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Ecological observations on the Bryophytes of Eravikulam National Park, South India

[1]Manju C.N., K.P. Rajesh[2] and P.V. Madhusoodanan[3]

[1&3]Botany Department, Calicut University, Malappuram-673 635, Kerala, India
Emails : mossomoss@rediffmail.com; kprajesh.botany@gmail.com; pvmadhu@gmail.com
[2]Botanical Survey of India, Andaman & Nicobar Circle, Haddo, Port Blair-744102, Andaman, India

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The ecological features of the bryophytes of Eravikulam National Park are examined. A total of 126 bryophytes including liverworts, honworts and mosses are present in the community. Out of the 126 species, about 39% are epiphytes, 27% are terrestrial, 12% are saxicolous; about 10% occur both as terrestrial and saxicolous; 6% are epiphytic and saxicolous and 1% is epiphytic and terrestrial and 6% in all forms. Several new records of species of Kerala are mentioned. A narrow endemic species of Nilgiri mountains, *Thysananthus rotundistipulus,* also could be collected during the present study.

Key-words—Bryophytes, Eravikulam National Park, Ecology, South India.

INTRODUCTION

THE bryophytes are one of the least studied groups of plants in South India, probably owing to their not so significant economic value and occurrence in inacessible, hostile habitats. However, they are ecologically highly significant element of diverse ecosystems. They play a key role in terrestrial ecosystems, such as habitat modification, nutrient cycling, maintenance of nutrient status of the soil, primary production, etc. They provide suitable micro environmental conditions for seed and spore germination and subsequent seedling and sporeling growth. Some of them also provide refuge to certain hibernating invertebrates and serve as food for several insects. They have been utilized in pollution detection, environmental monitoring and as climatic indicators. This group forms an important element in the biodiversity, especially of tropical ecosystem. Recent experimental studies show that they have antimicrobial and antifungal properties.

Our recent taxonomical studies from Eravikulam National Park yielded many new distributional records such as *Chaetomitriopsis glaucocarpa* to South India, *Pogonatum microstomum, Ditrichum difficile, Hedwigidium integrifolum, Diaphanodon procumbens, D. blandus,* etc. to Kerala (Nair & Madhusoodanan, 2001; Madhusoodanan & Nair, 2004). The paper presents the observations related with the microhabitat and distribution pattern of bryophytes of Eravikulam National Park, one of the most notable protected areas and proposed world heritage center owing to its unique assemblage of biodiversity. This study is the first of its kind in South India on the byrophytes.

STUDY AREA

The Eravikulam National Park (ENP) of 97 km^2, situated in the high ranges of Idukki District is one of the major protected areas of Kerala (Fig. 1). The area is popular for the presence of the endangered *Nilgiri Tahr* (*Nilgiritragus hylocrius*) and Anamudi, the highest peak in south of the Himalayas. ENP is with undulating hills and deep valleys, ranging from 950 m to 2695 m. The temperature varies from 6°C (rarely subzero) during the coolest months to 29°C during the summer months and rainfall exceeds over 30 cm. The vegetation of the area is mostly composed of montane wet temperate forests (shola) and grasslands which provide a congenial climate and microhabitat for the luxuriant growth of bryophytes. The ENP has perhaps the largest, relatively undisturbed high elevation grassland and shola (the Southern Wet Temperate) forest ecosystems in the entire Western Ghats (Nair, 1994). The sholas, vary from 1-50 hectares are scattered in the Park.

MATERIALS AND METHODS

Extensive field surveys were conducted for the inventory during 2000-2001 in three consecutive seasons, viz., summer, winter and rainy seasons. Random sampling technique was used for collecting the samples from the different microhabitats of ENP. The status of each species is recorded based on the distribution in ENP. The samples collected were processed and herbarium prepared were deposited in the Calicut University Herbarium (CALI).

Results

A total of 126 species could be collected from the ENP, including 82 species of mosses and 41 species of liverworts and three hornworts belonging to 45 families. Among mosses the family Bryaceae is the largest with 13 species followed by Polytrichaceae (8 spp.) and among liverworts Plagiochilaceae (11 spp.) is followed by Lejeuneaceae (6 spp.). *Aerobryopsis eravikulamensis* Nair *et al., (ined.)* is a new species found during this study. Some species are new distributional records

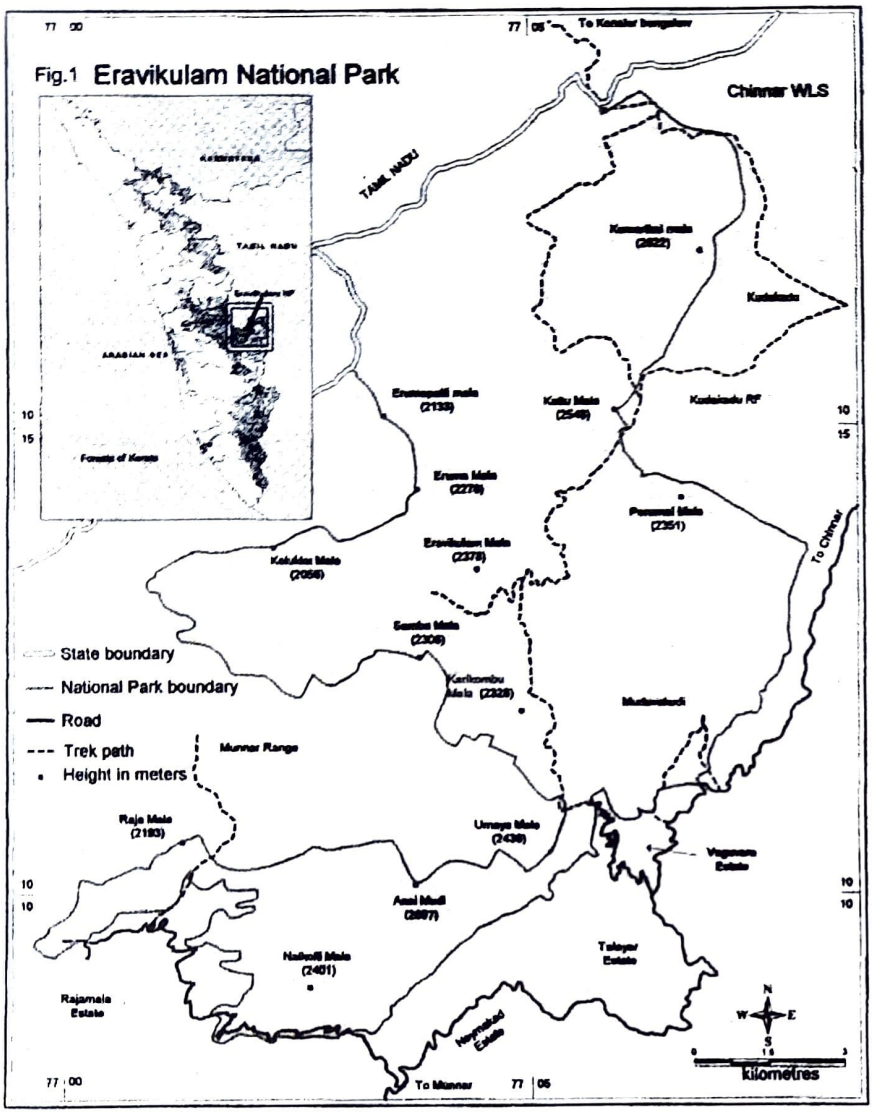

Fig. 1. Map showing location of Eravikulam National Park, Idukki District, Kerala

and are of phytogeographical importance. Two species viz., *Plagiochila arbuscula* (Nair *et al.*, 2005) and *Lejeunea exilis* (Nair *et al.*,2006) are new to India, Three species *viz., Plagiochila chinensis, P. fruticosa* and *P. parvifolia* are new to Peninsular India (Nair *et al.*, 2005) and 17 species *viz., Heteroscyphus splendens, Herbertus armitanus, Pogonatum himalayanam, Fissidens curvato-involutus, Syrrhopodon leucophanoides, Trichostomum hyalinoblastum, Racomitrium subsecundum, R. heterostichum, Mnium medium, Macromitrium bistratosum, Meteorium buchnanii, Neckeropsis lepineana, Distichophyllum montagnianum, Symphyodon perrottetii, Rhaphidostichum brevisetum, Rhytidiadelphus triquetrus* and *Leptohymenium tenue* are new records to Kerala. *Thysananthus rotundisitpulus* a narrow endemic species, earlier known only from the Nilgiri Mountains also could be collected from the area. The recording of more than 100 species indicates the high byrophyte abundance and diversity in ENP.

Bryophytes occur in three types of habitats viz., terrestrial, saxicolous and epiphytes. Some species occur in more than one habitat. Out of the 126 species recorded, about 39% are epiphytes, 27% are terrestrial, 12% are saxicolous; about 10% occur both as terrestrial and saxicolous; 6% are epiphytic and saxicolous and 1% is epiphytic and terrestrial and 6% occur in all habitats (Table 1 & Fig. 2).

Bryophytes distribution of ENP along macrohabitats

The macrohabitats of ENP include montane wet temperate forests (shola) and grasslands. The shola forests are rich in bryophytes, which support 88 species while 47 species were found in grasslands. Seventy eight species were exclusively found in shola and 24 in grasslands. Ten species occupy in both vegetation types. The bryophyte diversity is very high in ENP when compared to other protected areas of Kerala such as Chinnar, Aralam, Wayand, etc. Eventhough more and diverse forest types such as tropical evergreen, semi-evergreen, moist deciduouse, etc occur in these areas, the bryophyte diversity is much higher in ENP with only two vegetation types; grassland and shola forest. This indicates the uniqueness and great conservation potential of the area, especially the shola forest ecosystems.

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Bryophytes distribution of ENP along microhabitats

Though the bryophytes are cosmopolitan in distribution, most of them exhibit strong perference to specific microhabitats/ ecological niches. Usually they do not exist as single species-stands but are found growing mixed with other species of bryophytes, ferns, seed plants, etc. The microhabitats of bryophyte communities are determined by the amount of direct or indirect light, water availability, nutrients from direct rainfall and stem flow/exudates. The relative humidity and the physical and chemical characters of substrate, such as roots, stems, leaves of living and dead plants, underlying rocks, soil substrate, etc. also play significant roles.

Table 1–Ecological resume of bryophytes of Eravikulam National Park

Area				97 km^2
Altitude				950-2695 m
Temperature (sub zero)				6°C to 29°C
Relative Humidity				100%
Rainfall				Over 30 cm
Vegetation types				Grassland and Sholas
Total species				126
Habit types	Terrestrial			33
	Saxicolous			15
	Epiphytes			48
	Both as Terrestrial & Saxicolous			13
	Both as Terrestrial & Epiphytes			1
	Both as Saxicolous & Ephphytes			8
	Both as Terrestrial, Saxicolous & Epiphytes			6
Macrohabitats	Total species in Grassland			47
	Species exclusive in Grassland			24
	Total species in Sholas			88
	Species exclusive in Sholas			78
	Species in common to both			10
Microhabitats	Grassland	Soil & soil cuttings		23
		Rocks & stones		17
	Shola	Forest floor & cuttings		22
		Trees & shrubs	Base	17
			Lower Trunk	29
			Upper Trunk	25
			Branches & Twigs	16

Leafy liverworts of the family Lejeuneaceae are more specific in growing attached to branches and twigs. The pleurocarpic mosses inhabit tree trunks and hanging species such as *Bazzania pearsonii, B. tridens, Aerobryopsis eravikulamensis* and *Barbella pendula* inhabit branches and twigs. Species such as *Cephaloziella kiaerii, Lejeunea discreta* and *L. exilis* are found growing attached with the above species on branches and twigs. Rocks inside the shola forests are inhabited by a variety of high altitude species such as *Plagiomnium* spp. *Rhodobryum* spp., *Racopilum*, etc. However, rocks and stones of grassland are inhabited by only a few species such as *Bryum wightii, Entosthodon wichurae, Campylopus* spp., etc. Soil cuttings in grassland and forests and inhabited by acrocarpic mosses such as *Pogonatum* spp., *Polytrichum juniperinum, Dicranum* spp., etc. and thalloid liverworts such as *Asterella* spp., *Conocephalum conicum, Fossombronia* spp., etc. It is found that trees and shrubs are inhabited by more diverse bryophytes than that of other microhabitats (Table-1). However, the absence of epiphyllous species in sholas, which is usually very common in evergreen forests, was also noted. This may be due to the high stress caused by the heavy wind prevalent throughout the year in the area.

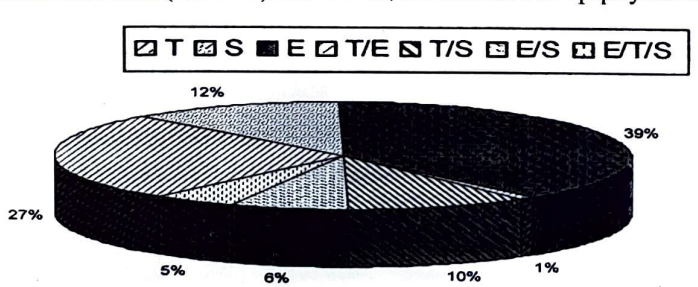

Fig. 2. Habitat types of Bryophytes of ENP (E-Epiphytes, T-Terresrial, S-Saxicolous)

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