

Bryophyte Diversity of the lowlands and midlands of Kozhikode District, Kerala, India

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This article presents the diversity of Bryophytes of the lowlands and midlands of the Calicut (Kozhikode) district of Kerala in the Peninsular India. It provides a list of 57 species, mainly from the thickly populated areas.

1. Introduction

The Calicut is well known as the historical spot where Vasco da Gamma, the Portugese explorer, landed in search of bio-resources of India. Currently it is known as Kozhikode. It is of great historical relevance as the capital of the kingdom of the Zamorin's and later that of the Malabar district during the British period. It is notable for its rich biodiversity at all levels from habitats and species. It offers almost all types of habitats available in Southern India, from coast, sandy plains, brackish water system, mangroves, rivers, midland scrubs to the misty forests of high altitudes of the Western Ghats. Located between latitudes 11° 08' & 11° 50' north and longitudes 75° 30' & 76° 08' east, the Calicut district is in the northern part of Kerala state of India. It lies bordered by Kannur district on the north, Wayanad district on the east, Malappuram district on the south and more than 80 km stretch of Arabian sea on the west (Fig. 1).

Topographically the area is typical of northern Kerala, with the coastal plains gradually merge into the undulating midlands, crisscrossed by many rivers and rivulets, and abruptly rise to the hills of the Western Ghats. Mangrove patches, scrubby lands, cultivated fields, coconut and areca nut groves, plantations, forested areas and sacred groves, etc also support unique assemblages of biodiversity. The transition of these habitats offers innumerable microhabitats for the luxuriant

growth of the bryophytes also. The lowlands and midlands are thickly populated. The vegetation also varies greatly from the coastal sandy beaches and mangroves of estuaries to the scrub jungles and agricultural fields of midland to the plantations and forests of the highlands. The area receives rainfalls during the both spells of monsoon, i.e., south-west and north-east. Major share is poured during the June-August months.

The district with a total area of 2344 sq.km. is divided into three taluks. The lowland region forms about 15% of the total area of the district. The midland area is formed of about 58% and the highland with about 26%. The vegetation varies from the herbaceous and shrubby thickets of beaches, mangroves of the estuaries and back waters of the lowlands. The lowlands being thickly populated, its natural vegetation had been largely changed to agricultural fields, plantations of coconut, arecanut, etc. The lateritic scrubs of the midlands are also been largely converted to human habitations and agricultural fields. The crusts of the hillocks at places retains its wild form as seasonally active grasslands. Left over patches of moist deciduous forests or scrubby vegetation may also could be seen in some places. The remnants of luxuriant plant growths of the old past can be seen retained in some sacred groves of lowlands and midlands. Plantations of rubber, is predominant in the foothills. Forest covered highlands borders on the east.

2. Review of earlier works

Except for some sporadic collection reports, the bryophyte diversity of the Kozhikode district has not been studied in detail, as attempted in the nearby Wayanad district by Nair *et al.* (2005). The earliest may be that by Nair and Madhusoodanan (2006), who provided an account of 53 species of mosses and leafy liverworts from the Vellarimala in the Western Ghats mountains of Kozhikode district. Savitha *et al.* (2007) reported *Mastigolejeunea auriculata* (Wilson & Hook.) Schiffn. collected from Pokkunnimala of Kozhikode district as new records for the Peninsular India. Savitha *et al.* (2008) reported *Cololejeunea latilobula* Herzog & Tixier and *Schiffneriolejeunea pulopenangensis* (Gott.) Gradst. from the same area as new records of occurrence for Kerala state. Nair *et al.* (2008) provided an account of 52 species of bryophytes including 28 liverworts and 24 mosses of Kakkayam forests in the Western Ghats of Kozhikode district. Manju and Rajesh (2009) reported the occurrence of *Notoscyphus pandei*, an Indian endemic species from the same area. Deepa (2010) studied the Moss flora of Pannikottor Reserve forest of Malabar Wild Life Sanctuary, in the Kozhikode district and recorded 27 species, belong to 22 genera and 12 families. Leena (2010) studied the Liverwort and Hornwort flora (totalling 19 species) of the same area. Jitha (2011) and Reshma (2011) respectively studied the Liverwort flora and Moss flora of Kakkavayal Reserve Forest of Kozhikode District. Manju *et al.* (2011) provided a summary of the Bryophyte diversity of the same area, totalling 40 species of bryophytes including 24 mosses and

16 liverworts. Deepa *et al.* (2012) presented an account of the Bryophyte diversity of Malabar wildlife Sanctuary of Kozhikode district, which contains 79 species including 35 liverworts, one hornwort and 43 mosses.

The present paper is an account on the Bryophyte diversity of the lowland and midland areas of Kozhikode district. A total of 57 species were recorded from the area, and are deposited in the herbarium of the Zamorin's Guruvayurappan College (ZGC). Eventhough the Kerala state is richer in bryophyte diversity, its lowlands and midlands are comparatively hold lesser number of bryophytes. It is mainly due to the availability of lesser number of suitable microhabitats, compared to the high altitude forest areas. The moisture also plays a significant role in the distribution of the bryophytes. The low and mid altitude habitats are more exposed, and hence with low moisture. The alterations in the habitats for human habitation, and other purposes such as agriculture, etc also influenced the distribution of the bryophytes. The species present in the low and mid altitude habitats are common ones and adapted to these habitats. Plant such as *Hyophila*, *Calymperes*, *Bryum*, etc, which are light tolerant and more adapted in these kind of habitats are common in the study area.

3. List of Bryophytes recorded from the lowlands and midlands of Kozhikode District, Kerala, India.

Liverworts

Cyathodium cavernarum Kunze in Lehm., Nov. Stirp. Pug. 6: 18. 1834.

Specimen/s examined: Kozhikode District: ZG College Campus (40 m) Rajesh 111623, 111649, 111670, 111678; Kakkavayal (100 m) Rajesh 6840; Ramanattukara (sea level) Rajesh 6841 (ZGC).

Riccia discolor L. et Ledbg., Pugill. 4 : 1, 1832.

Specimen/s examined: Kozhikode District: Ramanattukara, Rajesh 6846 (ZGC).

Riccia gangetica Ahmad, Curr. Sci. 11: 433. 1942.

Specimen/s examined: Kozhikode District: Mananchira (sea level), Rajesh 6810; ZG College Campus, Rajesh 111622, 111651, 111654 (ZGC).

Fossombronia indica Steph., Sp. Hapat. 6: 73. 1917.

Specimen/s examined: Kozhikode District: ZG College Campus (50 m) Rajesh, 111621, 111638, 111653 (ZGC).

Riccardia multifida (L.) S.F.Gray, Nat. Arr. Brit. Pl. 1:684.1821.

Specimen/s examined: Kozhikode District: Kakkavayal Reserve Forest (100 m), Rajesh 1182, 1192, 1063, 1183, 1184 (ZGC).

Pallavicinia himalayensis Schiffn., Kais. Alad. Wien LXVII p. 183.

Specimen/s examined: Kozhikode District: Kakkavayal Reserve Forest (100 m), *Rajesh 1184, 1164, 1178, 1180* (ZGC).

Heteroscyphus argutus (Nees) Schiffn., Osterr. Bot. Zeitschr. 60: 172. 1910.

Specimen/s examined: Kozhikode District: Kakkavayal (110 m) *Rajesh 1181* (ZGC).

Archilejeunea apiculifolia Steph., Sp. Hapat. 6: 558. 1924.

Specimen/s examined: Kozhikode District: ZGC Campus (50 m) *Rajesh 111607* (ZGC).

Cololejeunea appressa (Evans) Benedix, Fedds Repert. Beih. 134: 31, 1953.

Specimen/s examined: Kozhikode District: Kakkavayal Reserve Forest (100 m) *Rajesh 395, 396* (ZGC).

Cololejeunea follicola Srivast. & Srivast., Proc. Indian Acad. Sci. 99(2): 86. 1989.

Specimen/s examined: Kozhikode District: Kakkavayal Reserve Forest (100 m), *Rajesh 391, 398, 392* (ZGC).

Cololejeunea furcilibulata (Berrie & Jones) Schust., Nova Hedwig. Beih. 9: 178. 1963.

Specimen/s examined: Kozhikode District: Kakkavayal Reserve Forest (100 m), *Rajesh 1058* (ZGC).

Cololejeunea lanciloba Steph., Nova Hedwig. 34: 250. 1895.

Specimens/ examined: Kozhikode District: Kakkavayal Reserve Forest (100 m), *Rajesh 917, 918* (ZGC).

Cololejeunea latilobula (Herzog) Tixier, Bryophyt. Biblio. 27: 156. 1985.

Specimen/s examined: Kozhikode District: ZG College Campus (50 m), *Rajesh 111608, 111655, 111659* (ZGC).

Cololejeunea planissima (Mitt.) Mizut., J. Hattori, Bot. Lab. 24:115-302.

Specimen/s examined: Kozhikode District: Kakkavayal Reserve Forest (100m), *Rajesh 390, 397* (ZGC).

Cololejeunea udarii Asthana & Srivastava, Ind. Cololejeunea 40. 2003.

Specimen/s examined: Kozhikode District: Kakkavayal Reserve Forest (100m), *Rajesh 389, 400* (ZGC).

Cheilolejeunea intertexta (Lindenb.) Steph., Bull. Herb. Boiss 5: 79.1897.

Specimen/s examined: Kozhikode District: Kakkavayal Reserve Forest (100 m), *Rajesh 1175 b* (ZGC).

Cheilolejeunea serpentina (Mitt.) Mizut., J. Hattori Bot. Lab. 26 : 171. 1963.

Specimen/s examined: Kozhikode District: Kakkavayal Reserve Forest (100 m), *Rajesh 1077, 1187, 1071a, 1076a* (ZGC).

Lopholejeunea subfusca (Nees) Steph., Hedwigia 29: 16. 1890.

Specimen/s examined: Kozhikode District: ZGC Campus (50 m) *Rajesh 111625, 111641, 111658* (ZGC).

Lopholejeunea nigricans (Lindenb.) Schiffner, Consp. Hepat. Arch. Indici 293. 1898.

Specimen/s examined: Kozhikode District: Govt. Arts & Science College Campus, Meenchanda (sea level), *Rajesh 6393, 6394a* (ZGC).

Leptolejeunea follicola Steph., Hedwigia 106. 1896, non (Horik.) R.M. Schust., 1963.

Specimen/s examined: Kozhikode District: Kakkavayal (100 m), *Rajesh 393* (ZGC).

Mastigolejeunea auriculata (Wilson & Hook.) Schiffn. in Engl. & Prantl, Nat. Pflanzenfam. 129. 1893.

Specimen/s examined: Kozhikode District: ZG College Campus (40 m) *Rajesh, 111606* (ZGC).

Mastigolejeunea humilis (Gott.) Schiffn. in Engl. & Prantl., Nat. Pfl. fam 1, 3: 129. 1895.

Specimen/s examined: Kozhikode District: Govt. Arts & Science College Campus, Meenchanda (sea level), *Rajesh 6388, 6389, 6390* (ZGC).

Schiffneriolejeunea pulopenangensis (Gott.) Gradst., J. Hattori Bot. Lab. 38: 335. 1974.

Specimen/s examined: Kozhikode District: ZG College Campus (40 m) *Rajesh 111626* (ZGC).

Hornworts

Anthoceros angustus St., Spec. Hep. 5: 1001. 1916.

Specimen/s examined: Kozhikode District: Ramanattukara, *Rajesh, 418, 420* (ZGC).

Anthoceros subtilis Steph., Spec. Hep. 5: 1003. 1916.

Specimen/s examined: Kozhikode District: ZGC Campus (40 m) *Rajesh, 111619, 11139* (ZGC).

Notothylas levieri Schiffn. ex Steph., Sp. Hep. 5: 1021. 1917.

Specimen/s examined: Kozhikode District: ZG College Campus (50 m) *Rajesh 410* (ZGC).

Mosses

Garckea flexuosa (Griff.) Margad. & Nork., J. Bryol. 7: 440. 1973.

Specimen/s examined: Kozhikode District: ZG College Campus (40 m), *Rajesh, 111603, 111629, 111645*; Peruvannamuzhi, Near IISR, (52m), *Rajesh 4751* (ZGC).

Leucophanes albescens C.Muell., Bot. Zeit., 22: 347. 1864.

Specimens/ examined: Kozhikode District: Kakkavayal (100 m), *Rajesh 1194* (ZGC).

Octoblepharum albidum Hedw., Sp. Musc. 50. 1801.

Specimen/s examined: Kozhikode District: ZG College Campus (40 m) *Rajesh, 111602, 111665, 111657*; Peruvannamuzhi, Near IISR (50m), *Rajesh 4626, Rajesh 4766* (ZGC).

Fissidens bryoides Hedw., Species Musc. Frond. 153. 1801.

Specimen/s examined: Kozhikode District: ZG College Campus (40 m) *Rajesh, 111610, 111643, 111913*.

Fissidens ceylonensis Dozy & Molck., Ann. Sci. Nat. Bot. ser. 3(2): 304. 1844.

Specimen/s examined: Kozhikode District: ZG College Campus (40 m), *Rajesh 111609, 111631, 111648* (ZGC).

Fissidens crispulus Brid., *Musc. Rec. Suppl.* 4: 187. 1819 [1818]. var. *crispulus*: *Musc. Rec. suppl.* 4: 187. 1819.

Specimen/s examined: Kozhikode District: ZGC Campus (40 m) *Rajesh, 111611, 111920, 111922* (ZGC).

Fissidens flaccidus Mitt., *Trans. Linn. Soc. Lond.* 23: 56. 1860.

Specimen/s examined: Kozhikode District: ZG College Campus (40 m), *Rajesh, 111624* (ZGC).

Fissidens kurzii C. Muell., *Linnaea* 37: 163 (1872).

Specimen/s examined: Kozhikode District: Peruvannamuzhi, Near IISR, (52m), *Rajesh 4749, 4746* (ZGC).

Fissidens pulchellus Mitt. in *Musc. Ind. Or.* 140. 1859.

Specimen/s examined: Kozhikode District: Kakkavayal (100 m), *Reshma, 1185* (ZGC).

Calymperes afzelii Sw., *Jahrb. Gewachsk.* 1: 3. 1818.

Specimen/s examined: Kozhikode District: Kakkavayal (100 m), *Rajesh 1076b* (ZGC).

Calymperes erosum C.Muell., *Linnaea* 21: 182. 1848.

Specimen/s examined: Kozhikode District: Kakkavayal (100 m), *Rajesh 1062, 1175a* (ZGC).

Calymperes mangaloreense Dixon & P. de la Varde, *Arch. Bot. Bull. Mens.* 1(8–9): 164. 1927.

Specimen/s examined: Kerala, Kozhikode District: Ramanattukara (sea level) *6367 KPR* (MBG).

Calymperes tenerum C.Muell., *Linnaea* 37: 174. 1895.

Specimen/s examined: Kozhikode District: Arts College Campus, *Rajesh 6378, 6379, 6380, 6386, 6392, 6394b* (ZGC). ZG College Campus: *Rajesh 111617, 111634* (CALI).

Hyophila involuta (Hook.) A.Jaeger, *Ber. Senckenberg. Naturf. Ges.* 1871-72: 356. 1873.

Specimen/s examined: Kozhikode District: Govt. Arts & Science College Campus, Meenchanda, *Rajesh 6382*; ZGC Campus, *111604, 111630, 111647, 111650*; Kakkavayal (100 m), *Rajesh 1080*; Peruvannamuzhi, Near IISR (52m), *Rajesh 4755* (ZGC).

Semibarbula orientalis (F.Weber) Wilk & Margad., *Taxon* 8(2): 75. 1959.

Specimen/s examined: Kozhikode District: ZGC Campus, *Rajesh, 111614, 111632, 111640* (ZGC).

Gymnostomiella vernicosa (Hook.) M.Fleisch., *Musci. Fl. Buitenzorg* 1: 310. 1904.

Specimen/s examined: Kozhikode District: ZGC Campus, *Rajesh, 111615, 111633, 111644* (CALI).

Bryum coronatum Schwaegr., *Sp. Musc. Suppl.* 7(2): 103. 1816.

Specimen/s examined: Kozhikode District: ZG College Campus, *Rajesh 111601, 111618, 111635, 111661* (CALI).

Brym cellulare Hook., *Sp. Musc. Suppl.* 3 (1): 214. 1827.

Specimen/s examined: Kozhikode District: Kakkavayal (90 m), *Rajesh 1065* (ZGC).

Philonotis hastata (Duby) Wijk & Marg., Taxon 8: 74.1959.

Specimen/s examined: Kozhikode District: Govt. Arts & Science College Campus, Meenchanda, *Rajesh 6391b*; Botanical Garden, *Rajesh 111613*; ZGC Campus, *Rajesh 111662, 111673, 111689, 111691, 111695* (ZGC).

Stereophyllum ligulatum A.Jaeger, Ber. S. Gall. Naturw. Ges. 1877-78: 277. 1880.

Specimen/s examined: Kozhikode District: ZG College Campus, (50 m) *Rajesh, 111605, 111642, 111620* (CALI).

Entodontopsis nitens (Mitt.) W.R.Buck & R.R. Ireland, Nova Hedwigia 41: 104. 1985.

Specimen/s examined: Kozhikode District: Kakkavayal (100 m), *Rajesh 1043, 1196 b* (ZGC).

Entodontopsis wightii (Mitt.) W.R.Buck & Ireland, Nova Hedwigia 41: 106. 1985.

Specimen/s examined: Kozhikode District: Peruvannamuzhi, Near IISR, (55m), *Rajesh 4635* (ZGC).

Isopterygium albescens (Hook.) A.Jaeger, Ber. S. Gall. Naturw. Ges. 1876-77: 433. 1878.

Specimen/s examined: Kozhikode District: Kakkavayal (100 m), *Rajesh 1053, 1161, 1172* (ZGC).

Isopterygium minutirameum (C.Muell.) Jaeger, Ber. S. Gall. Naturw. Ges. 1876-77: 434. 1878.

Specimen/s examined: Kozhikode District: Kakkavayal (100m), *Rajesh 1074, 1078* (ZGC).

Isopterygium lignicola (Mitt.) Jaeger, Ber. S. Gall. Naturw. Ges., 1876-77: 432. 1878.

Specimen/s examined: Kozhikode District: Kakkavayal (100m), *Rajesh 1201*, (ZGC).

Foreauella orthothecia (Schwaegr.) Dixon. & P. Varde, J. Bot. 75: 129. 1937.

Specimen/s examined: Kozhikode District: Peruvannamuzhi, Near IISR (52m), *Rajesh 4624* (ZGC).

Sematophyllum subhumile (C.Muell.) M. Fleisch., Die Musci der Flora von Buitenzorg 4: 1264. 1923.

Specimen/s examined: Kozhikode District: ZG College Campus, *Rajesh 111628*; Kakkavayal (100 m), *Rajesh 1057* (ZGC).

Taxithelium nepalense (Schwaegr.) Broth. in Monsunia 1: 51. 1899.

Specimen/s examined: Kozhikode District: Kakkavayal (100 m), *Rajesh 1059, 1079, 1174, 1069 (a)* (ZGC).

Wijkia surcularis (Mitt.) Crum, Bryologist 74: 173. 1971.

Specimen/s examined: Kozhikode District: Peruvannamuzhi, Near IISR (52M), *Rajesh 4625, Rajesh 4655, Rajesh 4638* (ZGC).

Clastobryopsis muelleri (Dix.) Tix. in Rev. Bryol. Lichenol, 43: 413. 1977.

Specimen/s examined: Kozhikode District: Kakkavayal (100m), *Rajesh 1162* (ZGC).

Acroporium stramineum (Reinw. & Hornsch.) M. Fleisch., Musci Buitenzorg 4: 1301. 1923.

Specimen/s examined: Kozhikode District: Kakkavayal (100m), *Rajesh 106 b* (ZGC).

4. Discussion

Located in the west-coast of the Peninsular India, and the unique climatic conditions generated due to the Western Ghats mountains, provide a lot of habitats for the plants including Bryophytes. However, the distribution of the bryophytes is not uniform in this state. The diversity of the bryophytes varies along the altitudinal gradient. It is more in the higher attitudes. The low and midlands, being highly populated and altered over the ages, but holds less number of bryophytes. The present study was an effort to document the diversity of this group of plants in the low and mid altitude areas of the Calicut (Kozhikode) district of Kerala, and recorded 57 species. These are mainly composed of more light tolerant and generalist species.

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Fig. 1. Map of Kozhikode (Calicut) district, Kerala, India