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Research Article

Bryophyte diversity in the Sacred Groves, with special reference to Vallikkattukavu of Kozhikode district in Western Ghats

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Abstract

The bryophyte diversity in the Vallikkattu kavu of Kozhikode district is enumerated along with the conservation of bryophytes in the sacred grove is discussed. This report represents many interesting finds such as *Bryum retusifolium* var. *heterophyllum* Card. ex Gangulee a new record to Kerala and *Ditrichum tortuloides* Grout. is a new record for Peninsular India. The endemic species *Fissidens kammadensis* Manju *et al.* and the rare species *Calymperes palisotti* Schwaegr. could be collected from this sacred grove.

Keywords

Bryophytes; Sacred Grove; Vallikkattukavu; Western Ghats

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Introduction

Sacred groves represent patches of forests protected by assigning them as the abode of Gods and Goddesses. They are considered as one of the land use systems with ecological and socio-cultural importance in the region. They are also regarded as the treasure house of rare and endemic species. Kerala is one of the state having maximum number of Sacred Groves. They are traditionally conserved as a part of natural worship and these practices have played an important role in protection of biodiversity (Bhagawat *et al.*, 2005; Bhagawat & Rutte, 2006.). The sacred grove performs several ecological functions, which directly or indirectly helps to maintain ecosystem health of all other interacting landscape units.

Sacred Groves harbour a wide variety of habitat and landscapes and serve as a storehouse of

rare and endemic species. Despite the fact that many sacred groves are still well preserved, many have also been destroyed and others are now threatened by anthropogenic activities. A number of studies have been conducted on the floristic diversity and other aspects of sacred groves of Southern India such as Gadgil (1985), Chandran, *et. al.* (1998), Chandran and Hughes, (1997, 1998), Godbole (1998), Anupama (2008), *et. c.* There is only a single report on the bryophytes of sacred groves in Kerala (Manju *et al.* 2008).

Vallikkattukavu (11°23'17"N; 75°47'10"E) is the largest sacred grove in the Kozhikode district covering about 16 acres of area. This Kavau is situated 25 km away from Kozhikode city and exactly located in Edakkara desam of Thalakkulathur Village. The temple and the forests are managed by the Malabar Devaswom Board with

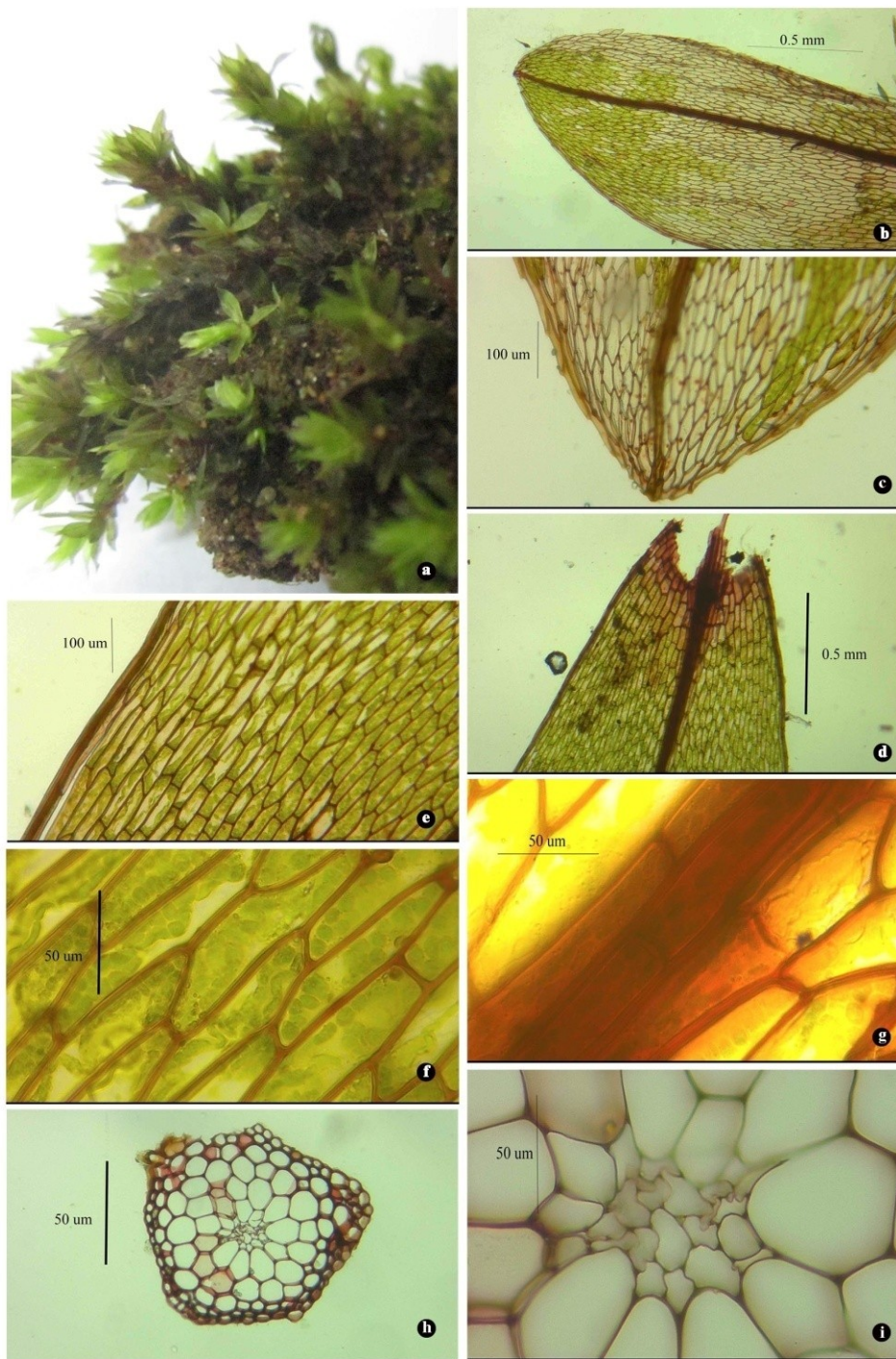


Plate 1. *Bryum retusifolium* var. *heterophyllum*. a. habit; b. leaf (4x); c. leaf apex (10x); d. leaf base (4x); e. leaf margin (10x); f. leaf cells (40); g. costa (40x); h. stem – c. s. (40x); i. cells enlarged (40x).

The support of Vallikkattukavu Management Committee. The vegetation in this Kavau represents a low land evergreen forest with *Myristica malabarica*, *Lagerstroemia microcarpa*, *Lophopetalum wightianum*, *Carallia brachiata* as the dominant tree species. Vallikkattu Kavau is also characterized by endemic species like *Hopea ponga*, *Ancistrocladus heyneanus*, *Holigarna arnottiana*, *Memecylon umbellatum* and *Gymnostachyum febrifugum* and a large number of medicinal plants including *Nervilia infundibulifolia* and *Aporosa cardiosperma*. This area is an abode of a variety of important plants including

nonflowering plant groups such as Fungi, Bryophytes and Pteridophytes, and the area is conserved properly.

The present paper enumerates the bryophyte diversity of the area in detail. This is the first of its kind from a sacred grove in India. The taxa are arranged in alphabetical order within each of the two divisions of bryophytes, the Marchantiophyta (liverworts) and Bryophyta (Mosses). For each species representative specimens with following data are included; the locality, the collector's name, collection number, and comments on the distribution of species is

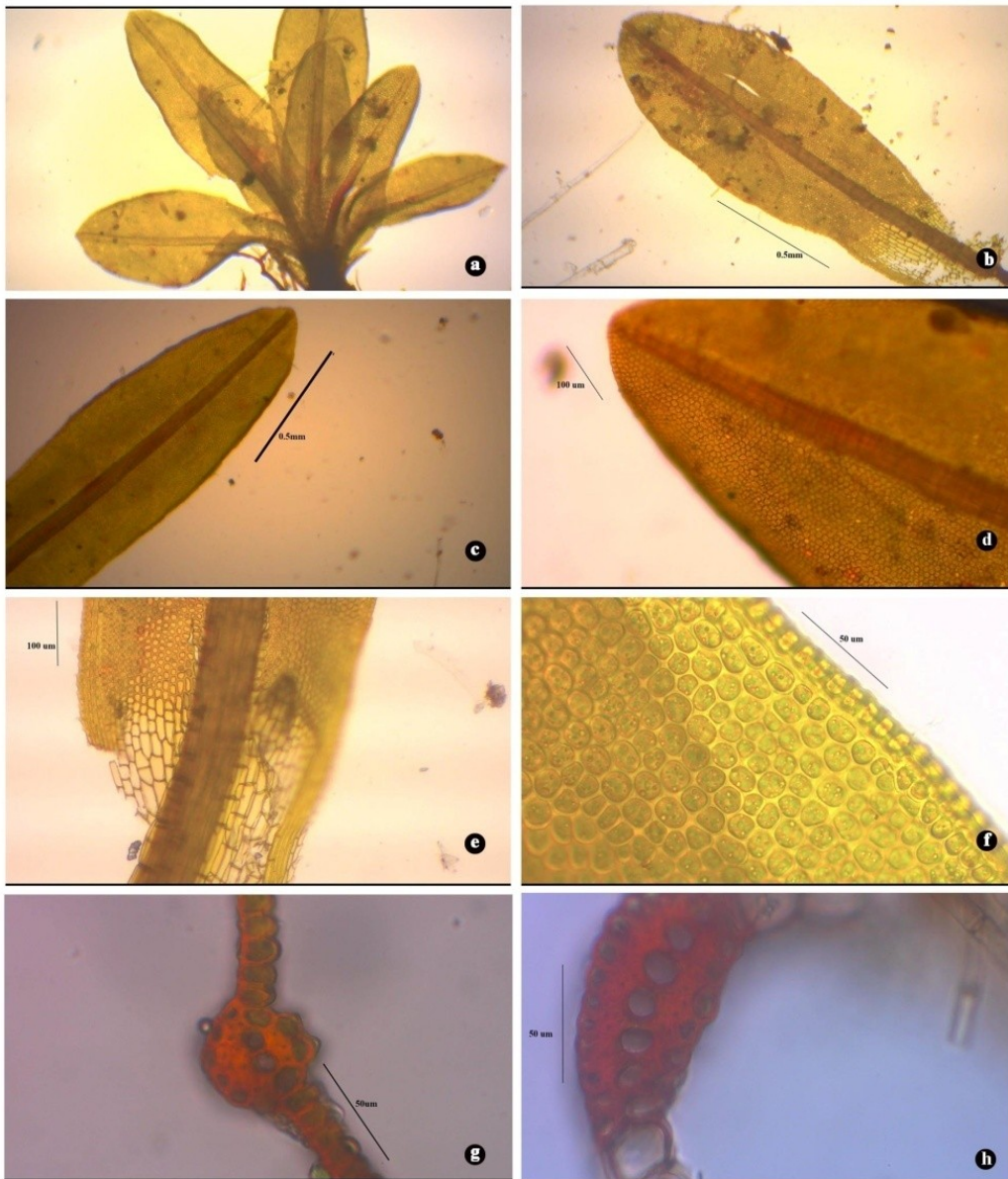


Plate 2. *Calymperes palisotti*. a. habit; b. single leaf (4x); c. leaf apex (4x); d. leaf apex – enlarged (10x); e. leaf base (10x); f. leaf margin (40x); g. leaf c.s (40x); h. leaf c.s – enlarged view (40x).

provided with photographs. The bryophyte specimens were deposited in the Zamorin's Guruvayurappan college herbarium (ZGC).

List of bryophytes recorded from Vallikkattukavu:

MARCHANTIOPHYTA (LIVERWORTS)

Archilejeunea minutilobula Udar & U.S. Awasthi, found on moist soil. Kozhikode-Vallikkattukavu (53 m), 27. 9. 2014, *Jyothi & Mithun 3819b* (ZGC). It is distributed in Western Ghats of Kerala, Maharashtra and Tamil Nadu.

Cheilolejeunea serpentina (Mitt.) Mizut.; epiphytic on bark of the tree. Kozhikode - Vallikkattukavu (53m) 29. 6. 2014, *Jyothi et al. 584*

(ZGC) Distributed in Kerala (Wayanad, Kozhikode, Idukki); Eastern Himalaya (Meghalaya: East Khasi Hills; West Khasi Hills).

Cololejeunea lanciloba Steph.; epiphyllous, leafy thallus is closely appressed to the angiosperm leaf surface. kozhikode-Vallikkattukavu (53m) 27. 9. 2014, *Jyothi & Mithun 3834, 3841, 3827*; 29. 6. 2014, *Jyothi et al. 579* (ZGC). It is distributed in India (Kerala-Kozhikode), Nicobar Islands; Japan, China, Borneo, Philippines, Hawaii, Java, Malaya, Bangladesh, Thailand, Cambodia, Indonesia, Malaysia, Polynesia, New Caledonia, Australia and Africa.

Cyathodium cavernarum Kunze; it was found on soil cuttings and on wet soil. Kozhikode - Vallikkattukavu (53m), 27. 9. 2014, *Jyothi & Mithun 3819a, 3823a* (ZGC). It is distributed in Peninsular



Plate 3. *Ditrichum tortuloides* a. habit; b. single leaf (4x); c. leaf apex (40x); d. leaf base (40x); e. leaf cells (40x).

India (Kerala, Gujarat); Central India (Maharashtra, Madhya Pradesh, Rajasthan); North-East India (Uttaranchal, Uttar Pradesh, West Bengal); Cuba, Africa, Indonesia, Mexico and America

Lophocolea bidentata (L.) Dumort., found on buttresses and on soil. Kozhikode-Vallikkattukavu (53 m) 27. 9. 2014, *Jyothi & Mithun 3833a, 3814, 3820* (ZGC). It is distributed in Kerala: (Thiruvananthapuram, Kozhikode); Eastern Himalayas (Meghalaya, East Khasi Hills, Mawphlong forest); Nepal and Australia.

Lopholejeunea sikkimensis Steph.; it was found

on bark of tree. Kozhikode - Vallikkattukavu (53m), 27. 9. 2014, *Jyothi & Mithun 3823b* (ZGC). Kerala (Lakkidi); Tamil Nadu (Nilgiri hills, Ootacamund, Naduvattam); Karnataka (Marcaca); Central India (Madhya Pradesh); North- East India (West Bengal, Manipur, Meghalaya, Uttar Pradesh) and Nepal.

Mastigolejeunea humilis (Gott.) Schiffn.; it was found on bark of tree. Kozhikode - Vallikkattukavu (53m), 13. 6. 2015, *Jyothi & Mithun 3894* (ZGC). It is distributed in India (Kerala -Kozhikode, Tamil Nadu); Japan, Ryukyu, Formosa. Widely distributed in tropical and subtropical Asia and Oceania.

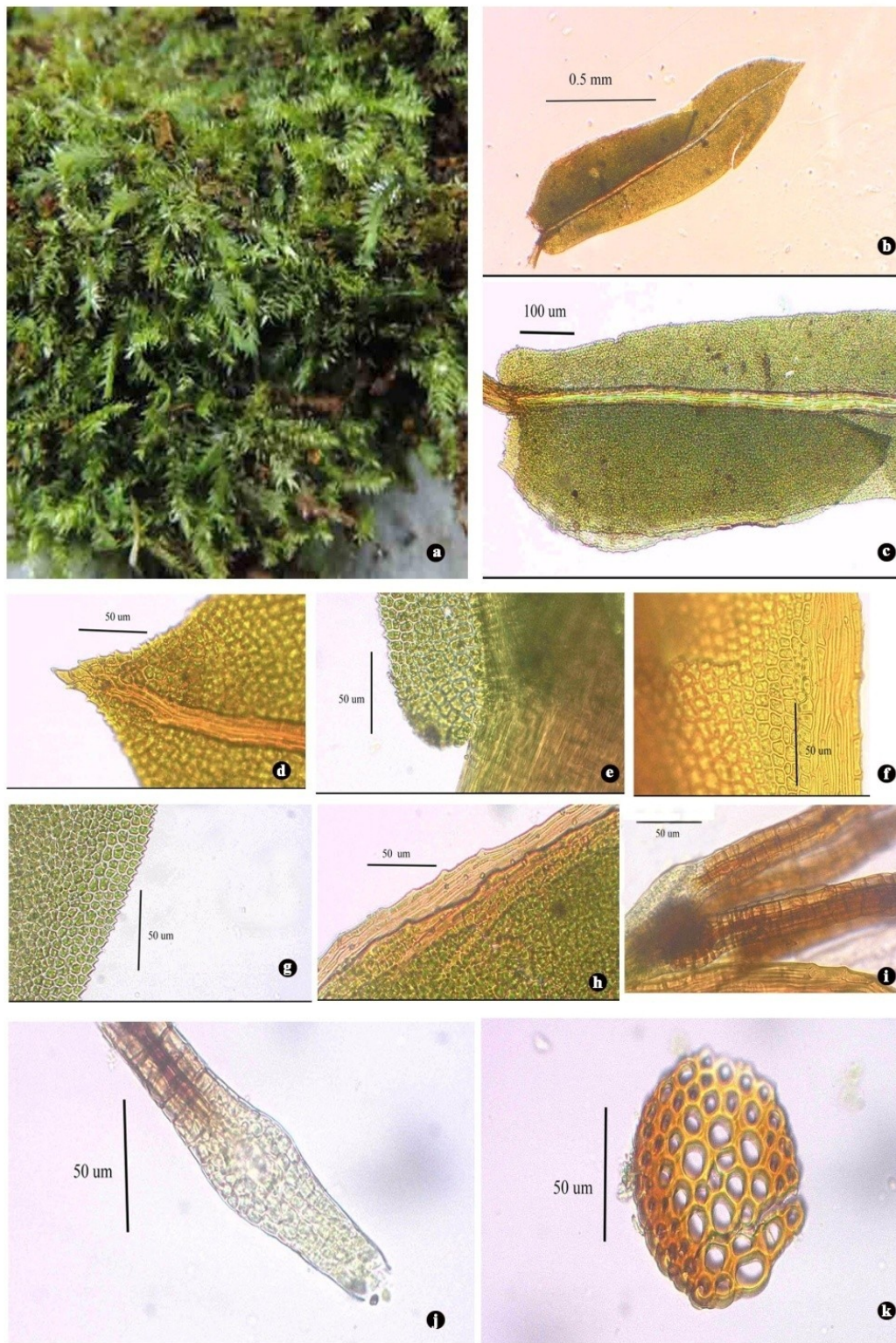


Plate 4). *Fissidens kammadensis*. a. habit; b. single leaf (4x); c. sheathing lamina (10x); d. leaf apex (10x); e. dorsal lamina base (40x); f. limbidial cells (40x); g. leaf margin (40x); h. limbidium (40x); i. archegonial cluster (40x); j. single archegonium (40x); k. stem c.s (40x).

Pallavicinia lyellii (Hook.) Carruth., this species is found near stream on land cuttings. Kozhikode - Vallikkattukavu (53 m) 29. 6. 2014, Jyothi *et al.* 1278; 27. 9. 2014, Jyothi & Mithun 3838 (ZGC). It is distributed in Kerala (Wayanad, Kozhikode), Tamil Nadu (Kanyakumari, Madurai, Nilgiri and Tirunelveli) Western Ghats of Karnataka,

Meghalaya and Madhya Pradesh; North America and British Island.

Riccardia multifida (L.) Gray, it is present on the buttresses of trees near stream. Kozhikode-Vallikkattukavu (53 m), 29. 06. 2014, Jyothi *et al.* 580; 27. 09. 2014, Jyothi & Mithun 3807a, 3803a, 3813a (ZGC). It is distributed in Kerala (Wayanad,

Silent Valley National Park, Kozhikode), Tamil Nadu: (Madura, Kodaikanal, Palni hills); Eastern Himalaya, Darjeeling; Sri Lanka, China, N. America, Europe, Alaska and Hawali.

Riccia gangetica Ahmad ex L.Söderstr; it was found on wet soil. Kozhikode Vallikkattukavu (53m), 13.6.2015; *Jyothi & Mithun 3897, 586, 587* (ZGC). It is distributed in India: Kerala- Kozhikode, Eastern Himalayas; Meghalaya, East Khasi Hills and Shillong.

BRYOPHYTA (MUSCI)

Barbula indica (Hook.) Spreng.; found in land cuttings. Kozhikode-Vallikkattukavu (53m), 29.6.2014, *Jyothi & Mithun 571a* (ZGC). Distributed in India (Kerala, Tamil Nadu); China, Japan, Indonesia and Philippines.

Bryum retusifolium var. ***heterophyllum*** Card. ex Gangulee; on Soil. Kozhikode- Vallikkattukavu (53m), 27. 09. 2014, *Jyothi & Mithun 3837a* (ZGC). This species was earlier recorded from Palni hills of Tamil Nadu and type collected from East Nepal. Hence the present collection is a new record for Kerala. (Plate 1).

Calymperes erosum C. Müll. Hal.; it is found in root buttresses, stone surfaces and on tree trunks. Kozhikode-Vallikkattukavu (53m) 29.06.2014, *Jyothi et al. 594 b, 585*; 27.9.2014 *Jyothi & Mithun 3809, 3819a* (ZGC). It is distributed in South India (Goa, Kerala, Tamil Nadu); Sri Lanka, Myanmar, China, Africa and America.

Calymperes palisotti Schwaegr.; on bark of the tree. Kozhikode - Vallikkattukavu (53m) 27.9.2014, *Jyothi & Mithun 3818b* (ZGC). Distributed in South India- Kerala (Changanacherry, Kozhikode). Recorded from Central Province of Sri Lanka (Kandy district) common in tropical Africa and various Islands in the Western Indian Ocean. It is a very rare species in India. (Plate 2).

Chionostomum rostratum (Griff.) C. Muell.; epiphytic, found on tree bark. Kozhikode -Vallikkattukavu (53m) 27.9.2014, *Jyothi & Mithun 3818a* (ZGC). It is distributed in India (Kerala, Khasia Hills, Darjeeling, Coorg); Thailand, N. & S. Vietnam, Philippines, Taiwan.

Ditrichum tortuloides Grout., on the soil. Kozhikode, Vallikkattukavu (53m), 27.09.2014, *Jyothi & Mithun 3824b, 3898* (ZGC). It is distributed in Khasi & Jaintia Hills; Western Himalaya; Europe; North America. The present collection is a new record for Peninsular India. (Plate 3).

Fissidens ceylonensis Dozy & Molk., found on land cutting. Kozhikode - Vallikkattukavu (53m), 29.6.2014 *Jyothi et al. 595* (ZGC). A widely distributed species found in South India (Kerala, Tamil Nadu); North-east India (Darjeeling, Himalaya, Sikkim, Uttar Pradesh, West Bengal); Sri

Lanka, Borneo, Iran, Java, Malaysia, Moluccas, Nepal, New Zealand, Philippines, Sumatra, Thailand, Vietnam and Yunnan.

Fissidens crispulus Brid. var. ***robinsonii*** (Broth.) B.C. Tan & Choy, it was found on soil along with *Riccardia multifida*. Kozhikode- Vallikkattukavu (53m) 27.9.2014. *Jyothi & Mithun 3889* (ZGC). It is distributed in India: Kerala (Wayanad, Kozhikode); North India (Himalaya); China and Philippines.

Fissidens crispulus Brid.; found on root buttresses and soil along with *Riccardia multifida*. Distributed in India: Kozhikode - Vallikkattukavu (53m) 29.6. 2014 *Jyothi et al. 583, 570*; 27.9.2014, *Jyothi & Mithun 3803b, 3807b, 3837b* (ZGC).it is distributed in South India (Kerala), North India (Himalaya); China and Philippines.

Fissidens flaccidus Mitt., terrestrial- found on soil Kozhikode- Vallikkattukavu (53m). 27. 9. 2014, *Jyothi & Mithun 3816b* (ZGC). Distributed in South India (Kerala-Wayanad, Tamil Nadu); Central India: (Maharashtra, Madhya Pradesh); North-east India: (Bengal, Haryana, Khandala, Western Himalayas); Sri Lanka, China, Indonesia, Borneo, Brazil, Myanmar, Taiwan, Japan, Java, Nepal, Mexico. New Guinea, Philippines and Ryukyus.

Fissidens ganguleei Norkett., it was found on root buttresses and on soil. Kozhikode-Vallikkattukavu (53m). 27.9.2014, *Jyothi & Mithun (3804) (3828)*; A.H. Norkett; Mungpoo 24.10.1970 (14979)(ZGC). it is distributed in. India: Kerala, Darjeeling; East Nepal.

Fissidens hollianus Dozy & Molk.; found on the surface of stone along with other species of *Fissidens*. Kozhikode – Vallikkattukavu(53 m), 27. 9. 2014, *Jyothi & Mithun 3821b* (ZGC). It is distributed in India, China, Japan, Thailand, Myanmar, Vietnam, Malay Peninsula, Indonesia and New Guinea.The present collection is a new record for Kerala.

Fissidens kammadensis Manju, Rajesh & Madhus., on bark of decayed wood, on rocks and on roots of higher plants. India: Kerala : Kozhikode - Vallikkattukavu (53m) 29. 6. 2014, *Jyothi et al. 576, 578, 588, 592a* (ZGC). This species is earlier recoded from Kammadam Kavuv in Kasaragod district of Kerala only by Manju et al. (2008). (Plate 4).

Fissidens pellucidus Hornsch., found on soil. Kozhikode- Vallikkattukavu (53m) 29.6.2014, *Jyothi et al. 598, 576a*; 27. 9. 2014, *Jyothi & Mithun 3821a, 3822, 3826, 3830, 3831a, 3888* (ZGC) Distributed in India, China, Nepal, Sri Lanka, Myanmar, Thailand, Vietnam, Malaysia, Singapore, Indonesia, Philippines and South America.

Garckea flexuosa (Griff.) Margad & Nork., terrestrial- found in the soil along with *Ditrichum tortuloides*. Kozhikode, Vallikkattukavu (53m),

27.09.2014, *Jyothi & Mithun (3824 a)* (ZGC). Distributed in South India: Kerala(Wayanad), Tamil Nadu, Karnataka, North India: West Bengal, Khasi hills, Tripura; Andaman Islands; Sri Lanka; Bhutan; Myanmar; Indochina; Japan; Java; Madagascar, Malaysia, Nepal; New Guinea; Philippines; Sumatra; Thailand; Australia; Oceania and C. America.

Isopterygium lignicola (Mitt.) A.Jaeger, found on root buttresses of trees with regularly moistened areas. Kozhikode - Vallikkattukavu (53m) ; 29. 6. 2014, *Jyothi et al 576b*; 27.09.2014 *Jyothi & Mithun 3807c, 3813, 3817, 3833b, 3811* (ZGC).it is distributed in India: South India (Kerala, Nilgiri, Coorg) Sikkim, Khasia hills, Sri Lanka and Myanmar.

Leucophanes glaucescens C. Muell. ex Fleisch., found on bark. Kozhikode - Vallikkattukavu (53m), 29.6.2014, *Jyothi et al., 574, 599* (ZGC).Distributed in Western Ghats of Tamil Nadu (Tirunelveli), Kerala (Kozhikode), Andaman Islands; Sri Lanka, Indonesia and Vietnam.

Plagiothecium entodontella Broth. ex Dix., found creeping on rock surfaces and bark of the trees. Kozhikode - Vallikkattukavu (53m) 29.6.2014, *Jyothi et al. (594a)*; (1279); 27.09.2014, *Jyothi & Mithun (3802)(3815)* (ZGC). Distributed in India: Darjeeling; Endemic in Thailand. The present collection is a new record for Peninsular India.

Sematophyllum subhumile (C. Muell.) Fleisch.; found on root butteresses of tree. Kozhikode - Vallikkattukavu (53m) 27.9.2014, *Jyothi & Mithun 3804b* (ZGC). Distributed in India (Kerala, Nilgiri, Palni, Upper Assam, East Nepal), Burma, Thailand, Java.

DISCUSSION

This study forms a preliminary report on the bryophytes of sacred grove in India. Sacred grove represent relic vegetation of the past, but no thorough studies on the bryophytes present in the sacred groves in India, especially Kerala. The present study resulted in recording of 29 species of bryophytes. Among these, 10 are liverworts and 19 are mosses. *Bryum retusifolium* var. *heterophyllum* Card. ex Gangulee is a new record to Kerala and *Ditrichum tortuloides* Grout. is a new record for Peninsular India. *Fissidens kammadensis* Manju et al., endemic to Kerala and rare species *Calymperes palisotti* Schwaegr. could be collected from this sacred grove.

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