

Studies on the life form and biological spectrum of Konthoujam Sacred Grove in Manipur, India

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Abstract

The present paper deals with the study of Life Form and Biological Spectrum of the Konthoujam Sacred Grove (24.764° N latitude and 93.858°E longitude), about 11 km west of the valley area of Imphal city. A total number of 50 species belonging to various plant groups were recorded during the present investigation. Altogether 5 types of life forms were recorded viz, Therophytes (5 species / 10.0 %), Cryptophytes (3 species/ 6.00 %), Hemicryptophytes (2 species/ 4.0 %), Phanerophytes (34 species/ 68.0 %) and Chamaephytes (6 species/ 12.0 %).

Key words: Life forms, Biological spectrum, Sacred Grove.

INTRODUCTION

Traditionally in India nature worship is common. All forms of life have been considered as sacred in Hindu scriptures. According to Gadgil & Vartak (1981), a sacred grove is a patch of vegetation ranging in extent from a few trees to forty hectares or more which is left undisturbed because of its association with some deity. In its original form this protection forbade any interference with the biota of the grove, whatever from it, or was grazing or any hunting permitted within the grove. Even when the protection has become less stringent, any removal of live wood continues to be a taboo. These groves therefore represent a sample of the vegetation in the climax state.

The concept of Life-Form in the study of vegetation was proposed for the first time by Humboldt (1806) who suggested the grouping of vegetation type on the physiognomic basis. Grisebach (1838) and Drude (1890) have emphasized the dependence of lifeforms on climate and assessed the role of species in vegetation with special reference to duration of protection to the perennating organs and mode of propagation. This has been established by Raunkiaer, (1934), a Danish ecologist. The life form system of categorising plants is based primarily on the methods, by which plants survive the unfavourable season. The proportions of the flora in the various categories (which Raunkiaer called the biological spectrum) vary from one climate to another. The life form system is an early and still useful attempt to relate plant morphology and life history to climate. The biological spectrum not only represents the climatic conditions but is also the most potent environmental factor representing the ecosystem, as it was demonstrated by Pandeya (1954) and Tiwari (1955). The essence of Raunkiaer's biological spectrum is also examined by Fekete & Laeze (1971) with emphasis on how it becomes a tool in phytogeography and plant ecology

Each forest has a distinct structure and composition which varies in accordance with the change in environmental conditions. The forest patches in the Sacred Groves constitute a prominent feature in the cultural landscape of Manipur. However, lack of investigation on the life form composition prompted us to undertake a study on the floristic composition and biological spectrum of Sacred Groves in Manipur.

STUDY AREA

The study was carried out in Manipur [latitude 23°50' N to 25°42' N and longitude 92°58' E to 94°45' E], a state located in the North-Eastern corner of India. The state enjoys sub-tropical climate, with temperature ranging from 4° C to 31° C. Rainfall varies from 1000 mm to 3500 mm with average rainfall of 2000 mm. Intensive survey was carried out for plant collections and observations in Konthoujam Lairembi Sacred Grove (24.764°N Latitude and 93.858° E Longitude), situated in the Konthoujam village, about 11 km West of the Valley and occupying an area of ca.141 ha. Figure 1 shows the location of Kothoujam Sacred Grove in Manipur, North East India.

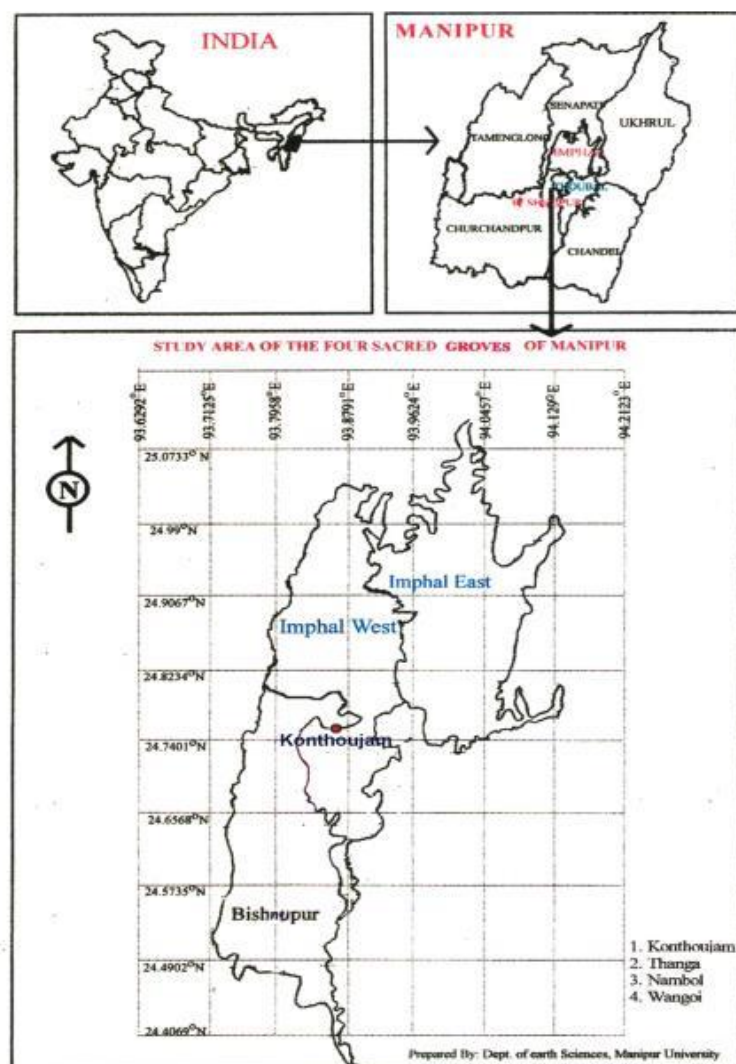


Figure 1: Map showing the location of Konthoujam Sacred Grove

MATERIALS AND METHODS

The present study is a part of phytosociological investigation carried out in the sacred grove which was done by laying down quadrats of size 10 x 10 m² for trees, 5 x 5 m² for shrubs and 1 x 1 m² for herbs and grasses. Ten quadrats were placed in the site randomly for each category. Further, specimens were processed into mounted herbarium sheets following Jain & Rao (1977). Authentic identification of the collected plant species was done with the help of local and regional floras (Bor 1940; Chauhan *et al.* 2000; Deb 1983, 1984; Hooker 1873 – 1897; Kanjilal *et al.* 1934 – 1940), the identity of different species were confirmed by matching to pre-identified specimens at Manipur University. The voucher specimens were deposited in the Herbarium of the Department of Life Sciences, Manipur University.

The collected plants were further divided and placed in various Life Form Classes as per Raunkiaer's (1934) system, using the position and degree of protection to perennating organ during the adverse season like that the seasonal plants, completing their life cycle in a single season and remaining dormant throughout the rest of the unfavorable period of year in the form of seeds (Therophytes); buds of plants invariably buried in the soil or substratum such as the bulbs and rhizomes (Cryptophytes); perennial plants with buds in or just below the soil surface, which may also be present at the soil surface but never exposed and remain concealed under the dead leaves and twigs (Hemicryptophytes); perennating buds above 25 cm the ground (Phanerophytes), plants with renewing buds close to the ground (Chamaephytes). In all the species, to designate biological life form, habit, height and position of the perennating buds was considered. Numerical distribution of species in each life form was calculated. Biological spectrum was worked out and for categorization of species in various life forms, the following formula was used.

$$\text{Percentage in a life form} = \frac{\text{No. of species in lifeform}}{\text{Total no. of species of all life forms}} \times 100$$

RESULT AND DISCUSSION

A total of 50 species in 30 families were recorded from the Konthoujam Sacred Grove. Among all the species, *Ficus benjamina* (tree), *Lantana camara* (shrub), and *Sida cordifolia* (herb) dominated the study site. Plate I shows laishang (temple) of Konthoujam Sacred Grove and *Ficus benjamina* tree growing in its premises. Families with presence of more than one species were Moraceae, Meliaceae, Malvaceae, Mimosoideae of Leguminosae, Myrtaceae, Asteraceae, Amaranthaceae, Boraginaceae, Lamiaceae, Lauraceae, Poaceae and Verbenaceae. Among the life-forms recognized, trees and shrubs contributed to Phanerophytes and herbs comprised of five major life-forms viz., Phanerophytes (Ph), Therophytes (Th), Cryptophytes (Cr), Hemicryptophytes (H) and Chamaephytes (Ch). The highest percentage of the Life Form in the study site was contributed by the Phanerophytes (68 %), which is followed by Chamaephytes (12 %), Therophytes (10 %), Cryptophytes (6 %), and Hemicryptophytes (4 %). Table 1 reveals the plant species recorded in Konthoujam Sacred Grove, their habit and Life Forms whereas Table 2 gives percentage representation of life-forms in the Biological spectrum recorded in Konthoujam Sacred Grove and a comparison with Raunkiaer's Normal biological spectrum. The biological spectrum of the present study reveals that Phanerophytes comprised the dominant life-form class.

The biological spectra of different regions of India have been worked out by different researches like Reddy *et al.* (2002), Pattanaik *et al.* (2007), Reddy *et al.* (2011). Analysis of the present study reveals the phytoclimate as Phanero-Chamaephytic

Table 1: Plant species recorded and their Life Forms in Konthoujam Sacred Grove

Name of Species [Family]; Exsicattae	Life-form	Habit
<i>Mangifera indica</i> Linnaeus [Anacardiaceae]; US-103	Ph	Tree
<i>Tupidanthus calyptratus</i> Hooker f. & Thomson [Araliaceae]; US-105	Ph	Tree
<i>Oroxylum indicum</i> (Linnaeus) Bentham ex Kurz [Bignoniaceae]; US-111	Ph	Tree
<i>Bixa orellana</i> Linnaeus [Bixaceae]; US-109	Ph	Tree
<i>Mallotus philippensis</i> (Lamarck) Müller-Argoviensis [Euphorbiaceae]; US-121	Ph	Tree
<i>Cordia grandis</i> Roxburgh [Boraginaceae]; US-112	Ph	Tree
<i>Quercus griffithii</i> Hooker f. & Thomson ex Miquel [Fagaceae]; US-106	Ph	Tree
<i>Litsea citrata</i> Blume [Lauraceae]; US-130	Ph	Tree
<i>Litsea polyantha</i> Jussieu [Lauraceae]; US-101	Ph	Tree
<i>Bombax insigne</i> Wallich [Malvaceae]; US-132	Ph	Tree
<i>Albizia chinensis</i> (Osbeck) Merrill [Leguminosae: Mimosoideae]; US-115	Ph	Tree
<i>Albizia</i> sp. [Mimosoideae]; US-107	Ph	Tree
<i>Amoora rohituka</i> (Roxburgh) Wight & Arnott [Meliaceae]; US-140	Ph	Tree
<i>Melia azedarach</i> Linnaeus [Meliaceae]; US-123	Ph	Tree
<i>Toona ciliata</i> M. Roemer [Meliaceae]; US-133	Ph	Tree
<i>Syzygium cymosum</i> (Lamarck) Augustin Pyramus de Candolle [Myrtaceae]; US-147	Ph	Tree
<i>Syzygium cumini</i> (Linnaeus) Homer Collar Skeels [Myrtaceae]; US-100	Ph	Tree
<i>Artocarpus lacucha</i> Buchanan-Hamilton [Moraceae]; US-104	Ph	Tree
<i>Ficus benjamina</i> Linnaeus [Moraceae]; US-124	Ph	Tree
<i>Ficus glomerata</i> Roxburgh [Moraceae]; US-102	Ph	Tree
<i>Ficus hispida</i> Linnaeus [Moraceae]; US-135	Ph	Tree
<i>Grevillea robusta</i> A. Cunningham ex R. Brown [Proteaceae]; US-125	Ph	Tree
<i>Meyna laxiflora</i> Robyns [Rubiaceae]; US-108	Ph	Tree
<i>Celtis australis</i> Linnaeus [Cannabaceae]; US-110	Ph	Tree
<i>Gmelina arborea</i> Roxburgh [Lamiaceae]; US-137	Ph	Tree
<i>Justicia adhatoda</i> Linnaeus [Acanthaceae]; US-122	Ph	Shrub
<i>Plumeria rubra</i> Linnaeus [Apocynaceae]; US-126	Ph	Shrub
<i>Hibiscus rosa-sinensis</i> Linnaeus [Malvaceae]; US-146	Ph	Shrub
<i>Solanum americanum</i> Miller [Solanaceae]; US-131	Ph	Shrub
<i>Lantana camara</i> Linnaeus [Verbenaceae]; US-145	Ph	Shrub

Name of Species [Family]; Exsicattae	Life-form	Habit
<i>Vitex negundo</i> Linnaeus [Lamiaceae]; US-128	Ph	Shrub
<i>Achyranthes aspera</i> Linnaeus [Amaranthaceae]; US-119	Cr	Herb
<i>Elephantopus scaber</i> Linnaeus [Asteraceae]; US-141	Th	Herb
<i>Crassocephalum crepidioides</i> (Bentham) S. Moore [Asteraceae]; US-127	Th	Herb
<i>Tagetes erecta</i> Linnaeus [Asteraceae]; US-118	Th	Herb
<i>Gynura cusimbua</i> (D. Don) S. Moore [Asteraceae]; US-136	Th	Herb
<i>Cynoglossum zeylanicum</i> (Vahl) W. Brand [Boraginaceae]; US-138	Th	Herb
<i>Argyrea</i> sp. [Convolvulaceae]; US-139	Ph	Herb
<i>Cyperus rotundus</i> Linnaeus [Cyperaceae]; US-148	Cr	Herb
<i>Dioscorea</i> sp. [Dioscoreaceae]; US-120	Cr	Herb
<i>Sida cordifolia</i> Linnaeus [Malvaceae]; US-134	Ph	Herb
<i>Mimosa pudica</i> Linnaeus [Leguminosae: Mimosoideae]; US-114	Ch	Herb
<i>Avena sativa</i> Linnaeus [Poaceae]; US-143	Ph	Herb
<i>Dactyloctenium aegypticum</i> (Linnaeus) Willdenow [Poaceae]; US-150	Ch	Herb
<i>Echinochloa crus-galli</i> (Linnaeus) P. Beauvois [Poaceae]; US-149	Ch	Herb
<i>Eragrostis pilosa</i> (Linnaeus) P. Beauvois [Poaceae]; US-117	Ch	Herb
<i>Adiantum lunulatum</i> Burman f. [Pteridaceae]; US-144	H	Herb
<i>Cyathea spinulosa</i> Wallich ex W. Hooker [Cyatheaceae]; US-116	H	Herb
<i>Portulaca oleracea</i> Linnaeus [Portulacaceae]; US-142	Ch	Herb
<i>Stachytarpheta indica</i> (Linnaeus) Vahl [Verbenaceae]; US-113	Ch	Herb

Table 2: Percent representation of life-forms in the Biological Spectrum recorded in Konthoujam Sacred Grove

Life-form classes	No. of species	Life-form %	Raunkiaer Normal Biological Spectrum (%)
Therophytes	5	10	13.0
Cryptophytes	3	6	6.0
Hemicryptophytes	2	4	26.0
Phanerophytes	34	68	46.0
Chamaephytes	6	12	9.0



type. Performance of Chamaephytes affects other associated species through their competitive ability. The Therophytes are represented as third dominant life-form class in the study site indicating anthropogenic stress operating in the system. Jamir *et al.* (2006) found that in the montane humid forests of Meghalaya receive annual rainfall of 12,00 mm and represents 51 % of Phanerophytes. So rainfall appears to be the most important operative factors in the evolution of biological spectrum. Present study revealed the presence of Phanerophytic climate predominantly. Prasad *et al.* (1998) found Thero-Phanerophytic spectrum for disturbed wooded areas like forests in Kerala. According to Cain (1950) Therophyte developed especially in areas where native vegetation has been disturbed. According to Meher - Homji (1964), the life-form reflects the bioclimate of the area. Thus, in humid regions, the bioclimate should be Phanerophytic, in arid regions and intensively cultivated areas as Therophytic and in temperate, high altitudinal zones, arctic regions as Chamaephytic.

PLATE - I: Konthoujam Sacred Grove: A. Laishang (temple); **B.** a *Ficus benjamina* tree with arial roots and buttresses

CONCLUSION

The biological spectrum of the present study reveals the phytoclimate to be of “Phenero-Chamaephytic” type in the sacred grove of Manipur. Presence of such phytoclimate indicated the significant role of the upper canopy in regulating the microclimate, controlling the regeneration, establishment of herbaceous plants, maintenances of diversity and functioning of the ecosystem are influenced by the Phenerophytic phytoclimate, which is of vital importance influencing ecosystem processes. Our study on the biological spectrum presented a higher proportion than expected of the life-form classes with perennating buds above the ground (Phanerophytes) in the unfavourable season and renewing buds close to the ground (Chamaephytes) and also a lower proportion than expected of the life-forms with renewing buds in or just below the soil surface (Hemicryptophytes) or in the form of seeds (Therophytes). Prevalence of “Phenero-Chamaephytic” type of phytoclimate indicates grove’s fairly undisturbed status and protection of germplasm in the grove through traditional belief system and institution.

LITERATURE CITED

- Bor, N.L. 1940. *Flora of Assam*. Vol. V. Assam Govt. Press, Shillong..
- Cain, S.A. 1950. Life-forms and phytoclimate. *Bot. Rev.* 16: 1 – 32.
- Chauhan, A.S.; Wadhwa, B.M.; Singh, D.K.; Singh, K.P.; Chakraborty, P.; Sanpru, R. & Dam, D.P. 2000. *Flora of Manipur*. Vol. I. Botanical Survey of India, Howrah.
- Deb, D.B. 1983, 1984. *The Flora of Tripura State*. Vols. I &II, Today & Tomorrow’s Printers & Publishers, New Delhi.
- Drude, D. 1980. *Handbuch der Pflanzengeographie*. J. Engelhorn, Stuttgart. Pp. 528.
- Fekete, G. & Laeze, J.S. 1971. A survey of the life form systems and the respective research characterization of phytoclimatic and vegetation analysis. *Ann. Hist. Nat. Mus. Nath. Hung* 63: 37 – 50.
- Gadgil, M. & Vartak, V.D. 1981. Sacred Groves of Maharashtra, An inventory in S.K. Jain (ed.), *Glimpses of Ethnobotany*. Oxford University Press, Bombay.
- Grisebach, A. 1838 Uber den Einfluss des Klimas auf die Begrenzung der naturlichen Floren. *Linnea* 12: 159 - 200.
- Hooker, J.D. 1873 – 1897. *The Flora of British India*. Vols. I – VII. L. Reevs & Co., London.
- Humbolt, A.V. 1806. De distributiane geographica plantarum secundum coeli temperiem et altitudinem montium prolegomena. In: *Aime Bonpland*, Paris. Pp. 28.
- Jain, S.K. & Rao, R.R. 1977. *A Handbook of Field and Herbarium Methods*. Today & Tomorrow’s Printers and Publishers, New Delhi.
- Jamir, S.A.; Upadhyaya, K. & Pandey, H.N., 2006. Life form composition and stratification of montane humid forests in Meghalaya, Northeast India. *Trop. Ecol.* 47(2): 183 – 190.
- Kanjilal, U.N.; Kanjilal, P.C; Das, A. & Purkayatha, C. 1934. *Flora of Assam*. Vol. I. Govt. of Assam, Shillong. [Reprint: Bishen Singh Mahendra Pal Singh, Dehradun].
- Kanjilal, U.N.; Kanjilal, P.C; Das, A & Purkayatha, C. 1936. *Flora of Assam*. Vol. II. Govt. of Assam, Shillong. [Reprint: Bishen Singh Mahendra Pal Singh, Dehradun]..
- Kanjilal, U.N.; Kanjilal, P.C.; Das, A. & De, R.N. 1938. *Flora of Assam*. Vol. III. Govt. of Assam Press, Shillong. [Reprint: Bishen Singh Mahendra Pal Singh, Dehradun]..

- Kanjilal, U.N.; Kanjilal, P.C.; Das, A. & De, R.N. 1940. *Flora of Assam*. Vol. IV. Govt. of Assam, Shillong. [Reprint: Bishen Singh Mahendra Pal Singh, Dehradun].
- Pandeya, S.C. 1954. *Ecological studies of grassland of Saugar*. Ph.D. Thesis, University of Saugar.
- Meher-Homji, V.M. 1964. Life-forms and biological spectra as epharmonic criteria of aridity and humidity in tropics. *J. Indian Bot. Soc.* 43: 424 – 430.
- Pattanaik, C.; Reddy, C.S. & Biswal, A.K. 2007. Life Forms and Biological spectrum of Bhitarkanika National Park, Orissa, India. *Indian J. For.* 30(3): 307 – 313.
- Prasad, R.; M. Krishnan, P.N. & Pushpangadan, P. 1998. The life-form spectrum of sacred groves – a functional tool to analyse the vegetation. *Trop. Ecol.* 39(2): 211 – 217.
- Rana, T.S.; Datt, B. & Rao, R.R. 2002. Life forms and Biological spectrum of the Flora of Tons Valley, Garhwal Himalaya (Uttaranchal), India, *Taiwania*. 47(2): 164 – 169.
- Raunkiaer, C. 1934. *The Life form of plants and statistical plant geography*. Clarendon press, Oxford.
- Reddy, K.N.; Jadhav, S.N.; Reddy, C.S. & Raju, V.S. 2002. Life forms and Biological spectrum of Marriguda Reserve Forest Khamman district, Andhra Pradesh, *Indian For.* 128(7): 751 – 756.
- Reddy, S.; Krishna, C.H.; Meena, P.; Bhardwaj, R. & Sharma, K.C. 2001. Composition of life forms and Biological spectrum along climate gradient in Rajasthan, India. *Intrn. J. Env. Sci.* 1(7): 1632 – 1639.