Nature Environment and Pollution Technology
An International Quarterly Scientific Journal

ISSN: 0972-6268	Vol. 10	No. 1	pp. 115-118	2011

Original Research Paper

Ecological Studies and Uses of Valued Aquatic Plants in Kashmir Wetlands

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Nat. Env. & Poll. Tech.
Website: www.neptjournal.com

Key Words:
Kashmir wetlands
Aquatic plants
Phenology
Biomass
Therapeutic uses

ABSTRACT

The wetlands of Kashmir are highly productive life support systems and are of immense socio-economical value to the people. The present studies concern with wetlands viz., Khushalsar, Anchar, Ahansar, Waskursar, Mansbal and Wular lake, which fall on the flood plains of River Jhelum and enjoy typical rural environment. The littoral zones of all these wetlands are occupied by emergent aquatic plants like *Typha angustata* and *Phragmites communis*, followed by rooted floating leafy aquatic plants like *Nelumbo nucifera*, *Nymphaea alba*, *Nymphoides peltata*, and *Trapa natans* which are extensively used for fodder, food and medicinal purpose. In the present study survey of such valued aquatic plants, their density, frequency, phenology, dry weight and therapeutic values were recorded in order to assess their role in maintaining the health of their users. The distribution frequency and density of various aquatic plants varied from wetland to wetland which could be because of availability of nutrients and the nature of the bottom sediment. It has been observed that the local knowledge on such valued plants abounds and their use is an important link between the dwelling communities and the biodiversity of the area.

INTRODUCTION

The wetlands of Kashmir like other wetlands of the world are the most productive life support systems and are of immense socio-economical value to the people, in general, and nearby inhabitants, in particular. The 'value' is anthropocentric concept as depends upon the perception of the human society about the usefulness of something. The good services provided by an ecosystem are then considered as values. All values are derived from the functions performed by an ecosystem. The habitat function of an ecosystem becomes a value if the concerned organisms are important to humans (Gopal 1990).

Most aquatic wetland plants of the valley have become a direct source of economic benefit in the form of harvestable resource for many nearby inhabitants and traditional societies who have remained dependent upon wetlands for millennia. Local communities in every ecosystem from the north to north-west Himalayas down to the coastal plains have discovered the medical use of thousands of plants found in their ecosystems (Arora 1981). Aquatic angiosperms are very remarkable plants due to the habitat in which they spend most of their lives. These plants include species of various conditions such as true aquatics which are free floating, submerged or emerged ones, plants which grow just on the border line between water and land surfaces, and plants which generally thrive in aquatic conditions. The growth of large number of hydrophytes has drawn the attention of ethno-medico botanical survey throughout India. So far, a systematic work on therapeutic values of these plants has not been done in India even though several workers have reported hydrophytic vegetation in different parts of the country (Subramanyam 1962, Mehta et al. 1972, Gupta 1979). Some ethno-botanists conducted studies concentrating mainly on the ethno-botanical aspects of medicinal plants (Uniyal 1968, Gaur & Tiwari 1987, Gaur 1999, Goel 1982, Tiwari 1986, Rawat & Bhatt 2002).

The present studies concern with wetlands viz., Khushalsar, Anchar, Ahansar, Waskursar, Mansbal and Wular lake which fall on the flood plains of River Jhelum. The important morphometric characteristics of the wetlands are given in Table 1. The littoral zones of all these wetlands are occupied by emergent aquatic plants like *Typha angustata* and *Phragmites communis*, followed by rooted floating leafy aquatic plants like *Nelumbo nucifera*, *Nymphaea alba*, *Nymphoides peltata* and *Trapa natans* which are extensively used for fodder, food and medicinal purpose. In the present study survey of such valued aquatic plants, their density, frequency, phenology, dry weight and their therapeutic values was conducted in order to assess their role in maintaining the health of their users.

MATERIALS AND METHODS

Vegetation of the wetlands was surveyed on the monthly basis (2008-2009) with the help of grappler tied to nylon

Table 1: Morphometric data of wetlands.

Morphometry	Khushalsar	Anchar	Ahansar	Waskur	Manasbal	Wular
Surface area (hectare)	16.6	680	17.0	38.0	280	5871
Average depth (m)	1.5	1.5	3.5	3.7	6.5	3.5
Maximum depth (m)	3.5	3.0	5.0	6.0	12.5	5.8

Table 2: Average distribution frequency (%) of some valued aquatic plants.

Aquatic Plants	Khushalsar	Anchar	Ahansar	Waskur	Manasbal	Wular
Typha angustata	45.5	46.3	32.6	38.5	25.5	48.5
Phragmites communis	30.5	35.5	30.5	32.5	30.5	45.5
Nelumbo nucifera	56.5	53.5	38.5	52.2	45.0	49.5
Trapa natans	25.5	22.5	30.5	35.5	20.5	30.0
Nymphaea alba	35.5	38.5	40.0	49.0	32.5	35.0

rope. The distribution of various aquatic plant communities was recorded in the field along with phenological data. The aquatic plants were harvested by placing metallic quadrat (25 cm^2) along transect. The harvested aquatic plants were washed under jet of water and separated. The samples were dried in an oven at 105°C till constant weight was obtained. The biomass has been calculated on the basis of the dry weight. The frequency and density of each species was calculated after Misra (1968) and the area covered by each species was calculated from the vegetation maps, prepared in the field after Zutshi (1968) and Vass (1973).

RESULTS

The data on distribution, frequency, density and biomass of the studied aquatic plants are given in Tables 2, 3 and 4.

***Typha angustata*:** On the shallow silted regions of all the wetlands under study emergent species like *Typha angustata*, commonly known as cattail, grew steadily during early spring (March-April) in all the wetlands and reached to its peak in autumn (September-November) with an average frequency of 25% (Manasbal) and 48.5% (Wular) and average density of 1.0 m^2 (Ahansar) and 9.5 m^2 (Khusalsar). During May to August the dry weight of the plant species ranged between 465 g/m^2 and 1758 g/m^2 with cattails formed in full swing. However, the leaves and fruits started to undergo senescence with the onset of winter (December-February). The therapeutic uses of the plant species include treatment of nose bleeds, haematemesis, haematuria, uterine bleeding, dysmenorrhoeal and abscesses. The rootstocks of the plant are used as astringent and diuretic and the underground stem is used as tonic, febrifuge and diuretic (Lavnert 1981).

***Phragmites communis*:** It grows in shallow pockets of the wetlands and its growth sets in early spring (March-April) reaching to its peak growth during autumn (September-November). The average distribution frequency of 30% was recorded in Manasbal and 4.5 % in Wular. Similarly, the lowest average density of 0.9 m^2 was recorded in Ahansar while the highest average density was recorded in Khushalsar (12.5 m^2). The maximum dry weight 310 g/m^2 was recorded during July in plant species and the senescence of the plant started during winter (December-February). The rhizomes of this plant contain silicic acid and 5.6% sugar. Therapeutically the plant parts are used as analgesic, antispasmodic and hypotensive (Duke 1988).

***Nelumbo nucifera*:** The studied wetlands are extensively exploited for growing of Nelumbo plants and more areas are brought under cultivation because of the commercial reasons. The first leaves of the plant species emerged in may in all the studied wetlands and their frequency ranged between 38.5% (Ahansar) and 56.5% (Khushalsar) with a minimum average density of 0.6 m^2 and 10.0m^2 respectively. The dry weight of leaves, stems and that of rhizome ranged between 15.8 g/m^2. The Nelumbo plants started flowering during June-July and lasted till September.

The Nelumbo plant is used as astringent, cardio tonic, febrifuge and hypotensive. The roots and rhizome are extensively used as vegetables and are a source of starch as its root contains 1.7% protein, 0.1 % fat, 9.7 % carbohydrate and 1.17 % ash. The extracts of rhizomes, seeds, flowers and leaves have varied in therapeutic potential. Several bioactive compounds have been derived from the plant parts including alkaloids, flavonoids, glycerides, etc. The leaf blades and leaves are also used for treatment of sinusitis (Duke 1988).

***Trapa natans*:** The plant species is one of the favourite and popular aquatic plants which is famous for its fruits and of wide uses. The fruits (water chestnut) locally called 'singhara' are used in both fresh and fried form. The grounded fruits or its flour is used for making bread. In most of the wetlands, the fruits are extensively used by migratory birds particularly during nurturing of young ones. The juvenile

Table 3: Average density (m^2) of some valued aquatic plants.

Aquatic plants	Khushalsar	Anchar	Ahansar	Waskur	Manasbal	Wular
Typha angustata	9.5	8.5	1.0	2.5	2.6	9.0
Phragmites communis	12.5	9.5	0.9	1.0	2.5	8.5
Nelumbo nucifera	10.0	6.5	0.6	3.8	3.8	6.8
Trapa natans	1.0	0.9	1.5	1.6	1.5	12.5
Nymphaea alba	2.5	2.5	1.6	1.7	2.5	10.5
Nymphoides peltata	5.5	6.5	7.0	11.5	3.5	9.5

Table 4: Dry weight (g/m^2) of some valued aquatic plants.

	Period	Dry weight
Typha angustata St + L)	March-September	465 - 1785
Phragmites communis (St + R)	March-July	107.8 - 310
Nelumbo nucifera (St + R)	June-September	15.8 - 52.2
Trapa natans (St + R)	May-August	1.5 - 9.4
Nymphaea alba (St + L)	May-August	12.5 - 20.5
Nymphoides peltata (St + L)	May-August	13.8 - 48.5

St. = stem; R = Rhizome/root; L = Leaf

leaves appeared in May and continued to grow until October. The flowering of the species set in June while the fruit formation was recorded in July. The minimum frequency 20.5 % was recorded in Manasbal while the maximum frequency of 35.5 % was recorded in Waskursar with a minimum average density of 1.6 m^2. The average dry weight of the plant species ranged between 1.5 g/m^2 and 9.4 g/m^2.

Fruits of trapa are sweet, astringent, cooling, diuretic and tonic. They are used in dyspepsia, haemorrhages, diarrhoea and dysentery. The presence of saponins, glycerides, phenolic compounds, flavonoids and phytosterols makes it important medicinal ingredient in many ayurvedic preparations. Therapeutic uses also include making liniments for the cure of rheumatism.

***Nymphaea alba*:** The aquatic species registered a frequency between 32.5 % (Manasbal) and 49.0 % (Waskur), while the density of the species ranged between 1.6 m^2 (Ahansar) and 10.5 m^2 (Wular). The leaves of the plant species appeared in the month of March (early spring) and flowering started in the month of April-May in all the wetlands. The average dry weight of the plant ranged between 12.5 g/m^2 and 20.5 g/m^2. Therapeutic uses of this aquatic plant species include its astringent and antiseptic properties besides treatment in bronchial congestion. The rhizome contains alkaloids viz., nymphacine, nupharine, glycosides and tannins. The general calming and sedative effects on the nervous system makes the plant species useful in the treatment of insomnia, anxiety and other disorders where nervous agitation is a factor.

***Nymphoides peltata*:** The plant species appeared in early spring in all the wetlands and with onset of favourable climatic conditions and rise in temperature recorded a frequency between 35.5 % (Manasbal) and 78.5 % (Waskur) with an average density ranging from 3.5 m^2 and 10.5 m^2 in the same wetlands. Though the flowering of the plant species was recorded in May-June in all the wetlands but the fruit formation was observed in September and October in all the wetlands. A delay of one month was, thus, recorded. The biomass studies were carried out from May to August and the minimum dry weight was recorded in May (13.8 g/m^2) and maximum in August (48.5 g/m^2).

Therapeutically, the plant species is anthelmintic, diuretic and febrifuge. The fresh leaves are used in treatment of periodic headaches. The plant extract is used in the treatment of burns, fevers, ulcers, snake bites and swelling.

DISCUSSION

In all the studied wetlands, the shallow, silted littoral zones were occupied by the emergent species viz., *Typha angustata, Phragmites communis* and *Nelumbo nucifera*. All the growth forms appeared with the advent of spring season and continued to grow till autumn. Thereafter, the senescence of the leaves and stem sets in and many forms enter into resting period which could be attributed to low temperature prevailing during the winter which is in agreement with Kundangar & Zutshi (1987), who studied the production of some macrophytes into rural lakes of Kashmir.

The distribution frequency and density of various aquatic plants varied from wetland to wetland which could be because of the availability of nutrients and the nature of the bottom sediment. The initial biomass of the studied aquatic plants in all the wetlands was lower during spring and reached to its peak in the month of July-August (summer). However, the biomass production was higher in emergents, which

is in close conformity with the findings of Kaul et al. (1972), while studying biomass production of macrophytes in some Srinagar lakes.

These aquatic plants are proving to be an increasingly valuable reservoir of compounds and extracts of substantial medicinal merit and have been traditionally used as home remedies and form an important part of Himalayan folk medicine. It has been observed that the local knowledge on such valued plants abounds and their use is an important link between dwelling communities and the biodiversity of the area.

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