), followed by *Trapa natans* (0.483 g/m^2/day), and *Nymphoides peltatum* (0.087 g/m^2/day) in a decreasing order. In general, *Typha angustata* alone contributed about 35 percent towards the primary productivity (Fig.1) followed by *Phragmites australis* (24%), *Sparganium ramosum* and *Ranunculus lingua* (11% each). All other species together contributed less than 30%.

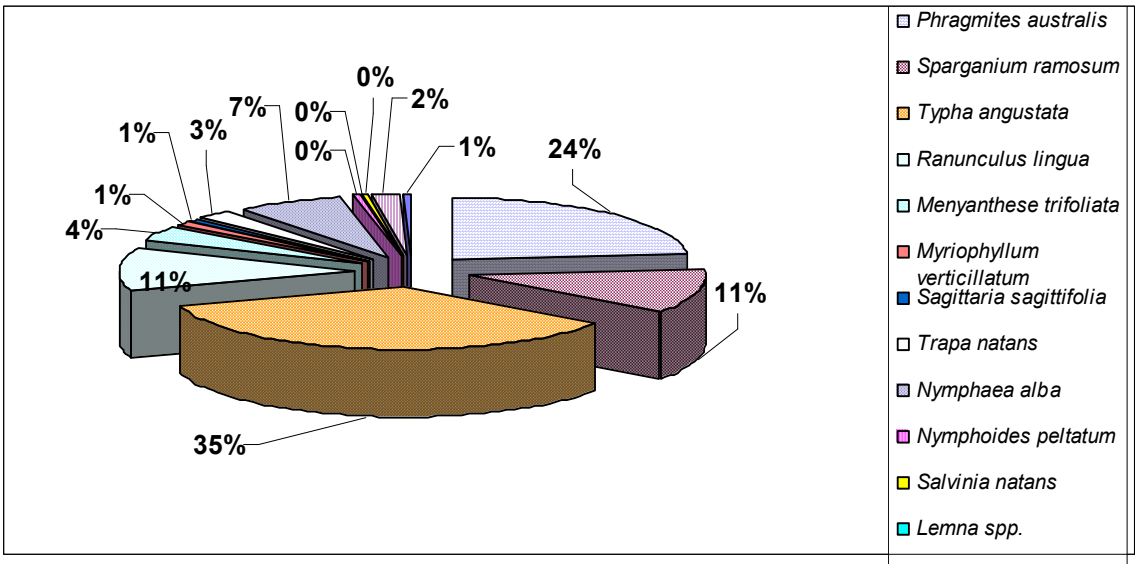

Fig. 1. Primary productivity of macrophytes in percentage

The greater productive capacity of emergents and that too of a few particular species is due to the spatial geometry of their individual leaves resulting in a high assimilative area, and there being no shading of any organs at various heights (Kaul *et al.*, 1978). During the present study *Typha angustata* and *Phragmites australis,* registered the higher values which has also been reported by Pearsall and Gorham (1956), Bray (1962) and Dykyjova (1971) Another probable reason for more productivity of emergents was that most of them had a growing season in accordance with increasing atmospheric temperature and increasing day length. Almost all of the emergent species taken for the estimation of primary productivity in the present study had the sprouting in spring (April) and reaching to their peak biomass in summer (July). Besides, habit of a particular species to grow in field conditions has a great bearing on its productive capacity. The shoot density, surface area of assimilative organs and the plant associations too have an impact on the biomass accumulation and hence primary productivity. The emergents, occupying lesser area, are more efficient in utilizing the available space and solar radiations with great economy (Kaul *et al.*, 1978).

Further more the emergent species are not only efficient accumulators of biomass but they also negatively influence the other life-form classes in carbon fixation by restricting the solar radiations to be received by the latter by virtue of shading when alive and by covering them by litter after the death and senescence.

In conclusion it can be inferred that the emergent vegetation dominates the wetland in primary productivity while floating-leaf type

vegetation occupies a sub-dominant position. This is attributed to the possession of better perennating organs by emergents and their comparative tolerance to changing physical and climatic conditions. Floating-leaf type vegetation, in turn, has also an advantage over submergeds for possessing broader leaves for perception of solar radiations and thus occupying an intermediate position between emergents and submergeds.

Submerged macrophytes in Hokersar do not contribute much towards the primary productivity probably because of the fact that most of the area of the wetland remains covered by floating-leaf type vegetation, restricting the solar radiations to reach the under-water flora. Therefore, biomass accumulation of submergeds is directly related to the presence of open water area and the perception of light radiations. However, *Ceratophyllum demersum,* in comparison to other submerged species, grew luxuriantly in the wetland and accumulated significant biomass for being relatively adapted to low irradiations, the fact also supported by Van der Valk and Bliss (1971).

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