

Life-form analysis of aquatic macrophytes in community ponds of Imphal Valley, Manipur, India

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Abstract

The present paper deals with the study of life form analysis of aquatic macrophytes recorded from the four community ponds in Imphal valley, Manipur, India during the period from July 2005 to July 2006. A total of 28 macrophyte species belonging to various plant groups were recorded. Altogether four types of life forms were categorized after Raunkiaer (1934). They are Therophytes, Errant Vascular Hydrophytes, Geophytes and Hemicryptophytes.

Key words: Community ponds, macrophytes life form, biological spectrum

INTRODUCTION

Community ponds are the important sources of water for various domestic purposes, fishery and agriculture in many parts of the state of Manipur (Latitude 23°83' N to 25°68' N and Longitude 93°03' E to 94°78' E) in India. The state is mountainous. And there is a small oval valley in the central part of the state known as Manipur valley, which rich in numerous water bodies. In addition to the famous Loktak Lake there are many other natural and artificial water bodies located in the valley. The importance of the conservation of the wetland biodiversity is now well recognized. The ponds located in the valley are also having good vegetation. It is important to understand the flora and vegetation of such wetlands before deciding any conservation strategy.

The life form composition in a plant community is found to be of special interest as the same may provide information on the response of a community to particular set of environmental factors on the utilization of space and the probable competitive relations within a community (Mueller Dombois & Ellenberg 1974). The general appearance of a plant community is caused more by the life-form of the dominant plants than by any other characteristics of the vegetation (Hanson & Churchill 1961). Life form classes (Raunkiaer 1934) also reflect the stratification of different layers above the ground and further indicate how a plant overcomes unfavorable seasons. This is assumed to have evolved in direct response to the climatic changes and accordingly, the proportion of the life-forms in an area would give a good indication of its climatic conditions (Kershaw 1973). Aquatic macrophytes play very important role in regulation of nutrients and mineral cycling. Only little information is available about the life forms from lakes, ponds and reservoirs of India. Therefore, the present paper analyses the life form classes of macrophytic species from four community ponds located in Imphal valley of Manipur, India.

MATERIALS AND METHODS

The study was conducted at monthly intervals from July 2005 to July 2006. Life form classification was done after Raunkiaer's system (Raunkiaer 1934) modified by Ellenberg & Muller-Dombois (1967) and Muller-Dombois & Ellenberg (1974). Periodical survey and sampling of the macrophyte was done at monthly intervals at the selected ponds as Site-I (Thangmeiband Lilasing Khongnangkong Pukhri), Site-II (Khurai Heikrumakhong Ipum), Site-III (Luwangsangbam Irong) and Site-IV (Ningthempukhri). Collected specimen were processed into mounted herbarium sheets following Jain & Rao (1977) and the plants were identified consulting a number of floras including *Flora of*

Assam (Kanjilal *et al* 1934, 1936, 1938 & 1940; Bor 1982) and the *Flora of Tripura State* (Deb 1983, 1984). All the voucher specimen were deposited in the Herbarium of the Department of Life Science, Manipur University.

RESULTS AND DISCUSSION

A total number of 28 species of macrophytes were recorded from all four study sites those belonged to 20 families. Maximum of 4 species are belonging to Nymphaeaceae followed by Polygonaceae (3 species). Family Cyperaceae, Pontederiaceae and Salviniaceae had contributed 2 species each, whereas other families like Alismataceae, Amaranthaceae, Apiaceae, Araceae, Arecaceae, Asteraceae, Convolvulaceae, Hydrophyllaceae, Lemnaceae, Marsileaceae, Onagraceae, Poaceae, Potamogetonaceae, Ricciaceae and Lentibulariaceae contributed one species each (Table 1). Four types of life forms have been recognized among the 28 macrophytic species reported from the four study sites. They are Therophytes (11 species), Geophytes (8 species) Errant Vascular Hydrophytes (5 species), and Hemicryptophytes (4 species) (Table 2). As much as 8 of the recorded species are Geophytes. In this type the perennating buds of plants are invariably buried in the soil or substratum such as the bulbs and rhizomes, the species belonging to this category are *Colocasia esculenta*, *Cyperus rotundus*, *Marsilea quadrifolia*, *Nelumbo nucifera*, *Nymphaea pubescens*, *Nymphaea stellata*, *Potamogeton crispus* and *Sagittaria sagittifolia*. Therophytes are the seasonal plants, completing their life cycle in a single favorable season, and remain dormant throughout the rest of the unfavorable period of year in the form of seeds; the species recorded in this category are *Echinochloa stagnina*, *Euryale ferox*, *Hydrolea zeylanica*, *Lemna perpusilla*, *Ludwigia adscendense*, *Monochoria hastata*, *Oenanthe javanica*, *Persicaria barbata*, *Persicaria hydropiper*, *Rumex nepalensis* and *Utricularia flexuosa*. Errant Vascular Hydrophytes (EVH) are plants surviving the unfavorable conditions in the form of vegetative parts like stolons, in favourable conditions they grow fast by vegetative means. *Azolla pinnata*, *Eichhornia crassipes*, *Pistia stratiotes*, *Riccia natans* and *Salvinia natans* are the macrophytes belonging to this (EVH) type. The fourth type of life-form recognized was Hemicryptophytes which are perennial plants with buds remain just below the soil surface, however buds may also be present at the soil surface but they are never exposed; they remain concealed under the dead leaves and twigs. This category included only two species which are *Alternanthera philoxeroides*, *Carex cruciata*, *Enydra fluctuans* and *Ipomoea aquatica*.

Table 1: Macrophytic species and their families in the ponds of study sites

Macrophytic Species	Family	Site I	Site II	Site III	Site IV
<i>Alternanthera philoxeroides</i> (Martius) Grisebach	Amaranthaceae	+	+	+	+
<i>Azolla pinnata</i> R.Brown	Salviniaceae	+	+	+	-
<i>Carex cruciata</i> Wahlenberg	Cyperaceae	+	-	-	-
<i>Colocasia esculenta</i> (L.) Schott	Araceae	+	-	-	-
<i>Cyperus rotundus</i> L.	Cyperaceae	+	-	-	-
<i>Echinochloa stagnina</i> Retzius	Poaceae	+	+	+	-
<i>Eichhornia crassipes</i> (Martius) Solms	Pontederiaceae	+	+	+	+
<i>Enydra fluctuans</i> Loureiro	Asteraceae	+	+	+	-
<i>Euryale ferox</i> Salisbury	Nymphaeaceae	-	+	+	-
<i>Hydrolea zeylanica</i> (L.) Vahl	Hydrophyllaceae	-	+	-	+
<i>Ipomoea aquatica</i> Forsskål	Convolvulaceae	+	-	+	-
<i>Ludwigia adscendens</i> (L.) Hara	Onagraceae	+	+	+	+
<i>Lemna perpusilla</i> J. Torrey	Lemnaceae	+	+	+	-
<i>Marsilea quadrifolia</i> L.	Marsileaceae	-	-	+	-

Macrophytic Species	Family	Site I	Site II	Site III	Site IV
<i>Monochoria hastata</i> (L.) Solms	Pontederiaceae	+	+	+	-
<i>Nelumbo nucifera</i> var. <i>rubra</i> Roxburgh	Nymphaeaceae	+	-	+	-
<i>Nymphaea pubescens</i> Willdenow	Nymphaeaceae	-	+	-	+
<i>Nymphaea stellata</i> Willdenow	Nymphaeaceae	+	-	+	-
<i>Oenanthe javanica</i> (Blume) DC.	Apiaceae	+	-	-	-
<i>Pistia stratiotes</i> L.	Araceae	+	+	+	-
<i>Persicaria barbata</i> (L.) Hara	Polygonaceae	-	+	+	-
<i>Persicaria hydropiper</i> (L.) Spach	Polygonaceae	+	+	-	-
<i>Potamogeton crispus</i> L.	Potamogetonaceae	+	+	+	+
<i>Riccia natans</i> Corda O. Kuntze	Ricciaceae	+	-	-	-
<i>Rumex nepalensis</i> Sprengel	Polygonaceae	-	-	+	-
<i>Sagittaria sagittifolia</i> L.	Alismataceae	-	-	+	-
<i>Salvinia natans</i> Hoffmann	Salviniaceae	+	-	-	-
<i>Utricularia flexuosa</i> Vahl	Lentibulariaceae	+	-	-	-
Total		21	15	18	06

[+ : Present; - : Absent]

Table 2: Life-forms of various macrophytic species based on position and degree of protection of the perennating organs of the study sites (Ellenberg & Mueller-Dombois 1967; Mueller-Dombois & Ellenberg 1974)

Macrophytic Species	Position and degree of protection to perennating organ during adverse season	Life-form	Percentage of composition
<i>Echinochloa stagnina</i> , <i>Ludwigia adscendens</i> , <i>Oenanthe javanica</i> , <i>Persicaria barbata</i> , <i>Persicaria hydropiper</i> , <i>Rumex nepalensis</i> , <i>Monochoria hastata</i> , <i>Euryale ferox</i> , <i>Hydrolea zeylanica</i> , <i>Utricularia flexuosa</i> , <i>Lemna perpusilla</i> (11 spp.)	Plants survives adverse season through seeds; produce flowers and seeds in favorable season	Therophytes	39.29 %
<i>Colocasia esculenta</i> , <i>Cyperus rotundus</i> , <i>Marsilea quadrifolia</i> , <i>Nelumbo nucifera</i> , <i>Nymphaea stellata</i> , <i>Nymphaea pubescens</i> , <i>Potamogeton crispus</i> , <i>Sagittaria sagittifolia</i> (8 spp.)	Buds on bulbs and rhizomes remain buried in soil or substratum	Geophytes	28.57 %
<i>Azolla pinnata</i> , <i>Eichhornia crassipes</i> , <i>Pistia stratiotes</i> , <i>Riccia natans</i> , <i>Salvinia natans</i> , (5 spp.)	Plants survive adverse conditions through vegetative parts like stolons; grows fast by vegetative means in favorable season	Errant Vascular Hydrophytes	17.86 %
<i>Enhydra fluctuans</i> , <i>Ipomoea aquatica</i> , <i>Alternanthera philoxeroides</i> , <i>Carex cruciata</i> (4 spp.)	Perennating buds remain protected just under soil surface; may also remain on soil surface but are never exposed and remain concealed under dead plant materials	Hemicryptophytes	14.28 %

Table 3: Comparison of life-form spectrum of the present study sites with Raunkiaer's Normal Biological Spectrum (RNBC)

Life-forms	No. of species	Life-form (%)	RNBC (%)
Therophytes	11	39.29	13
Geophytes	8	28.57	6
Errant Vascular			
Hydrophytes	5	17.86	—
Hemicryptophytes	4	14.28	26
Phanerophytes	—	—	46
Chamaephytes	—	—	9

The life-form spectra in the various study sites are presented in Table 3. It is evident that the highest percentage of the biological spectrum in the community ponds was contributed by the Therophytes (39.29%), which is almost three times the percentage value of Therophytes in the normal spectrum *i.e.* 13%. Geophytes constitute the second highest percentage life-form with 28.57% which is also more than four times than that of the Raunkiaer's normal biological spectrum (6%). Then it was followed by Errant-Vascular Hydrophytes (17.86%) and lowest percentage value of 14.28 was exhibited by Hemicryptophytes.

CONCLUSION

When comparison is made with the Raunkiaer's normal spectrum, the biological spectrum of the present study area may be designated as the 'Thero-geophytic' phytoclimate. Maximum number of plants belonging to life form such as Therophytes, Geophytes, and Errant Vascular Hydrophytes indicate a habitat which is rich in organic matter and nutrients and also reflects a very fertile habitat characteristic of eutrophic water bodies as well as more anthropogenic impact in the system.

LITERATURE CITED

- Bor, N.L. 1982. *Flora of Assam Vol.V*. A Von Book company Delhi.
- Deb, D.B. 1983-1984. *The Flora of Tripura State. Vol.I &II*. Today and Tomorrow print and publisher, New Delhi.
- Ellenberg, H. & Mueller-Dombois, D. 1967. A key to Raunkiaer plant life-forms with revised subdivisions. *Ber. Goebot. Instt. ETH. Stiftg Rubel, Zurich*, 37: 56 – 73.
- Hanson, H.C. & Churchill, E.D. 1961. *The Plant Community*. New York: Reinhold Publishing Corporation.
- Jain, S.K. & Rao, R. R. 1977. *A Handbook of Field and Herbarium Methods*. Today & Tomorrow's Printers and Publishers, New Delhi.
- Kanjilal, U.N.; Kanjilal, P.C.; Das, A. & the Pustayastha, C. 1934. *Flora of Assam*. Vol.I Bishen Singh Mahendra pal Singh, Dehradun.
- Kanjilal, U.N.; Kanjilal, P.C.; Das, A. & Pustayastha, C. 1936. *Flora of Assam*. Vol.II Bishen Singh Mahendra pal Singh, Dehradun.
- Kanjilal, U.N.; Kanjilal, P.C.; Das, A. & De, R.N. 1938. *Flora of Assam*. Vol.III Bishen Singh Mahendra pal Singh, Dehradun.
- Kanjilal, U.N.; Kanjilal, P.C.; Das, A. & De, R.N. 1940. *Flora of Assam*. Vol.IV Bishen Singh Mahendra pal Singh, Dehradun.
- Kershaw, K.A. 1973. *Quantitative and Dynamic Plant Ecology*. Edward Arnold Publishing Ltd.
- Mueller-Dombois, D. & Ellenberg, H. 1974. *Aims and Methods of Vegetation Ecology*. New York: John Wiley and Sons.
- Raunkiaer, C. 1934. *The Life-forms of Plants and Statistical Plant Geography*. Oxford: Clarendon press, pp. 632.