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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.

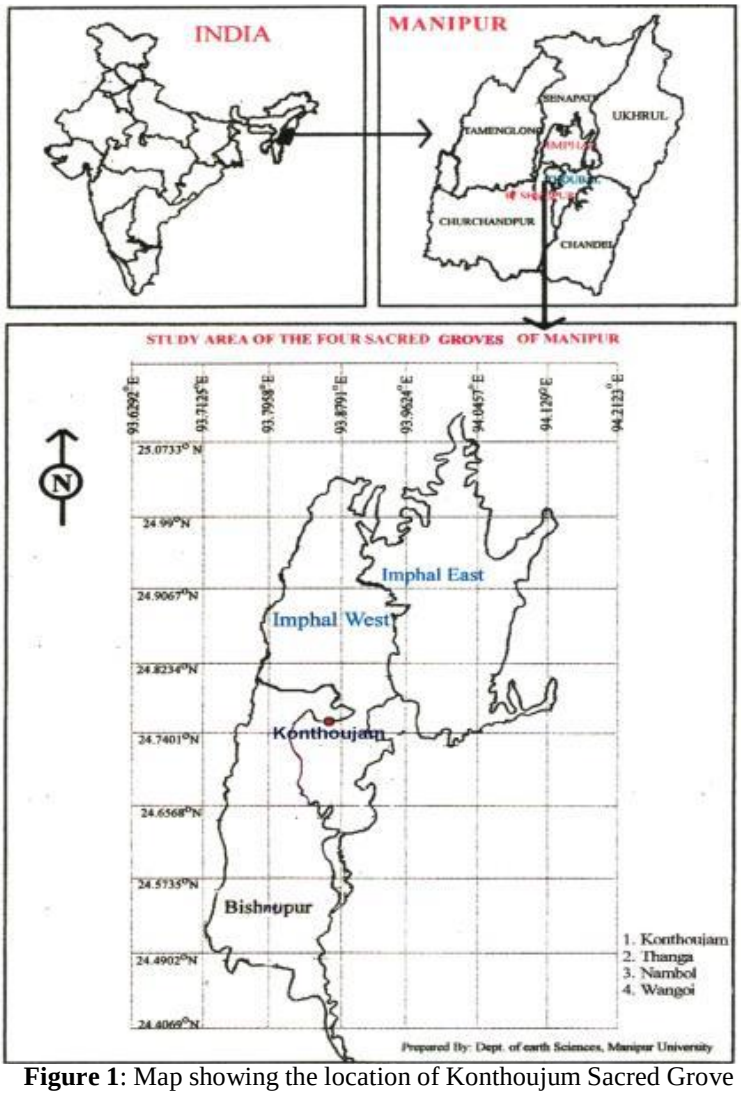

Figure 1: Map showing the location of Konthoujum Sacred Grove

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 m^2 for trees, 5 x 5 m^2 for shrubs and 1 x 1 m^2 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.

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

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

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

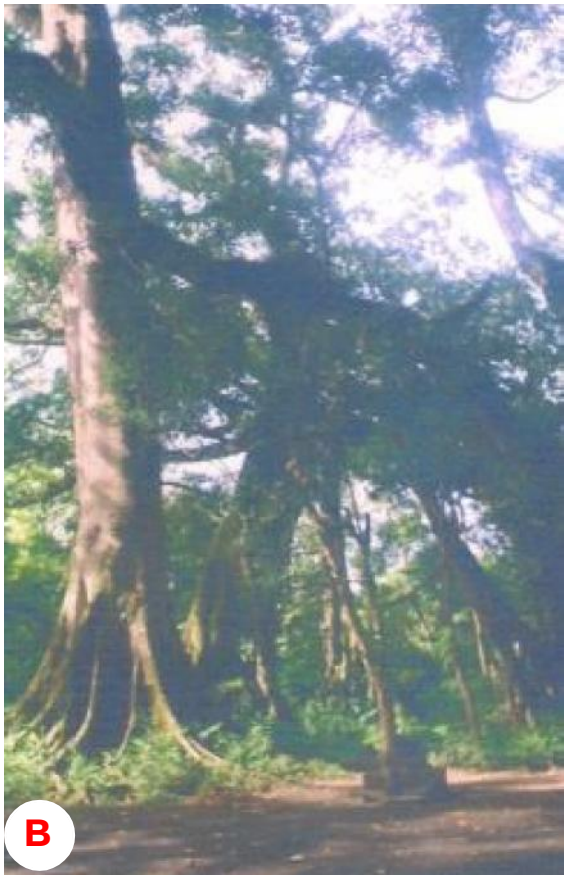

PLATE - I: Konthoujam Sacred Grove: A. Laishang (temple); **B.** a *Ficus benjamina* tree with arial roots and buttresses

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, artic regions as Chamaephytic.

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.

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