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Floristic Diversity of Thevarmala Sacred Grove in Western Ghats, Kerala, India

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Abstract: *A study on the flowering plant diversity of Thevarmala sacred grove in the Western Ghats of Kerala region was carried out during the period 2015-2016. During the study a total of 152 species of flowering plants belong to 136 genera under 50 families were documented. Plants in all life forms, viz. herbs (56 species), shrubs (64 species) and trees (32 species) are well represented in the grove. Fabaceae is the dominant family with 15 species in 12 genera followed by Euphorbiaceae and Rubiaceae. As many as 17 families are represented by single species in each. Out of the 152 species 18 are rare endemics especially confined to the southern Western Ghats. About 62 % of the documented plants are having economic importance as medicine (76 species), food (8 species), timber (6 species), and fodder (3 species) or as source of commercially useful fibres and resins. 19 species documented in the present study are new record to the Kottayam district of Kerala state. The present conservation status of this sacred grove and future threats are also discussed in this paper.*

Keywords: *Sacred groves, Western Ghats, Kerala, Floristic diversity, Conservation.*

1. INTRODUCTION

Sacred groves are sanctified patches of native vegetation traditionally been protected on the ground of religious beliefs and are generally dedicated to different gods, goddesses, spirits, serpents, etc. These are the remnants of a rich indigenous vegetation that has existed in an area in the distant past and are survived the axe of development simply on grounds of religious beliefs. Each sacred grow has a deity and people are afraid to anger the deities when damaging the vegetation or overexploiting other resources of sacred groves as it is strongly believed that the deities will punish by bringing illness, deaths or misfortune. Religious sentiments thus played a critical role in the conservation of these natural treasures for centuries.

As described by Vartak (1983), sacred groves are natural museums of living giant trees, treasure house of rare, endemic and endangered species, dispensary of medicinal plants, recreation centre for urban life, garden for botanists, gene bank of economic species, paradise for nature lovers and laboratory for environmentalists. They are considered as repository of local biodiversity. The sacred groves play an important role in ecosystem services by providing clean air, soil and water, conservation of flora and fauna, temperature control and conservation of traditional knowledge. Being a biotype in a rural landscape, the sacred groves performs a critical role in the maintenance of ecological and hydrological balance of an area, and also help to compensate for carbon emissions of polluting industries and thereby offers economic benefits to the communities besides other ecological benefits (Chandrashekara, 2011).

Sacred groves are found in all continents except Antartica with varied religions and forms of social and economic organizations (Hughes & Chandran, 1998). In India the sacred groves are found scattered all over the country especially in the Khasi and Jaintia hills of Northeastern Himalayas, Aravalli Hills, Central India and Western Ghats. They are known under different names in different states like *Dev van* in Himachal Pradesh, *Orans* in Rajasthan, *Sarnas* in Bihar, *Lai Umang* in Manipur, *Ki Law Kyntang* in Meghalaya, *Dev* or *Sarna* in Madhya Pradesh, *Deovani*, *Devrai* or *Devrahati* in Maharashtra, *Devarabana*, *Devarakadu* or *Pavitravana* in Karnataka, *Kavu* or *Kovilkadu* in Tamil Nadu, and *Kavu* in Kerala (Murugan *et al*., 2008).

Sacred groves are seen throughout Kerala from coastal areas to the ghats and are having different cultural practices and belief systems. The area of sacred groves varies from few trees to several hectares. In Kerala, the sacred groves are mostly distributed along the plains of northern and southern

Kerala and are comparatively well studied (Induchoodan, 1998, Jayarajan, 2004; Chandrashekara, 2011; Sreevidhya, 2014). However, the sacred groves in central Kerala, especially in Kottayam and Idukki districts are poorly explored. Haritha *et al*. (2014 & 2015) studied the floristic wealth of some selected sacred groves in Kottayam district. However, the studied groves are located in the plains and are representative of low land vegetation of Kottayam district. In this scenario, the present investigation on the floristic diversity of Thevarmala sacred grove is of special relevance, since this sacred grove represents the few sacred groves in Kerala above 400 m altitude with unique Western Ghats floristic composition. The evergreen forests in the high ranges of Kottayam district are widely cleared a century ago for the establishment of Rubber plantations and Thevarmala sacred grove has become a refuge for some rare endemic and medicinally useful plants in that area.

1.1. Study Area

The study area, Thevarmala sacred grove is located in central Kerala, near Kayyur, in the Bharananganam panchayat of Kottayam revenue district, lies between 9^0 75' North latitude and 76^0 70' East longitude (**Fig. 1.a.**). The grove is situated on the top of a small hill called Thevarmala, at 450–480 m altitude above the mean sea level and covers an area of 15 acres of land. The grove is associated with a temple dedicated to Lord Sankaranarayana and Pandavas, since the origin of the grove is related to the epic Mahabharatha. The grove is managed by three Nair families namely, Kulappuram, Chooramala and Machukad. Womens are not allowed to enter in to the grove and temple.

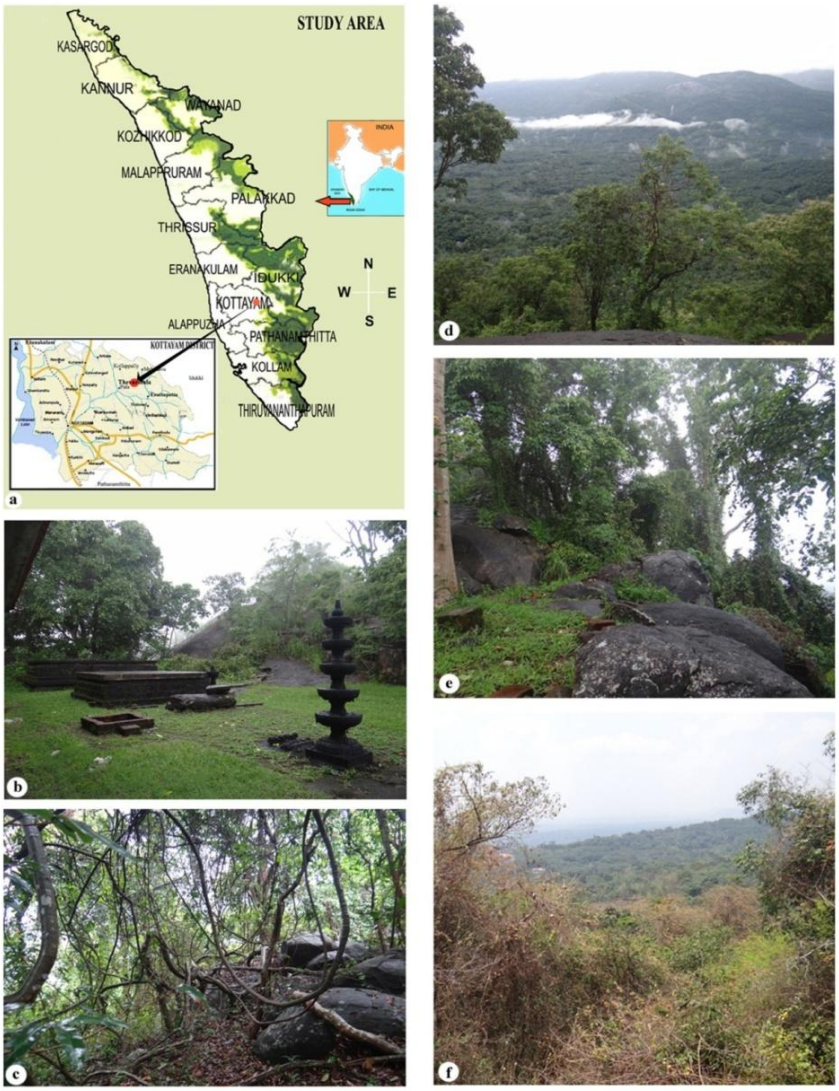

Figure 1. a. *Location of Thevarmala sacred grove; b-f. Vegetation of Thevarmala sacred grove.*

1.2. Climate and vegetation

This sacred grove is located in the border of Kottayam and Idukki district in southern Western Ghats and receives comparatively higher rate of south-west and north-east monsoon. The mean annual rainfall is 2700 mm. The mean annual temperature varies from 25^0 C to 31^0 C. The temperature drops to 18^0 C–20^0 C during winter and raises to 35^0 C–38^0 C in summer months. The mean relative humidity varies from 80–90 % during rainy seasons and lowers to 65–70 % in summer months.

The natural vegetation of the sacred grove is mixed deciduous type (Fig. 1.b.–f.). During the rainy season the canopy looks similar to that of semi-evergreen forests and during dry season some of the trees shed their leaves and revealed its deciduous nature. *Albizia odoratissima* (L. f.) Benth., *Ceiba pentandra* (L.) Gaertn., *Dalbergia latifolia* Roxb., *Pterocarpus marsupium* Roxb., *Strychnos nux-vomica* L., *Terminalia paniculata* Roth, *Vitex altissima* L. f., *Wrightia tinctoria* (Roxb.) R. Br. etc. are the dominating trees. Undergrowth is dominated by *Allophylus cobbe* (L.) Raeusch., *Breynea retusa* (Dennst.) Alston, *Canthium coromandelicum* (Burm. f.) Alston, *Chassalia curviflora* (Wall. ex Kurz) Thw., *Psilanthus travancorensis* (Wight & Arn.) Leroy etc. *Aganosma cymosa* (Roxb.) G. Don, *Dioscorea oppositifolia* L., *Jasminum coarctatum* Roxb., *Spatholobus parviflorus* (Roxb. ex DC.) O. Ktze., *Strychnos minor* Dennst., *Toxocarpus kleinii* Wight & Arn., *Zehneria maysorensis* (Wight & Arn.) Arn. etc. are the major climbers.

2. MATERIALS AND METHODS

Extensive floristic explorations were conducted in Thevarmala sacred grove during the period 2015-2016 in different seasons. Specimens of each taxon were collected and herbarium sheets were prepared as per the standard practices. Plants are identified with the help of regional floras like The Flora of Presidency of Madras (Gamble, 1915-1936), Flowering Plants of Travancore (Ram Rao, 1914.) etc. and also with the help of experts from Kerala Forest Research Institute, Peechi. Nomenclature and distribution details of each taxon are based on Sasidharan (2004) and Nair et al., (2014). The socio-cultural history of the grove is collected from the senior members of the governing families.

3. RESULTS & DISCUSSION

The present study was undertaken to assess the angiosperm plant diversity of Thevarmala sacred grove, Kottayam District, Kerala. This sacred grove is rather rich in its floristic composition. Mixtures of both evergreen and deciduous elements are found in the grove. A total of 152 species of flowering plants belong to 136 genera under 50 families were documented (Table 1). Dicots are dominating with 129 species in 41 families; meanwhile monocots are represented by 23 species in 22 genera under 9 families. In dicots, the group polypetalae is represented by 48 species (45 genera under 20 families), gamopetalae by 54 species (48 genera under 14 families) and monochlamydeae by 27 species (21 genera under 7 families). Details are illustrated in Fig.2.

Table1. *List of flowering plants in Thevarmala sacred grove.*

	Name of the plant	**Utility**
	1. **ACANTHACEAE**	
1	*Andrographis atropurpurea* (Dennst.) Alston	
2	*Justicia diffusa* Willd.	
3	*Justicia japonica* Thunb.	
4	*Phaulopsis imbricata* (Forssk.) Sweet.	Medicine (Ambasta, 1986)
	2. **AMARANTHACEAE**	
5	*Alternanthera brasiliana* (L.) Kuntze	
6	*Cyathula prostrata* (L.) Blume	Medicine (Vijaya Raghavan, 2011)
	3. ANACARDIACEAE	
7	*Holigarna arnottiana* Hook. f.	Medicine (Nambiar *et al*., 1985)
8	*Mangifera indica* L.	Medicine (Kirtikar & Basu, 1918) Food, Timber (Ambasta, 1986)
9	*Solenocarpus indicus* Wight & Arn.	
	4. APOCYNACEAE	
10	*Aganosma cymosa* (Roxb.) G. Don	
11	*Alstonia scholaris* (L.) R. Br.	Medicine (Vijaya Raghavan, 2011)
12	*Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don	Medicine (Nambiar *et al*., 1985)

13	*Ichnocarpus frutescens* (L.) R. Br.	Medicine (Nambiar *et al*., 1985)
14	*Tabernaemontana alternifolia* L.	Medicine (Nambiar *et al*., 1985)
15	*Wrightia tinctoria* (Roxb.) R. Br.	Medicine (Nambiar *et al*., 1985)
	5. ARACACEAE	
16	*Calamus rotang* L.	
17	*Caryota urens* L.	Medicine (Nambiar *et al*., 1985)
	6. ARACEAE	
18	*Colocasia esculenta* (L.) Schott	Medicine (Nambiar *et al*., 1985) Food (Ambasta, 1986)
19	*Pothos scandens* L.	Medicine (Parrota, 2001)
	7. ARALIACEAE	
20	*Schefflera venulosa* (Wight & Arn.) Harms	
	8. ARISTOLOCHIACEAE	
21	*Aristolochia indica* L.	Medicine (Nambiar *et al*., 1985)
22	*Thottea duchartrei* Sivar.	
	9. ASCLEPIADACEAE	
23	*Cosmostigma racemosum* (Roxb.) Wight	Medicine (Kirtikar & Basu, 1918)
24	*Gymnema sylvestre* (Retz.) R. Br. ex Schult.	Medicine (Kirtikar & Basu, 1918)
25	*Toxocarpus kleinii* Wight & Arn.	
	10. ASTERACEAE	
26	*Ageratum conyzoides* L.	Medicine (Kirtikar & Basu, 1918)
27	*Chromolaena odorata* (L.) King & Robins.	
28	*Crassocephalum crepidioides* (Benth.) S. Moore	Medicine (Ambasta, 1986)
29	*Elephantopus scaber* L.	Medicine (Parrota, 2001)
30	*Mikania micrantha* Kunth	
31	*Synedrella nodiflora* (L.) Gaertn.	
32	*Tridax procumbens* L.	Medicine (Ambasta, 1986)
33	*Vernonia cinerea* (L.) Less.	Medicine (Kirtikar & Basu, 1918)
	11. BALSAMINACEAE	
34	*Impatiens flaccida* Arn.	
	12. BOMBACACEAE	
35	*Ceiba pentandra* (L.) Gaertn.	Medicine (Kirtikar & Basu, 1918) Fibre (Ambasta, 1986)
	13. CAPPARACEAE	
36	*Cleome monophylla* L.	
	14. COMBRETACEAE	
37	*Calycopteris floribunda* Lam.	Medicine (Nambiar *et al*., 1985)
38	*Terminalia paniculata* Roth	Medicine (Kirtikar & Basu, 1918) Timber (Rama Rao, 1914)
	15. COMMELINACEAE	
39	*Commelina ensifolia* R. Br.	
40	*Cyanotis pilosa* Schult. & Schult. f.	
	16. CONVOLVULACEAE	
41	*Argyreia hirsuta* Wight & Arn.	
42	*Hewittia malabarica* (L.) Suresh	
43	*Ipomoea mauritiana* Jacq.	
44	*Ipomoea triloba* L.	
45	*Xenostegia tridentata* (L.) Austin & Staples	
	17. CUCURBITACEAE	
46	*Zehneria maysorensis* (Wight & Arn.) Arn.	
	18. CYPERACEAE	
47	*Cyperus dubius* Rottb.	
	19. DIOSCOREACEAE	
48	*Dioscorea bulbifera* L.	Medicine (Kirtikar & Basu, 1918) Food (Rama Rao, 1914)

49	*Dioscorea oppositifolia* L.	Medicine (Kirtikar & Basu, 1918) Food (Rama Rao, 1914)
	20. DIPTEROCARPACEAE	
50	*Vateria indica* L.	Medicine (Kirtikar & Basu, 1918) Food, Soft wood,Resin (Ambasta, 1986)
	21. EUPHORBIACEAE	
51	*Aporosa cardiosperma* (Gaertn.) Merr.	Medicine (Nambiar *et al*., 1985)
52	*Breynia retusa* (Dennst.) Alston	Medicine (Ambasta, 1986)
53	*Briedelia retusa* (L.) A. Juss.	Medicine (Parrota, 2001) Timber (Ambasta, 1986)
54	*Briedelia stipularis* (L.) Blume	Medicine (Nambiar *et al*., 1985)
55	*Euphorbia hirta* L.	Medicine (Kirtikar & Basu, 1918)
56	*Euphorbia thymifolia* L.	Medicine (Kirtikar & Basu, 1918)
57	*Flueggea virosa* (Roxb. ex Willd.) Voigt	
58	*Macaranga peltata* (Roxb.) Muell.-Arg.	
59	*Manihot carthaginensis* ssp. *glaziovii* (Muell-.Arg.) Allem	
60	*Micrococca mercurialis* (L.) Benth.	
61	*Microstachys chamaelea* (L.) Muell.-Arg.	
62	*Phyllanthus airy-shawii* Brunel & Roux	
63	*Phyllanthus amarus* Schum. & Thonn.	Medicine (Nambiar *et al*., 1985)
64	*Phyllanthus myrtifolius* Moon	Ornamental
	22. FABACEAE	
	Subfamily Papilionoideae	
65	*Abrus precatorius* L.	Medicine (Nambiar *et al*., 1985)
66	*Abrus pulchellus* Wall. ex Thw.	
67	*Dalbergia lanceolaria* L. f.	Timber (Ambasta, 1986)
68	*Dalbergia latifolia* Roxb.	Timber (Ambasta, 1986)
69	*Desmodium motorium* (Houtt.) Merr.	Medicine (Nambiar *et al*., 1985)
70	*Desmodium triflorum* (L.) DC.	Medicine (Kirtikar & Basu, 1918)
71	*Pterocarpus marsupium* Roxb.	Medicine (Kirtikar & Basu, 1918) Timber (Ambasta, 1986)
72	*Pueraria phaseoloides* (Roxb.) Benth.	
73	*Spatholobus parviflorus* (Roxb. ex DC.) O. Ktze.	Medicine (Nambiar *et al*., 1985)
74	*Vigna dalzelliana* (O. Kzte.) Verdc.	Food (Ambasta, 1986)
	Subfamily Caesalpinioideae	
75	*Senna alata* (L.) Roxb.	
	Subfamily Mimosoideae	
76	*Acacia pennata* (L.) Willd.	Medicine (Kirtikar & Basu, 1918)
77	*Albizia odoratissima* (L. f.) Benth.	Medicine (Nambiar *et al*., 1985)
78	*Mimosa pudica* L.	Medicine (Kirtikar & Basu, 1918)
79	*Paraserianthes falcataria* (L.) Neils.	
	23. LAMIACEAE	
80	*Anisochilus carnosus* (L. f.) Wall. ex Benth.	Medicine (Nambiar *et al*., 1985)
81	*Leucas aspera* (Willd.) Link	Medicine (Nambiar *et al*., 1985)
	24. LAURACEAE	
82	*Cinnamomum malabatrum* (Burm. f.) Blume	
83	*Litsea coriacea* (Heyne ex Meisner) Hook. f.	
	25. LOGANIACEAE	
84	*Fagraea ceilanica* Thunb.	
85	*Strychnos minor* Dennst.	
86	*Strychnos nux-vomica* L.	Medicine (Nambiar *et al*., 1985)
	26. MALVACEAE	
87	*Hibiscus rosa-sinensis* L. var. *rosa-sinensis*	Ornamental
88	*Sida alnifolia* L.	Medicine (Nambiar *et al*., 1985)

89	*Urena lobata* L. ssp. *lobata*	Medicine (Kirtikar & Basu, 1918)
	27. MELASTOMACEAE	
90	*Clidemia hirta* (L.) D. Don	
91	*Melastoma malabathricum* L.	Medicine (Nambiar *et al*., 1985)
92	*Memecylon umbellatum* Burm.f.	Medicine (Nambiar *et al*., 1985)
93	*Osbeckia virgata* D. Don ex Wight & Arn.	
94	*Sonerila wallichii* Bennett	
	28. MELIACEAE	
95	*Naregamia alata* Wight & Arn.	Medicine (Nambiar *et al*., 1985)
	29. MENISPERMACEAE	
96	*Cyclea peltata* (Lam.) Hook. f. & Thoms.	Medicine (Vijaya Raghavan, 2011)
97	*Diploclisia glaucescens* (Blume)Diels	Medicine (Ambasta, 1986)
	30. MORACEAE	
98	*Artocarpus heterophyllus* Lam.	Medicine (Kirtikar & Basu, 1918) Food, Timber (Ambasta, 1986)
99	*Artocarpus hirsutus* Lam.	Medicine (Nambiar *et al*., 1985)
100	*Ficus arnottiana* (Miq.) Miq.	Medicine (Nambiar *et al*., 1985)
101	*Ficus religiosa* L.	
	31. MYRSINACEAE	
102	*Embelia tsjeriam-cottam* (Roem. & Schult.) DC.	Medicine (Nambiar *et al*., 1985)
	32. OCHNACEAE	
103	*Ochna obtusata* DC.	
	33. OLEACEAE	
104	*Jasminum coarctatum* Roxb.	Medicine (Nambiar *et al*., 1985)
105	*Olea dioica* Roxb.	Medicine (Kirtikar & Basu, 1918) Timber (Watt, 1885)
	34. ORCHIDACEAE	
106	*Bulbophyllum sterile* (Lam.) Suresh	
107	*Dendrobium barbatulum* Lindl.	
108	*Habenaria longicornu* Lindl.	
109	*Pholidota imbricata* Hook.	
110	*Seidenfia rheedei* (Sw.) Szlach.	
	35. OXALIDACEAE	
111	*Biophytum sensitivum* (L.) DC.	Medicine (Kirtikar & Basu, 1918)
112	*Oxalis corniculata* L.	Medicine (Kirtikar & Basu, 1918)
	36. PERIPLOCACEAE	
113	*Hemidesmus indicus* (L.) R. Br.	Medicine (Nambiar *et al*., 1985)
	37. PIPERACEAE	
114	*Peperomia pellucida* (L.) Kunth	
115	*Piper trioicum* Roxb.	Medicine (Nambiar *et al*., 1985)
	38. POACEAE	
116	*Alloteropsis cimicina* (L.) Stapf	
117	*Arthraxon hispidus* (Thunb.) Makino	Fodder (Ambasta, 1986)
118	*Axonopus compressus* (Sw.) P. Beauv.	
119	*Digitaria ciliaris* (Retz.) Koeler	
120	*Eragrostis unioloides* (Retz.) Nees ex Steud.	Fodder (Rama Rao, 1914)
121	*Oplismenus compositus* (L.) P. Beauv.	
122	*Pennisetum polystachyon* (L.) Schult.	Fodder (Ambasta, 1986)
	39. RHAMNACEAE	
123	*Ziziphus oenoplia* (L.) Mill.	Medicine (Nambiar *et al*., 1985)
	40. RUBIACEAE	
124	*Canthium angustifolium* Roxb.	
125	*Canthium coromandelicum* (Burm. f.) Alston	

126	*Chassalia curviflora* (Wall. ex Kurz) Thw. var. *ophioxyloides* (Wall.) Deb & Krishna	Medicine (Rama Rao, 1914)
127	*Coffea arabica* L.	Medicine (Kirtikar & Basu, 1918) Food (Ambasta, 1986)
128	*Ixora coccinea* L.	Medicine (Kirtikar & Basu, 1918)
129	*Mitracarpus hirtus* (L.) DC.	
130	*Mussaenda frondosa* L.	Medicine (Kirtikar & Basu, 1918)
131	*Oldenlandia auricularia* (L.) K. Schum.	
132	*Oldenlandia umbellata* L.	
133	*Psilanthus travancorensis* (Wight & Arn.) Leroy	
134	*Spermacoce latifolia* Aubl.	
135	*Spermacoce ocymoides* Burm.f.	
	41. RUTACEAE	
136	*Aegle marmelos* (L.) Correa	Medicine (Nambiar *et al*., 1985)
137	*Glycosmis pentaphylla* (Retz.) DC.	Medicine (Watt, 1885)
	42. SAPINDACEAE	
138	*Allophylus cobbe* (L.) Raeusch.	Medicine (Ambasta, 1986)
	43. SCROPHULARIACEAE	
139	*Lindernia crustacea* (L.) F.v. Muell.	
140	*Scoparia dulcis* L.	Medicine (Kirtikar & Basu, 1918)
	44. SMILACACEAE	
141	*Smilax zeylanica* L.	Medicine (Ambasta, 1986)
	45. SOLANACEAE	
142	*Solanum violaceum* Ortega	Medicine (Ambasta, 1986)
	46. STERCULIACEAE	
143	*Helicteres isora* L.	Medicine (Nambiar *et al*., 1985)
144	*Pterospermum diversifolium* Blume	
145	*Sterculia villosa* Roxb. ex Smith	
	47. URTICACEAE	
146	*Pouzolzia zeylanica* (L.) Bennett	Medicine (Nambiar *et al*., 1985)
	48. VERBENACEAE	
147	*Clerodendrum infortunatum* L.	Medicine (Kirtikar & Basu, 1918)
148	*Lantana camara* L.	Medicine (Kirtikar & Basu, 1918)
149	*Stachytarpheta jamaicensis* (L.) Vahl	Medicine (Parrota, 2001)
150	*Vitex altissima* L. f.	
	49. VITACEAE	
151	*Cissus discolor* Blume	
	50. ZINGIBERACEAE	
152	*Curcuma neilgherrensis* Wight	

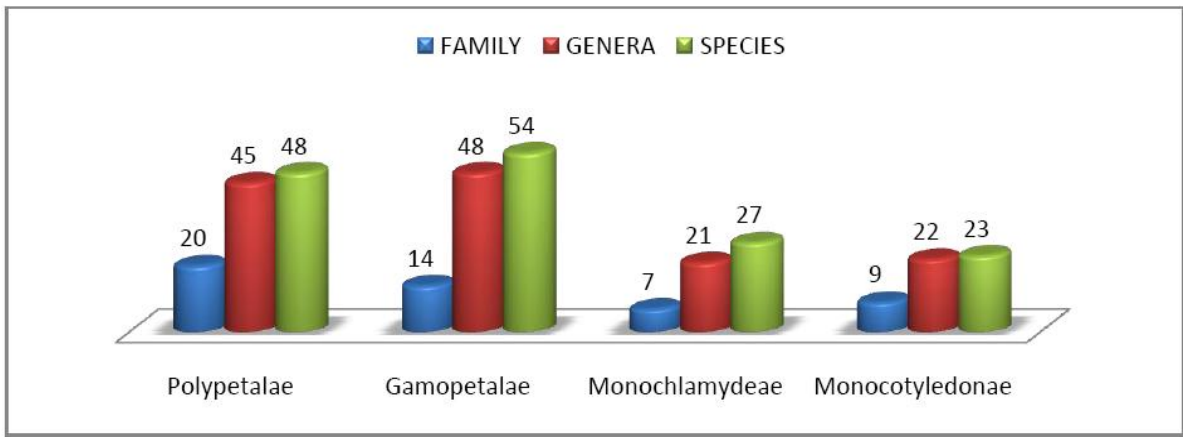

Figure 2. *Phytodiversity analysis of Thevarmala sacred grove.*

Among the families, Fabaceae dominates with 15 species in 12 genera followed by Euphorbiaceae (14 species in 10 genera) and Rubiaceae (12 species in 9 genera). As many as 16 families are represented by single species in each (Fig. 3.).

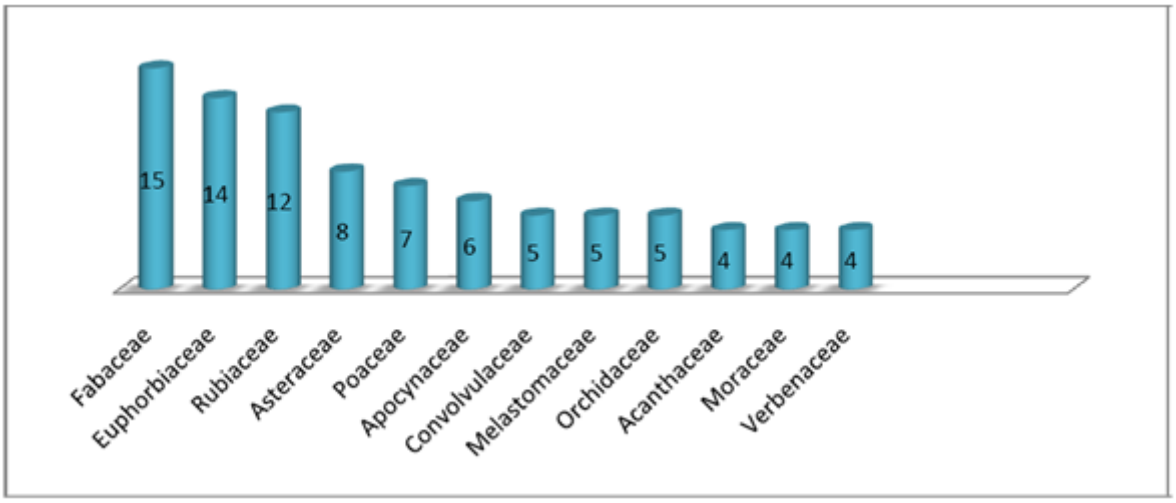

Figure 3. *Analysis of dominant Angiosperm families in Thevarmala sacred grove.*

The analysis of total life forms present in the sacred grove (Fig. 4.) revealed that shrubs are dominating with 64 species (42 %) followed by herbs with 56 species (37 %) and trees with 32 species (21 %). Almost half of the shrubs are climbers. Among the herbs, 3 orchids, namely, *Bulbophyllum sterile* (Lam.) Suresh, *Dendrobium barbatulum* Lindl. and *Pholidota imbricata* Hook. are epiphytes.

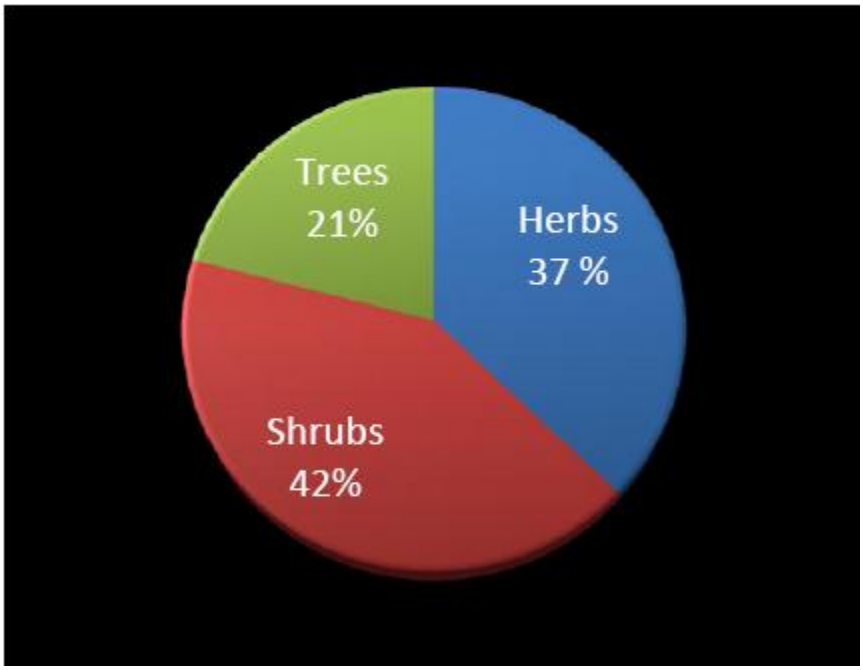

Figure 4. *Life form analysis of flowering plants in Thevarmala sacred grove.*

3.1. Endemic Plants

Endemism encompasses taxonomic units of any rank or taxa which occur in a biogeographical area usually isolated by geographical, ecological or temporal barriers and such species are known as endemic species. Thevarmala sacred grove is located in the Western Ghats, one of the world recognized biodiversity hotspot. Out of the 152 species documented in the present study 18 are endemic to Indian peninsula and majority of them are strictly confined to the Southern Western Ghats (**Fig. 5.a–r.)**. 18 species found only in the Western Ghats-Sri Lanka biodiversity hotspot. Presence of Critically Endangered trees like *Vateria indica* L., etc. makes the flora of this sacred grove invaluable.

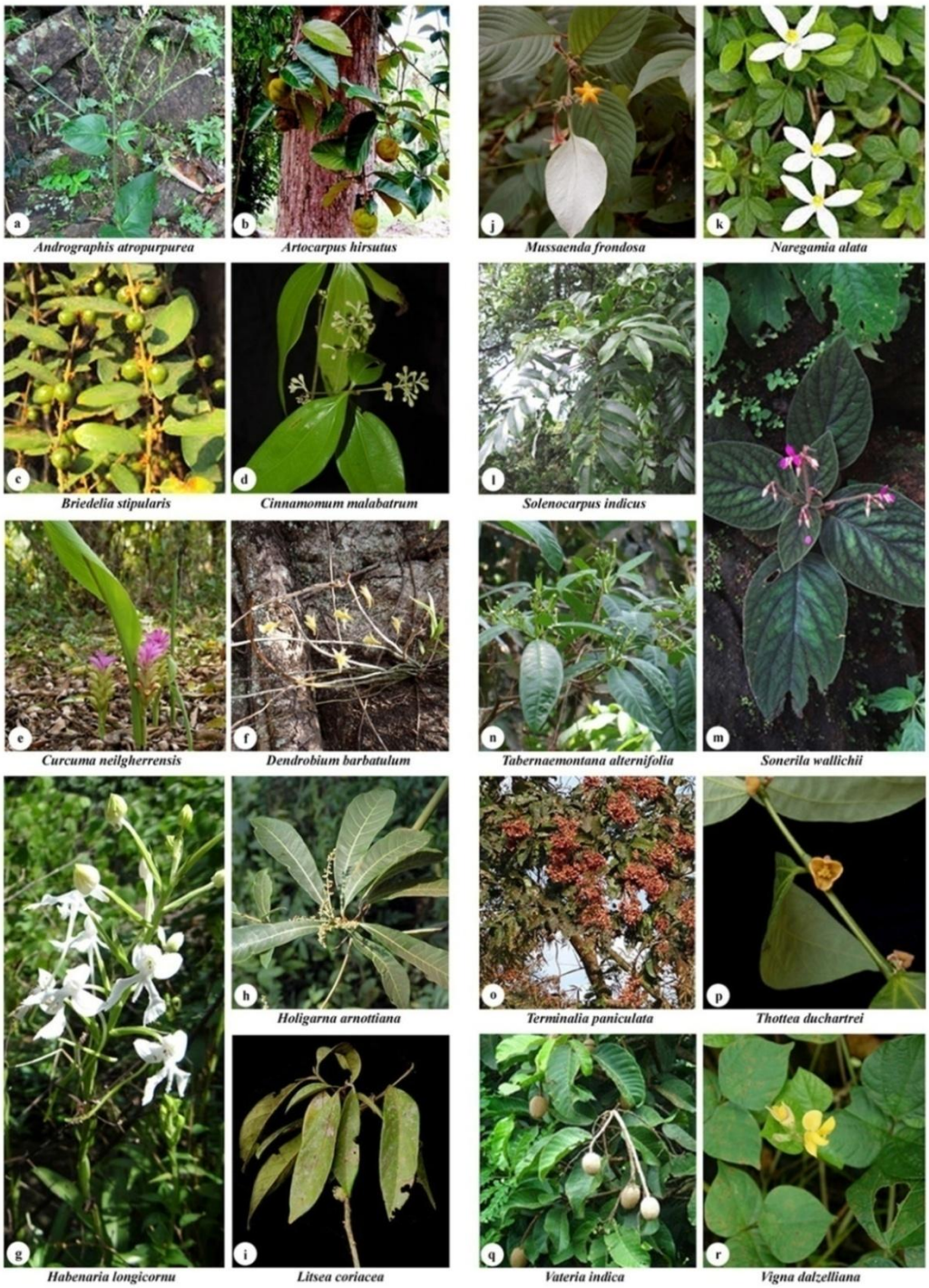

Figure 5. *a.–r. Indian endemic plants found in Thevarmala sacred grove*.

3.2. Economically important Plants

Thevarmala sacred grove is endowed with a large number of medicinally and economically useful plants. About half of the documented plants are having recorded medicinal properties. Anisochilus carnosus (L.f.) Wall. ex Benth., Aristolochia indica L., Cosmostigma racemosum (Roxb.) Wight, Dioscorea oppositifolia L., Embelia tsjeriam-cottam (Roem. & Schult.) DC., Gymnema sylvestre (Retz.) R. Br. ex Schult., Hemidesmus indicus (L.) R. Br., Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don, Ichnocarpus frutescens (L.) R. Br., Strychnos nux-vomica L., Vateria indica L., Wrightia tinctoria (Roxb.) R. Br., etc. are some widely used medicinal plants located in this sacred grove. Many plants are economically important as food (8 species), timber (6 species), and fodder (3 species) and as sources of fibres and resins (2 species).

3.3. Additions to the Flora of Kottayam District

Thevarmala sacred grove is also home to several plants that are not common in the rest of Kottayam district. *Abrus pulchellus* Wall. ex. Thw. (Fabaceae), *Aganosma cymosa* (Roxb.) G. Don (Apocynaceae), *Canthium angustifolium* Roxb. (Rubiaceae), *Canthium coromandelicum* (Burm. f.) Alston (Rubiaceae), *Calamus rotang* L. (Arecaceae), *Commelina ensifolia* R. Br. (Commelinaceae), *Dendrobium barbatulum* Lindl. (Orchidaceae), *Diploclisia glaucescens* (Blume) Diels (Menispermaceae), *Embelia tsjeriam-cottam* (Roem. & Schult.) DC. (Myrsinaceae), *Habenaria longicornu* Lindl. (Orchidaceae), *Impatiens flaccida* Arn. (Balsaminaceae), *Jasminum coarctatum* Roxb. (Oleaceae), *Justacia diffusa* Willd. (Acanthaceae), *Phyllanthus airy-shawii* Brunel & Roux (Euphorbiaceae), *Schefflera venulosa* (Wight & Arn.) Harms (Araliaceae), *Solenocarpus indicus* Wight & Arn. (Anacardiaceae), *Sterculia villosa* Roxb. ex Smith (Sterculiaceae), *Toxocarpus kleinii* Wight & Arn. (Asclepiadaceae) and *Thottea duchartrei* Sivar., Babu & Indu (Aristolochiaceae) are new additions to the flora of Kottayam district.

4. CONCLUSION

The present study aimed to study the floristic wealth of Thevarmala sacred grove, Kayyoor in Kottayam district of Kerala state. The study revealed that, the sacred grove is rich in its floristic wealth and is an abode of certain rare endemic as well as medicinally useful plants. A total of 152 species of flowering plants belong to 136 genera in 50 families were collected during the study and the specific and generic diversity present in this comparatively small area of land is exceptional. Among the 152 species documented in the present study, 18 species are Indian endemics and majority of them are very rare and are extremely restricted to the Southern Western Ghats. 19 species reported in this present study is new addition to the Kottayam district. While the adjacent forest areas were all cleared for agriculture and human settlements, this sacred grove is the last refuge for such rare plants in that area.

Similar to all other sacred groves, the sacred religious beliefs and associated taboos helped to prevent the over exploitation of the natural resources present in Thevarmala sacred grove. However, the present status of this sacred grove is rather precarious. Earlier the '*kavu*' was spreads in 50 acres of land, which has now been reduced to just 15 acres. Human interactions led to the degradation of the natural flora to a certain extent. Invasive alien species like *Alternanthera brasiliana* (L.) Kuntze, *Chromolaena odorata* (L.) King & Robins., *Lantana camera* L., etc. are also a threat to the native flora. Pressure from the ever increasing human population and the agriculture related activities in the adjacent private properties are adversely affecting this serene ecosystem. In this context, necessary actions are urgently needed to protect the invaluable natural wealth of this sacred grove from further degradation. The present scientific documentation of the floristic wealth of this sacred grove will be baseline data for the stakeholders to plan conservation strategies in the future.

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