ATLANTIS PRESS

Advances in Engineering Research, volume 178

Mizoram Science Congress 2018 (MSC 2018)

Life-form characteristics and biological spectrum of the aquatic macrophytes in Ṭam Dil, a natural lake in Mizoram

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Ṭam Dil is a natural lake but reconstructed as fish pond at Saitual, Mizoram. The area around the lake enjoys a moderate climate owing to its tropical location. It receives an adequate amount of rainfall. It is also fed by small streams from surrounding catchment area. During the present investigation, sixteen aquatic macrophytic species were found in the lake. The plants were categorized into submerged, rooted with floating leaves, free-floating, and emergent groups. Life-form of the macrophytic vegetation were determined based on the height, form, habit and nature of the position and degree of protection of the perennating buds together with occurrence of each species in the field. Life-forms were classified as chamaephytes, hemicryptophytes, geophytes, therophytes and errant vascular hydrophytes. Therophytes had the greatest number of species, such as *Alternanthera philoxeroides, Alternanthera sessiles, Brachiaria mutica, Echinochloa stagnina, Kyllinga tenuifolia, Leersia hexandra* **and** *Polygonum glabrum.* **Errant vascular hydrophytes had three species such as** *Ceratophyllum demersum, Eichhornia crassipes* **and** *Marsilea quadrifoliata.* **Also, three species of hemicryptophytes, namely** *Commelina bengalensis, Enhydra fluctuans* **and** *Hygroryza aristata* **were identified. Geophytes was represented by** *Nymphaea pygmaea helvola* **and** *Zizania latifolia***. Only one species** *Phragmites karka* **belong to chamaephytes. Thus, therophytes dominated over the other life-forms classes. Therefore, the lake may be designated as therophytes type of phytoclimate.**

Keywords: Life-form, biological spectrum, macrophytes, Ṭam Dil, Mizoram.

INTRODUCTION

Life-form classification offers key evidences on the response of a community to particular environmental factors on the utilization of space and the probable comparative relations within the community (Mueller-Dombois and Ellenberg, 1974). A comprehensive life-form spectrum of the different regions of India was compiled by Meher-Homji (1981). There are ten (10) identified phytoclimates types in India based on Raunkiær's life-form classes (Puri *et al.*, 1990). Life-forms are mainly classified into five (5) major types *viz.* chamaephytes, hemicryptophytes, geophytes, therophytes and phanerophytes based on the position and the degree of protection of the perennating buds during adverse seasons (Raunkiær, 1934).

Raunkiær's classification was modified by Ellenberg and Mueller-Dombois (1967) and Mueller-Dombois and Ellenberg (1974). In the modified classification, various additional features like the structure and seasonality of the crown foliage and shoot system have also been highlighted besides the structure and nature of perennating bodies. The benefit of this revised classification is the inclusion of other life-forms like mosses, lichens, algae and other thallophytic forms along with parasites and heterophytic plants in the analysis. Life-form classes also signify the adaptational feature of the plants to the changes in the climate (Raunkiær, 1934). The percentage of the life-forms in an area gives a worthy indication of its climatic condition (Kershaw, 1973). Therefore, the

present study has been undertaken to assess the life-form characteristics and biological spectrum of the aquatic macrophytes in Ṭam Dil, Mizoram.

Materials and Methods

The present study was carried out in Ṭam Dil, a lake located at Saitual in Aizawl district, Mizoram. For detailed study and investigation, the lake was divided into four sampling sites (Figure 1). Collections of macrophytic plants species were carried out on monthly regular intervals from the four study sites during the period July 2016 to June 2018.

The assessment of life-form of the macrophytic vegetation was done based on the height, form, habit and nature of the position and degree of protection of the perennating buds together with occurrence of each species. The vegetation of the various plant species was classified after Raunkiær's life-forms classification as modified by Ellenberg and Mueller-Dombois (1967) and Mueller-Dombois and Ellenberg (1974). Comparisons between the biological spectrum of the study area and the normal spectrum of the world (Raunkiær, 1934) as well as with the spectra available for other localities were done.

Results

The life-form classification of the aquatic macrophytes of Ṭam Dil is furnished in Table 1. The present study reveals the occurrence of 16 (sixteen) aquatic macrophytic plant species in the lake under investigation. The aquatic plants were classified into the following category namely (a) submerged (b) rooted with floating leaves (c) free-floating (d) emergent groups. The different macrophytic species have been categorized into five major life-forms *viz.* chamaephytes, hemicryptophytes, geophytes, therophytes and errant vascular hydrophytes. The percentage composition of life-form classification in Ṭam Dil is presented in Figure 2. It is evident that maximum of seven (7) species were recorded under therophytes category. The species included are *Alternanthera philoxeroides*, *Alternanthera sessiles*, *Brachiaria mutica*, *Echinochloa stagnina*, *Kyllinga tenuifolia*, *Leersia hexandra* and *Polygonum glabrum.* Under the errant vascular hydrophytes following three (3) species *viz. Ceratophyllum demersum*, *Eichhornia crassipes* and *Marsilea quadrifoliata* were reported; following three (3) species *viz. Commelina bengalensis*, *Enhydra fluctuans* and *Hygroryza aristata* are included in Hemicryptophytes. It has been found *that under* geophytes, two (2) species *viz. Nymphaea pygmaea helvola* and *Zizania latifolia* were recorded whereas only one species (*Phragmites karka)* was reported under chamaephytes. It is evident from the result that therophytes dominated over the other life-forms classes in the present lake.

Discussion

Life-forms and biological spectrum introduced by Raunkiær (1934) analysed the various biological spectra in the different regions of the world and prepared a normal biological spectrum for the phanerogamic flora of the whole world. The biological spectrum is the ratio of life-forms of the different species in terms of percentage in any floristic community. The species that have the capacity to grow in adverse climatic conditions of the regions are taken in account and the possible phytoclimate of the region reflects the dominant life-forms which comprise the largest number of plants that occur

Table 1: Life-form classification of the aquatic macrophytes of Ṭam Dil, Mizoram.

Life-form group	Name of species	Number of species	Percentage composition (%)
Chamaephytes (CH)	*Phragmites karka*	1	6.25
Hemicryptophytes (H)	*Commelina bengalensis* *Enhydra fluctuans* *Hygroryza aristata*	3	18.75
Geophytes (G)	*Nymphaea pygmaea helvola* *Zizania latifolia*	2	12.5
Therophytes (TH)	*Alternanthera philoxeroides* *Alternanthera sessiles* *Brachiaria mutica* *Echinochloa stagnina* *Kyllinga tenuifolia* *Leersia hexandra* *Polygonum glabrum*	7	43.75
Errant vascular hydrophytes (EVH)	*Ceratophyllum demersum* *Eichhornia crassipes* *Marsilea quadrifoliata*	3	18.75

Table 2: Biological spectrum of the aquatic macrophytes of Ṭam Dil, Mizoram.

Parameters	Life-form category						Total
	CH	H	G	TH	PH	EVH	
Total number of species	1	3	2	7	-	3	16
Life-form percentage (%)	6.25	18.75	12.5	43.75	-	18.75	100
Raunkiaer's Normal Spectrum and composition (%)	9.00	26.00	6.00	13.00	46.00	-	100

Figure 1: Study site - map of Ṭam Dil, Mizoram.

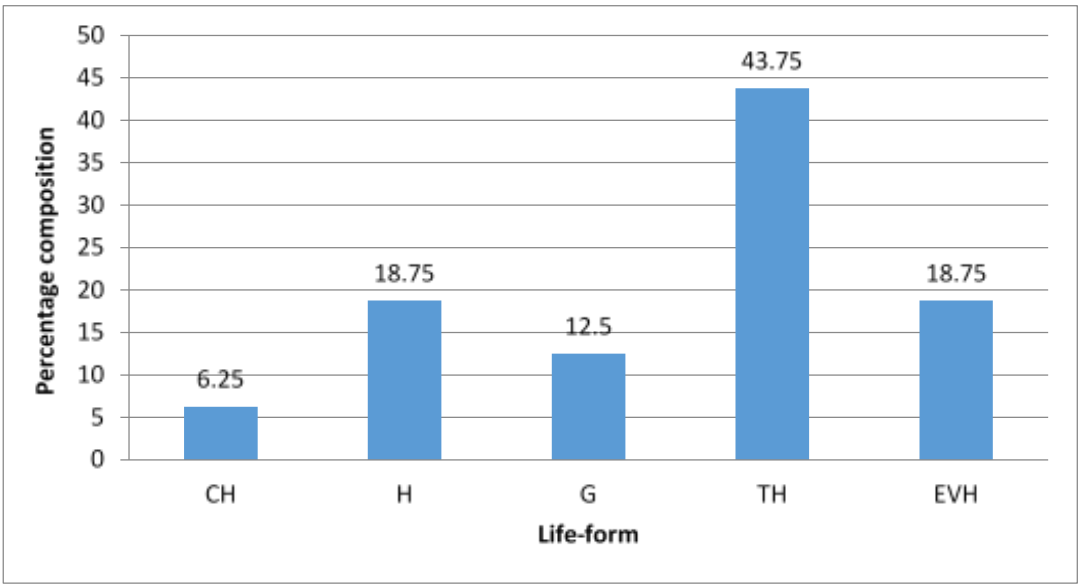

Figure 2: Percentage composition of life-forms in Ṭam Dil. (**CH** = chamaephytes; **H** = hemicrypto-phytes; **G** = geophytes; **TH** = therophytes; **EVH** = errant vascular hydrophytes)

in a particular community. The biological spectrum of Ṭam Dil is presented in Table 2. It's obvious from the outcomes that highest number of aquatic macrophytes was recorded under the therophytes category. Similar findings were also recorded from Kharungpat Lake (Singh, 2010), Laisoipat Lake (Devi and Sharma, 2008), Poiroupat Lake (Usha and Sharma, 2008), Loktak Lake (Devi and Sharma, 2002). The present findings are in consonance with the studies carried out in Awangsoipat Lake (2007), Sanapat Lake (Devi, 2001), and Utrapat Lake (Devi, 1998). Lowest number of aquatic macrophytes reported under chamaephytes in the present study are comparable to the one reported from Oksoipat Lake (Devi, 2008), Laisoipat Lake (Devi and Sharma, 2008) and Ikoppat Lake (Devi, 2002).

CONCLUSION

The different life-forms category of Ṭam Dil in terms of their percentage compositions clearly indicates therophytes contributing the highest percentage composition with 43.75%. This is followed successively by hemicryptophytes and errant vascular hydrophytes with 18.75% each and geophytes with 12.50%. The lowest percentage composition was observed in chamaephytes (6.25%). Since therophytes dominated over the other life-forms classes, the present lake may be designated as therophytes type of phytoclimate.

ACKNOWLEDGEMENT

The first author is thankful to University Grants Commission for providing the financial assistance to carry out the research work in the form of UGC Major Research Project.

REFERENCES

Devi, Ch.B. (2001). *Variation in Species Distribution and Primary Production of the Macrophytes in Sanapat Lake, Manipur*. Ph.D. Thesis, Manipur University, Manipur.

Devi, Ch. N. (2002). *Vegetational Structure and Primary Production of the Macrophytes of Ikop Lake, Manipur.* Ph.D. Thesis, Manipur University, Manipur.

Devi, K. I. (1998). *Ecological Studies of Freshwater Macrophytes in Utrapat lake, Manipur*. Ph.D. Thesis, Manipur University, Manipur.

Devi, L. G. (2007). *Studies on the Vegetational Dynamics and Primary Productivity of Awangsoipat Lake, Bishnupur (Manipur).* Ph.D. Thesis, Manipur University, Manipur.

Devi, L. K., Sharma, B.M. (2008). Floristic distribution and growth form analysis of macrophytes of Laisoipat lake, Manipur. *Frontier Botanist*, Special Volume, 10–19.

Devi, N. B., Sharma, B.M. (2002). Life-form analysis of the macrophytes of the Loktak Lake, Manipur, India. *Indian J. Environ & Ecoplan*. 6: 451–458.

Devi, S. U. (2008). *Ecological Analysis of the Macrophytes in Oksoipat lake (Bishnupur) Manipur*. Ph.D. Thesis, Manipur University, Manipur.

Ellenberg, H., Mueller-Dombois, D. (1967). A key to Raunkiaer plant life forms with revised sub-divisions. *Ber. Geobot Inst. ETH. Stiftg. Rubel. Zurich* 37: 56–73.

Kershaw, K.A. (1973). *Quantitative and Dynamic Plant Ecology*. Edward Arnold Publishers. Ltd.

Meher-Homji, V.M. (1981). Environmental Implications of life-form spectra from India. *J. Ecol. Taxon. Bot*. 2: 23–30.

Mueller-Dombois, D., Ellenberg, H. (1974). *Aims and Methods of Vegetation Ecology*. John Wiley and Sons. Inc., New York.

Puri, G.S., Meher-Homji, V.M., Gupta, R.K., Puri, S. (1990). *Forest Ecology Vol-I: Phytogeography and Forest Conservation*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

Raunkiaer, C. (1934). *The Life Forms of Plants and Statistical Plant Geography*. Oxford. Clarendon Press.

Singh, K. K. (2010). *Synecological Studies of Macrophytes in Kharungpat Lake, Thoubal District, Manipur*. Ph.D. Thesis, Manipur University, Manipur.

Usha, Kh., Sharma, B.M. (2008). Life form analysis of macrophytes of Poiroupat Lake, Manipur, India. In: *Proceedings of XI Manipur Science Congress*, March 28-30 2008, pp. 43–47.