

## Moss (Bryophyta) diversity of Thusharagiri Hills, Kerala, India

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**Abstract:** Mufeed, B., Deepa, K.M., Haripriya, P. and Manju, C.N. (2014): Moss (Bryophyte) diversity of Thusharagiri hills, Kerala, India. *Frahmia* 6:1-9.

This article presents the Moss (Bryophyta) diversity of Thusharagiri hills in the Western Ghats of Kozhikode district, Kerala, India. A total of 32 species were recorded from a small evergreen patch.

### Introduction

Located in the Western Ghats of Kozhikode district, the Thusharagiri hills are notable for its scenic beauty and rich vegetation. The area lies between 11° 28' 22.9"N and 76° 03' 10.4"E. It is a well known spot in the Kozhikode district, with its five water falls amidst the thick forest cover. Two streams originating from the Western Ghats merge up near the hill forming the Chalippuzha River and pass through the area. The water falls are in a series, two of them located bit distantly and the rest three in closely adding visual richness. The river splits and cascade down as three separate yet adjacent water falls. The biggest one is the Thenpara fall that cascade from an altitude of 75 meters. The water falls also create a humid misty zone with the heavy spray of water, confirming the literal meaning of the name of the place in the Malayalam language, the Thusharagiri, as the mist capped hill.

The area experiences warm humid tropical climate, typically of this part of the Western Ghats. It receives both South-West and North-West monsoons, with more than 3000 mm, and a mean annual rainfall of 2480 mm. The temperature of this region varies from 12°C to 31°C, and at times to 34°C during the hot summer. The altitude of the area ranges from 50 to 400 m above MSL.

The Bryophyte diversity of the Kozhikode district has not been explored in full. Some sporadic explorations were done in this area, which resulted in publication of some collection reports such as 53 species from the Vellarimala forests (Nair and Madhusoodanan, 2006), 40 species from

Kakkavayal Reserve Forest (Manju *et al.*, 2011) and 79 species from the Malabar Wildlife Sanctuary (Deepa *et al.*, 2012). Extended distribution of some species were also recorded from the Kozhikode district such as; *Mastigolejeunea auriculata* (Wilson & Hook.) Schiffn. (Savitha *et al.*, 2007), *Cololejeunea latilobula* Herzog & Tixier, *Schiffneriolejeunea pulopenangensis* (Gott.) Gradst. (Savitha *et al.*, 2008), *Notoscyphus pandei* Udar & Ad.Kumar (Manju and Rajesh, 2009), and *Lejeunea cocoes* Mitt. (Manju *et al.*, 2012). Rajesh *et al.* (2013) reported *Symphyodon complanatus* as a new record for Kerala from this area. Rajesh and Manju (2014) also recorded 57 species of bryophytes from the lowlands and midlands of Kozhikode district.

The present paper is an account on the Moss diversity of the Thusharagiri hills of Kozhikode district. Among the 31 species recorded from the area, 14 were acrocarpic and 17 were Pleurocarpic. Of the 14 acrocarpic mosses 13 were identified up to species level and one up to generic level. The specimens of *Fissidens* could not be identified up to species, as it does not match with any of the species known from India. The family Bryaceae, with the genus *Bryum*, are widely distributed in the study area with four species followed by Bartramiaceae with three species of *Philonotis*.

Among the Acrocarpic mosses, the species of *Calymperes* grows on bark and on leaf litters only, along with other pleurocarpic mosses. *Hyophila* prefer to grow in wide range of habitat such as on land cuttings, on logs, calcareous soil and on small rocks. *Leucophanes glacum* which generally found grow on logs, but was found on land cuttings in the present study area. *Philonotis* was mostly found on rocky patches where water drips regularly.

The Pleurocarpic mosses identified include 18 species growing in different microhabitats. Of these species 16 were identified up to species level and one up to generic level. One species of the genus *Calypothecium* could not be identified up to species, as it does not match with any of the species known from India. The 17 species belong to 15 genera and eight families. The collection of two species from the Thusharagiri hills, viz., *Symphyodon complanatus* Dix. (Rajesh *et al.* 2013), *Indothuidium kiasense* (R.S.Williams) A.Touw as records of extended distribution of occurrence to the Peninsular India. In India. All these species were earlier known only from the North-eastern regions of India.

The Pleurocarpic mosses prefer to grow mostly on rocky substratum, bark and exposed roots of higher plants. In the present study area also, thick growth of Pleurocarpic mosses were found on the base of trees and rocks.

#### **List of Mosses recorded from the Thusharagiri hills, Kozhikode District, Kerala, India.**

##### **Acrocarpic Mosses**

**Polytrichaceae** Schwaegr.*Pogonatum neesii* (Müll. Hal.) Dozy

Microhabitat: Along land cuttings in grass lands.

Specimens examined: Thusharagiri hills (300- 400 m), *Haripriya 110, 125* (ZGC); *Anoop 7781* (MBG).

Distribution: Western Himalayas, South India (Kerala, Tamil Nadu: Coorg, Nilgiri, Palni hills).

**Fissidentaceae** Schimp.***Fissidens* sp.**

Microhabitat: Grows on moist soil.

Specimens examined: Thusharagiri hills (750 mm), *Haripriya 127,123* (ZGC); *Prajitha 5300* (MBG).

Note: This collection does not match with any of the species reported from India.

**Calymperaceae** Kindb.*Calymperes erosum* Müll. Hal.

Microhabitat: Epiphytic, also seen on leaf litter.

Specimens examined: Thusharagiri hills (300 m), *Haripriya 112, 113, 114, 118* (ZGC); *Ashitha 7762* (MBG).

Distribution: Common species in the study area. It is widely distributed in South India (Goa, Kerala, Tamil Nadu), Sri Lanka, Myanmar, China, Africa and America.

**Leucobryaceae** Schimp.*Leucophanes glaucum* Müll. Hal. ex Fleisch

Habitat: On land cuttings and on logs.

Distribution: Widely found in the study area. It is distributed in Indonesia, China, Japan, Thailand, Vietnam, Malaysia, Philippines, Papua New Guinea, Australia, Thailand and India (Nicobar Islands) as *L. albescence*. In the mainland of India it is distributed in Kerala and Tamil Nadu.Specimen examined: Thusharagiri hills (700), *Haripriya 134* (ZGC).***Leucoloma amoene-virens* Mitt.**

Microhabitat: Seen on land cuttings.

Specimens examined: Thusharagiri hills (400), *Haripriya 115, 121, 126, 128* (ZGC).

Distribution: An Indo-Sri Lankan species distributed in South India (Kerala, Tamil Nadu), East India (Khasi hills) and Sri Lanka.

**Pottiaceae** Schimp.*Hyophila involuta* (Hook.) A.Jaeger

Habitat: It is seen in a variety of habitats such as on soil, logs, rocks, etc.

Distribution: It was earlier reported from the Peninsular India (Kerala, Tamil Nadu (Nilgiri Hills, Palni hills), Karnataka, Mysore, Gujarath), Central India (Madhya Pradesh, Orissa), North East India (Assam, Arunachal Pradesh).

Specimens examined: Thusharagiri (750 m), *Haripriya* 124, 132, 133, 136 (ZGC).

***Oxystegus cylindricus*** (Brunch ex Brid.) Hilp.

Habitat: On small rocky patches in grasslands.

Specimen examined: Thusharagiri hills (400) *Haripriya* 137 (ZGC).

***Bryum capillare*** Hedw.

Microhabitat: On land cuttings and on rocks along with other mosses.

Specimens examined: Thusharagiri hills (750 m) *Haripriya* 117, 134, 135 (ZGC); *Anoop* 7848 (MBG).

Distribution: A wide spread species distributed in North India (Western Himalayas), South India (Kerala, Tamil Nadu), China, Japan, Europe.

***Bryum cellulare*** Hook.

Habitat: On land cuttings.

Specimens examined: Thusharagiri hills (300 m) *Haripriya* 118, 123 (ZGC); Manju 80102 (CALI); *Anoop* 5306 (MBG).

Distribution: A wide spread species distributed in Northern India (Western Himalayas), South India (Kerala, Tamil Nadu), Myanmar, China, Japan, Sumatra, Java, Philippines, Taiwan, Europe, Australia, North and Central Africa.

***Bryum coronatum*** Schwaegr

Microhabitat: On calcareous soils or walls and also on rocks.

Specimen examined: Thusharagiri hills (750 m), *Haripriya* 118 (ZGC).

Distribution: It is common throughout the study area and distributed widely in low altitude areas of Kerala.

***Bryum wightii*** Mitt.

Microhabitat: Near wet areas such as water falls often on moist rocky substratum.

Specimens examined: Thusharagiri hills (750 m), *Haripriya* 116, 122 (ZGC).

Distribution: This Indo-Sri Lankan species is common in the study area. It was also reported from other adjacent areas such as Vellarimala in Kozhikode district.

**Bartramiaceae** Schwaegr.

***Philonotis angusta*** Mitt.

Microhabitat: Lithophytic.

Specimen examined: Thusharagiri hills (750 m), *Haripriya* 129 (ZGC).

Distribution: *P. angusta* is a less distributed species, earlier recorded from the North-east India (Western Himalaya, Darjeeling, Assam, Arunachal Pradesh, Manipur), South India (Kerala), Sri Lanka and Thailand.

***Philonotis seriata* Mitt.**

Microhabitat: Lithophytic and also on land cuttings.

Specimen examined: Thusharagiri hills (750 m), *Haripriya 119* (ZGC).

Distribution: It is a common species in the study area. It has earlier reported from various parts of India.

***Philonotis mollis* (Dozy & Molk.) Mitt.**

Habitat: Lythophytic.

Specimen examined: Thusharagiri hills (700), *Haripriya 111* (ZGC).

Distribution: It was reported earlier from Southern India (Kerala: Wayanad, Idukki; Karnataka: Kanara, Coorg; Tamil Nadu: Western Ghats of Tirunelveli, Old Ghat Road), Central India (Rajasthan), Andaman Islands, Sri Lanka, China, Borneo, Java, Indonesia, Thailand, Japan, Madagascar, New Caledonia, New Guinea, Malaysia, Philippines, Sumatra and Tonkin.

#### **Pleurocarpic mosses**

##### **Racopilaceae**

***Racopilum orthocarpum* Wils. ex Mitt.**

Micro Habitat: Bark of trees, logs, bare rocks, etc.

Specimens examined: Thusharagiri hills (400 m) *Mufeed 7773, 7744* (ZGC).

Distribution: South India (Kerala: Wayanad, Idukki, Kozhikode); Tamil Nadu (Kodaikanal); North-East India (Western Himalayas, Khasi hills, Sikkim), Sri Lanka, Nepal and Myanmar.

##### **Pterobryaceae**

***Pterobryopsis acuminata* (Hook.) Fleisch.**

Microhabitat: On bark.

Specimens examined: Thusharagiri hills (350 m), *Mufeed 302, 7775, 7788* (ZGC).

Distribution: It is rare in the study area. This species is distributed in South India (Kerala, Tamil Nadu: Nilgiri hills), North-east India (Sikkim, Khasi hills), Nepal and Myanmar.

***Pterobryopsis divergens* (Mitt.) Nog.**

Microhabitat: On bark.

Specimen examined: Thusharagiri hills (350 m), *Mufeed 7778* (ZGC).

Distribution: It is rare in the study area. This species is distributed in South India (Kerala, Tamil Nadu: Nilgiri hills), North-east India (Sikkim, Khasi hills), Nepal and Myanmar.

##### **Meteoriaceae Kindb.**

***Floribundaria walkerii*** (Ren. & Card.) Broth.

Microhabitat: On rocky patches and as epiphytes along with other leafy liverworts.

Specimens examined: Thusharagiri hills, *Mufeed* 7772 (ZGC), *Prajitha* 7769, 7790 (MBG).

Distribution: It is an Indian endemic species distributed in Kerala, Tamil Nadu, Eastern Himalayas and West Bengal.

**Neckeraceae** Schimp.***Calypothecium wightii*** (Mitt.) Fleisch.

Microhabitat: Epiphytic and terrestrial.

Specimen examined: Thusharagiri hills (300-400 m), *Mufeed* 25 (ZGC).

Distribution: It is a common species in the study area, distributed in India (Kerala, Tamil Nadu), Bangladesh, Sri Lanka, Myanmar, Laos, Thailand, Vietnam, Yunnan and Taiwan.

***Calypothecium* sp.**

Microhabitat: Epiphytic and terrestrial.

Specimens examined: Thusharagiri hills (450 m), *Mufeed* 24, 301 (ZGC).

Note: This collection differs from *C. wightii* being the leaf tips thrice denticulate in compared to the single pointed in the latter. This collection does not match with any of the species known from India.

***Himantocladium plumula*** (Nees) Fleisch.

Microhabitat: Bark of the tree.

Specimens examined: Thusharagiri hills (400 m), *Mufeed* 27, 308 (ZGC); *Prajitha* 7768 (MBG).

Distribution: An Indo-pacific species found distributed in North-East India (Arunachal Pradesh, Assam, Khasi hills), South India (Kerala, Tamil Nadu), Bangladesh, China, Taiwan, Japan, Sumatra, Indonesia, Philippines, New Caledonia, New Guinea, Australia and Pacific Ocean Islands.

***Pinnatella calcutensis*** M.Fleisch.

Microhabitat: On basal and upper part of tree trunk.

Specimens examined: Thusharagiri hills (300-450 m), *Mufeed* 304, 306 (ZGC).

Distribution: It is a Southeast Asiatic species reported from South India (Karnataka: Kanara, Mahabaleshwar; Kerala), North-east India (West Bengal, Darjeeling) and Thailand.

**Hookeriaceae** Schimp.***Symphyodon complanatus*** Dixon

Microhabitat: On rocks.

Specimen examined: Thusharagiri hills (400 m), *Mufeed* 312 (ZGC).

Distribution: It is distributed in India (Eastern Himalaya, Arunachal Pradesh and Darjeeling). The present collection is a new record of occurrence for Peninsular India.

**Hypopterygiaceae** Kindberg

*Hypopterygium flavolimbatum* Müll. Hal.

Microhabitat: On rocky patches near streams.

Specimen examined: Thusharagiri hills (400 m) *Mufeed 39* (ZGC).

Distribution: This species is rare in Thusharagiri hills and was earlier recorded from South India (Tamil Nadu: Tirunelveli; Kerala: Wayanad), Northern India (Himalayas), China, Java, New Guinea and Indo-Malayan region.

**Thuidiaceae** Schimp.

*Pelekium gratum* (P.Beauv.) Touw.

Microhabitat: On concrete walls.

Specimen examined: Thusharagiri hills (300 m), *Mufeed 7789* (ZGC).

Distribution: It was earlier reported from India (Kerala), Sri Lanka, Indonesia, Malaysia and Philippines.

*Indothuidium kiasense* (R.S.Williams) A.Touw

Microhabitat: On rocky patch.

Specimen examined: Thusharagiri hills (300 m) *Mufeed 37* (ZGC).

Distribution: It is reported from India (Darjeeling, Assam, Arunachal Pradesh) and Philippines. This species was not collected earlier from Peninsular India hence, the present collection is a new record of occurrence for Peninsular India.

**Sematophyllaceae** Broth.

*Wijkia surcularis* (Mitt.) Crum

Microhabitat: On rocky patch.

Specimen examined: Thusharagiri hills (350 m), *Mufeed 41, 35* (ZGC).

Distribution: Distributed in India (East Nepal, Sikkim, Khasi hills, Kerala, Andaman Islands), Myanmar and Thailand.

*Acroporium stramineum* (Reinw. & Hornsch) Fleisch.

Micro habitat: On rocky patches.

Specimen examined: Thusharagiri hills (350 m), *Mufeed 5302* (ZGC).

Distribution: It is distributed in India (Kerala, Tamil Nadu, North Eastern India), Nepal, Bhutan and Singapore.

**Hypnaceae** Schimp.

*Taxiphyllum maniae* (Ren. & Par.) Fleisch.

Microhabitat: On rocky patches or on soil banks

Specimens examined: Thusharagiri hills (300-450 m), *Mufeed 38* (ZGC), *Prajitha 7777* (MBG).

Distribution: It is rare in the study area. Distributed in India (Kerala, Tamil Nadu, North East India, Mussoorie), East Nepal, Madagascar, Java and New Guinea.

*Isopterygium minutirameum* (Müll. Hal.) A.Jaeger

Microhabitat: On bark and rotten logs.

Specimen examined: Thusharagiri hills (400 m), *Mufeed 309* (ZGC).

Distribution: It is a South-east Asiatic-Pacific species. It is distributed in India (Kerala; Tamil Nadu: Palni hills; Kulu), Sri Lanka, Myanmar, Vietnam, Sumatra, Java, Molucca, Borneo, Philippines, Japan, Australia and Fiji.

*Vesicularia montagnei* (Bel.) Broth.

Microhabitat: On rocks.

Specimen examined: Thusharagiri hills (300 m) *Mufeed 12* (ZGC).

Distribution: Rare in the study area. It is distributed in North-East India (Western Himalaya, West Bengal, Arunachal Pradesh), South India (Kerala) China, Thailand, Australia, Sumatra, Vietnam, Java and Oceania.

### Discussion

The recording of 31 species from a small patch of evergreen forest of the Western Ghats, the Thusharagiri hills in the Kozhikode district, shows the richness of the area. The thick canopy cover and the spray zone formed due to the cascading water falls also contribute a lot on the rich growth of the plants including the bryophytes.

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