

## Endemic and threatened flowering plants of sacred *Kaanu* forests of Sharavathi River basin, Central Western Ghats, Karnataka

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### ABSTRACT

Since long time, people of few villages located in the region of Sharavathi river basin conserved their village forests in the name of God as a cultural practice. Those sacred forests are generally called as *Kaanu* forests in the *Malenadu* region of Central Western Ghats. The traditional conservation practices followed was helped to retain its virgin state as a relic forest patch. The study area lies in the region of Central Western Ghats which is known for its luxuriant floristic wealth. In the present study, an attempt has been made to document the diversity and distribution of endemic and threatened flowering plants of sacred *Kaanu* forests in the region of Sharavathi river basin with due consideration of low disturbance. Evergreen to semi-evergreen vegetation type was observed. A total of 103 species of endemic & threatened categories in 79 genera which belongs to 43 families are recorded. The *Kaanu* forests having perennial stream supported high floral endemism. The diversity of life form includes herbs, shrubs, climbers, lianas, epiphytes, lithophytes and trees. A very less number of epipetric annual and epiphytic perennial endemic herbs were witnessed in the study area. Further, considering the existence of diverse endemic & threatened taxa in the region, the study emphasizes for strict conservation of relic forest patches.

**Key words:** Sharavathi river basin, *Kaanu* forest, Western Ghats, Endemic flowering plants, Threatened taxa

### INTRODUCTION

*Kaanu* forests are the sacred groves conserved by local communities which remain undisturbed since the ages. *Devarakadu*, *Nagarabana*, *Chowdivana* and *Kaanu* forests are similar in habitats & broad religious beliefs but they are the different ethnic names given by local community in Western Ghats part of Karnataka. The traditional practices implied for conservation has made them to retain its virgin state as a storehouse of number of endemic and threatened floristic wealth. These forests have remained in the Central Western Ghats as a set aside patch of thick forest for millennia and are considered to be a relic of the original forest vegetation of the region (Joshi & Gadgil, 1991). Under a community-based management, forests are used for their resources for various domestic, cultural & agricultural activities by ethnic community and not altered its land use pattern, leading to the creation of undisturbed or less altered forest patch as a sacred grove. The low disturbance and strict traditional way of conservation have influenced the ecology of an area to hold a number of characteristic rare, endemic and threatened (RET) species like *Madhuca bourdillonii* (Gamble) Lam, *Syzygium stocksii* (Duthie) Gamble, *Semecarpus kathalekanensis* Dasappa & Swam. They are also domiciling of wild relatives of cultivated plants, medicinal plants, perennial water source, endemic animals, birds, butterflies, insects etc. (Ghate *et al.*, 2004; Chandran *et al.*, 2010; Kulkarni *et al.*, 2014).

The sacred groves have been reported in many parts of Asia, Africa, Europe, Australia, and America by Hughes and Chandran (Hughes & Chandran, 1998). In India, sacred forests are found almost in all states with

differing numbers and areas especially in the regions where ethnic community lives. Western Ghats, Central India and North-eastern India are the major regions to have more sacred groves than any other regions of India (Gadgil & Varthak, 1976; Burman, 1992; Rodgers, 1994; Balasubramanyan & Induchoodan, 1996). In Kodagu district of Karnataka, Kushalappa *et al.*, (2001) documented 1214 sacred groves and 165 different deities under which *Kans* are protected. Though most of the sacred groves are much smaller category in area, Karnataka state is regarded as 'hotspot of sacred groves' for having highest density of the groves in the world (Khan & Tripathi, 2008; Kushalappa, Bhagwat & Kushalappa, 2001).

Thus, by considering the importance of sacred groves in conserving endemic and threatened species, an attempt has been made in the *Kaanu* forests of Sharavathi river basin to document the diversity and distribution of endemic and threatened species. The study serves a baseline data about the distribution of rare, endemic and threatened flowering plants for future research in floristic compositions.

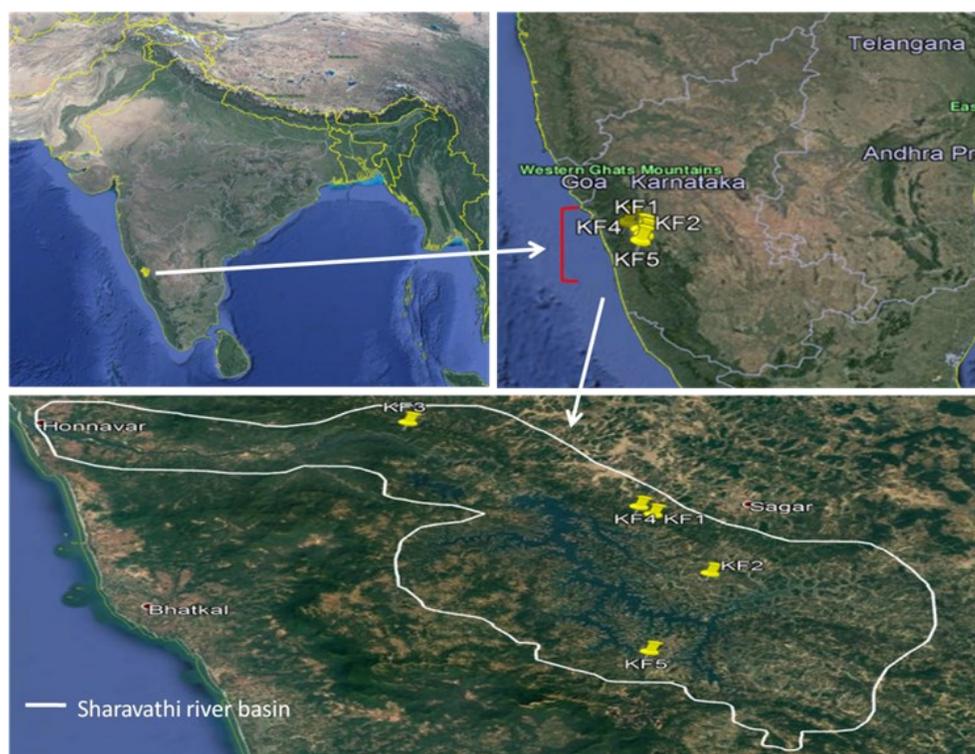
### Study area

The study was conducted in the sacred forests (*Kaanu*) of Sharavathi river basin region. The bigger size ( $\geq 10$ Ha) six *Kaanu* forests are categorized and shortlisted. The forests type is evergreen to semi-evergreen distributed in two taluks (Sagara, Hosanagara) of Shivamogga district and one taluk (Siddapura) of Uttara Kannada district. The area receives an average annual rainfall of 2500-3000mm. The location details of study stations are given in the Table 1 and Figure 1.

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**Table 1.** Location details of study stations

Station	Name/Locality/Taluk/District of Kaan forest	Location with respect to river basin	with river	Range of Location	Altitude range (m)
KF1	Rameshwara devarakadu/Hulkodu/Sagar/Shivamogga	Right bank		N 14°07'42.30" to 14°08'31.66" E 74°57'15.09" to 74°57'48.50"	581-773
KF2	Rameshwara Kaanu/Gullehalli/Sagar/Shivamogga	Right bank		N 14°02'39.05" to 14°02'53.13" E 75°00'17.71" to 75°00'37.24"	587-602
KF3	Kathalekanu/Kodkani/Siddapura/Uttara Kannada	Right bank		N 14°16'15.60" to 14°16'39.80" E 74°44'21.90" to 74°44'54.95"	535-635
KF4	Pandavara Kodlu/Hakkare/Sagar/Shivamogga	Right bank		14°08'48.49" to 14°08'56.94" E 74°56'34.33" to 74°56'41.44"	663-710
KF5	Eshwara Kaanu/Harigara/Hosanagara/Shivamogga	Left bank		N 13°55'10.14" to 13°55'35.00" E 74°57'14.60" to 74°57'26.95"	562-593

**Figure 1.** Map of study area (Map source – Google Earth)

The floristic survey was carried out for the period of three years (2017, 2018 & 2019). A random floristic survey through frequent field visits was followed to document diversity and distribution of angiosperms. The flora documented was identified using various regional and district floras such as Flora of the presidency of Madras, Flora of British India and Flora of Shivamogga district (Hooker, 1897; Gamble, 1994; Ramaswamy, Rao & Govindappa, 2001). The recorded angiosperms are categorized and sorted to shortlists of endemic species using literature and digital herbaria (Gunaga *et al.*, 2015; Page, 2017; Herbarium JCB, 2012; Herbarium JCB, 2020). The threatened species list categorized using available IUCN records (IUCN, 2020). Some of the collected flowering specimen was given DBT voucher and stored in Biodiversity laboratory of DBT BUILDER Project, Kuvempu University.

## RESULTS AND DISCUSSION

### *Diversity and Distribution*

The evaluation of floristic survey of endemic and threatened flowering plants across selected *Kaanu* forests in the region of Central Western Ghats have come up with the documentation of 103 species in 79 genera of 43 diverse families. The detailed checklists of recorded endemic and threatened taxa are given in the Table. 2. The vegetation type of sacred forests is tropical evergreen and tropical semi-evergreen types. *Gymnacranthera canarica* (Bedd. ex King) Warb, *Myristica fatua* var. *magnifica* (Bedd.) Sinclair, *Myristica malabarica* Lamarck were typical *Myristica* swamp species recorded in the study stations. Among five stations, Rameshwara devarakadu (KF1), Kathlekanu (KF3) and Pandavara Kodlu (KF4) are having a patch of swamp forest. The station KF3, Kathlekanu in Siddapura taluk have greater number of

characteristic swamp species such as *Gymnacranthera canarica* (Bedd. ex King) Warb, *Myristica fatua* var. *magnifica* (Bedd.) Sinclair, *Pinanga dicksonii* (Roxb.) Blume, *Semecarpus kathalekanensis* Dasappa & Swam, *Syzigium stocksii* (Duthie) Gamble and *Dipterocarpus indicus* Bedd. It is a low lying evergreen forest receiving much rainfall than other stations during south-west monsoon and also had a very low anthropogenic disturbance. These factors structured the ecology of an area to hold diverse swamp species and also the occurrence of these species provides a relic status (Chandran *et al.*, 2010).

The station KF1 has only *Syzigium stocksii* (Duthie) Gamble while KF4 has *Pinanga dicksonii* (Roxb.) Blume and *Dipterocarpus indicus* Bedd. The station KF4 is a small category swamp forest with considerable number of young saplings of southern climax species *Dipterocarpus indicus* Bedd.

The station KF2 is a disturbed, low rainfall area having *Myristica malabarica* Lamarck only while station KF5 does not have any characteristic swamp species as it is a tropical semi evergreen forest harboring less number of endemic species. The diversity of endemic and threatened species is more in sacred grove having perennial stream while non stream station have less number of endemic species. Most of these swamp species occur in huge number in a very small area is observed. The micro climate of a stream forest sheltered endemic and threatened species forming a very fragile ecosystem which deserves strict conservation to preserve the climax species of swampy relic forests.

In our study, among 5 selected sacred landscapes of Sharavathi river basin, 3 stations are located in Sagara taluk. The floristic survey study of sacred groves of Sagar taluk had recorded three major swamp species while our study recorded seven major swamp species (Gunaga *et al.*, 2015).

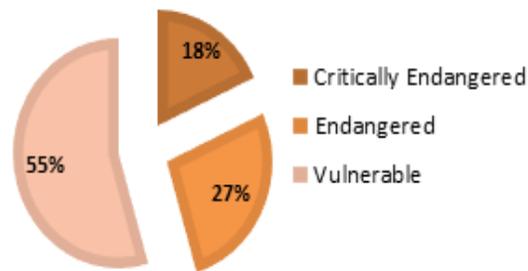
### Threatened Species

The recorded species *Semecarpus kathalekanensis* Dasappa & Swam. & *Syzigium stocksii* (Duthie) Gamble belongs to critically endangered status. *Syzigium stocksii* (Duthie) Gamble was recorded in two of the Kaanu forests (KF1 & KF3) having perennial stream. *Semecarpus kathalekanensis* Dasappa & Swam is found only in KF3 station which is its type locality- Kathalekan forest. The red listed species, *Semecarpus kathalekanensis* Dasappa & Swam. is known only from its type locality till Gaonkar *et al.*, (2014) reported it in swamp forest of Goa (Gaonkar *et al.*, 2014).

Three endangered species such as *Dipterocarpus indicus* Bedd, *Hopea ponga* (Dennst.) Mabb from a tropical family Dipterocarpaceae and *Syzigium caryophyllatum* (L.) Alston of Myrtaceae is witnessed in our study stations. *Dipterocarpus indicus* Bedd recorded in two stations (KF3 & KF4) while *Hopea ponga* (Dennst.) Mabb recorded in all stations. Many number of adult & young saplings of *Hopea ponga* (Dennst.) Mabb is found to gather in smaller areas of all stations.

*Impatiens pulcherrima* Dalzell, *Diospyros candolleana* Wight, *Mallotus aureopunctatus* (Dalzell) Mull.Arg., *Saraca asoca* (Roxb.)Willd., *Gymnacranthera canarica* (Bedd. ex King) Warb., *Myristica malabarica* Lamarck are vulnerable species recorded in the study stations. *Impatiens pulcherrima* Dalzell, an annual species considered as a weed in associated agriculture field nearby study stations. It occurs along the borders of Kaanu forest under open canopy or forest clearings.

*Diospyros candolleana* Wight recorded in all the study stations with scattered distribution where as *Myristica malabarica* Lamarck and *Mallotus aureopunctatus* (Dalzell) Mull.Arg recorded in only one station KF2 & KF3 respectively. The study station Gullehalli Kaanu (KF2) has no perennial stream but still has one species of *Myristica* which is known from only swampy habitat in the South and Central Western Ghats. There is only two individuals (>30cm DBH) of *Myristica malabarica* Lamarck was noticed in an area of 5 hectare area in station KF2. The percentage scale of three different threatened categories are demonstrated in Figure 2.



**Figure 2.** Percentage comparison of flowering plants under different threatened categories recorded in the study area.

### Endemics

Among the recorded flowering plants, 49 species are endemic to Western Ghats. Two species such as *Beilschmiedia dalzellii* (Meisn.) Kosterm and *Curcuma karnatakensis* Amalraj, Velay. & Mural. endemic to Western Ghats part of Karnataka recorded in the study stations. *Beilschmiedia dalzellii* (Meisn.) Kosterm recorded in KF3 station where as *Curcuma karnatakensis* Amalraj, Velay. & Mural. recorded in KF1 & KF5 stations. The genera *Actinodaphne* of lauraceae, *Diospyros* of ebenaceae, *Holigarna* of anacardiaceae and *Psychotria* of rubiaceae contributed each three species endemic to Western Ghats. The study stations hold greater number of species endemic to Western Ghats. It is predominated by the species endemic to Indo-Srilankan range. Endemism is comparatively higher in the stations (KF1 & KF3) having perennial streams was observed. Between these two stations, endemism is greater in KF3 (Kathlekanu) station having low disturbed swamp forest patches.

### Habit type

The dominated habit type is tree with 62 species and that is followed by shrub type with 18 species. A wild distribution of a liana *Thunbergia mysorensis* (Wt.) T.Anderson endemic to Western Ghats recorded in KF1, KF3 & KF4 stations. It is now cultivated throughout India for its beautiful saffron yellow inflorescence for the purpose of adornment in educational institutions, hotels, parks etc. An only species of cane habit type i.e, *Calamus thwaitesii* Becc. and palm habit type i.e, *Pinanga dicksonii* (Roxb.) Blume is recorded. *Pinanga dicksonii* (Roxb.) Blume is recorded in two stations (KF3 & KF4) while *Calamus thwaitesii* Becc. is recorded in KF3 station only. Two species with herb lithophytic habit from the genus *Begonia* of Begonaceae and two species with herb epiphytic habit from the genera *Bulbophyllum* & *Kingidium* of orchidaceae recorded. The percentage comparison of habit type contribution is showed in Figure 4.

**Table 2.** Detailed checklist of endemic and threatened flowering plants of sacred *kaan* forests of Sharavathi river basin, Central Western Ghats, Karnataka.

SL NO.	Family/Botanical Name	Habit/ Endemism/IUCN Status	Voucher	Distribution
<b>Acanthaceae</b>				
1	<i>Thelepaepale ixiocephala</i> (Benth.) Bremek.	US/WG/NE	-	All stations
2	<i>Thunbergia mysorensis</i> (Wt.) T.Anderson	L/WG/NE	-	KF1, KF3, KF4
<b>Anacardiaceae</b>				
3	<i>Holigarna arnottiana</i> J. Hooker	T/WG/NE	-	All stations
4	<i>Holigarna ferruginea</i> Marchand	T/WG/NE	-	KF3
5	<i>Holigarna grahamii</i> (Wight) Kurz	T/WG/NE	-	All stations
6	<i>Nothopegia racemosa</i> (Dalzell) Ramamoorthy	T/IS/NE	KUBPHS6	All stations
7	<i>Semecarpus kathalekanensis</i> Dasappa & Swam.	T/WG/CR	KUBPHS7	KF3
<b>Ancistrocladaceae</b>				
8	<i>Ancistrocladus heyneanus</i> Wall. ex J.Graham	L/PI/NE	-	All stations
<b>Annonaceae</b>				
9	<i>Artabotrys zeylanicus</i> J. Hooker & Thoms.	L/IS/NE	-	All stations
10	<i>Desmos lawii</i> (Hooker.f. & Thomson) Safford	S/IS/NE	-	KF1, KF3
11	<i>Goniothalamus cardiopetalus</i> (Dalz.) J. Hk. & Thoms.	T/WG/NE	KUBPHS125	KF1, KF3
12	<i>Meiogyne pannosa</i> (Dalzell) Sinclair	T/WG/LC	-	All stations
13	<i>Orophea zeylanica</i> J. Hooker & Thoms.	S/IS/NE	-	KF1, KF3, KF4
<b>Apocynaceae</b>				
14	<i>Hoya wightii</i> J.Hooker	C/PI/NE	-	All stations
<b>Areaceae</b>				
15	<i>Calamus thwaitesii</i> Becc.	Ca/WG/NE	-	KF3
16	<i>Pinanga dicksonii</i> (Roxb.) Blume	P/WG/NE	-	KF3, KF4
<b>Balsaminaceae</b>				
17	<i>Impatiens pulcherrima</i> Dalzell	H/WG/VU	-	KF1
18	<i>Impatiens minor</i> (DC.) Bennet	H/PI/LC	-	All stations
<b>Begonaceae</b>				
19	<i>Begonia crenata</i> Dryand	LH/PI/NE	-	KF3
20	<i>Begonia malabarica</i> Lam	LH/SI/NE	-	KF1, KF3
<b>Burseraceae</b>				
21	<i>Canarium strictum</i> Roxb	T/WG/NE	-	All stations
<b>Calophyllaceae</b>				
22	<i>Calophyllum apetalum</i> Willd	T/WG/NE	-	KF3
23	<i>Mammea suriga</i> (Buch.-Ham. ex Roxb.) Kosterm.	T/WG/NE	-	All stations
<b>Celastraceae</b>				
24	<i>Euonymus indicus</i> B.Heyne ex Wall.	T/SI/NE	-	KF1, KF3
25	<i>Lophopetalum wightianum</i> Arn.	T/IM/LC	-	KF3, KF4, KF5
26	<i>Maytenus rothiana</i> (Walp.) Ramamoorthy	S/PI/NE	KUBPHS106	All stations
27	<i>Salacia oblonga</i> Wall. ex Wight & Arn.	CS/IS/NE	-	KF3
<b>Clusiaceae</b>				
28	<i>Garcinia gummi-gutta</i> (L.) N.Robson	T/IS/LC	-	KF3
29	<i>Garcinia indica</i> (Dupetit-Thouars) Choisy	T/WG/NE	-	KF2, KF4
30	<i>Garcinia morella</i> (Gaertn.) Desr.	T/IM/NE	KUBPHS98	All stations
<b>Connaraceae</b>				
31	<i>Connarus wightii</i> Hook. f.	L/SWI/NE	KUBPHS15	KF3, KF4
<b>Dichapetalaceae</b>				
32	<i>Dichapetalum gelonioides</i> (Roxb.) Engl.	S/IM/NE	-	All stations
<b>Dipterocarpaceae</b>				
33	<i>Dipterocarpus indicus</i> Bedd.	T/WG/EN	-	KF3, KF4
34	<i>Hopea ponga</i> (Dennst.) Mabb.	T/WG/LC	-	All stations
35	<i>Vateria indica</i> L.	T/WG/LC	-	All stations
<b>Ebenaceae</b>				
36	<i>Diospyros candolleana</i> Wight	T/WG/VU	-	All stations
37	<i>Diospyros paniculata</i> Dalzell	T/WG/NE	-	KF3, KF4
38	<i>Diospyros sylvatica</i> Roxb.	T/WG/NE	-	KF2, KF3
<b>Elaeocarpaceae</b>				
39	<i>Elaeocarpus serratus</i> L.	T/IM/NE	KUBPHS21	All stations
<b>Euphorbiaceae</b>				
40	<i>Antidesma menasu</i> Muell.-Arg.	T/WPI/NE	-	KF1
41	<i>Glochidion ellipticum</i> Wight	T/WG/NE	KUBPHS99	All stations
42	<i>Mallotus aureopunctatus</i> (Dalzell) Mull.Arg.	S/WG/VU	-	KF3
43	<i>Mallotus beddomei</i> Hook.f.	S/WG/NE	KUBPHS24	KF3

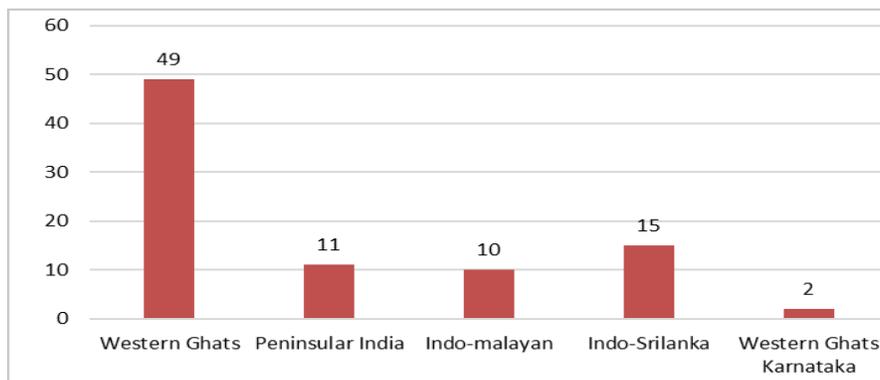
Table 2 contd.

	<b>Fabaceae</b>			
44	<i>Moullava spicata</i> (Dalzell) Nicolson	L/SWI/NE	-	All stations
45	<i>Saraca asoca</i> (Roxb.) Willd.	T/IS/VU	-	KF1
	<b>Lamiaceae</b>			
46	<i>Callicarpa tomentosa</i> (L.) Murray	T/SWI/NE	KUBPHS30	All stations
	<b>Lauraceae</b>			
47	<i>Actinodaphne angustifolia</i> (Blume) Nees	T/WG/NE	KUBPHS61	All stations
48	<i>Actinodaphne hookeri</i> Meisner	T/WG/NE	-	KF1, KF3
49	<i>Actinodaphne malabarica</i> N.P. Balakr	T/WG/NE	-	KF3
50	<i>Beilschmiedia dalzellii</i> (Meisn.) Kosterm	T/WGK/NE	-	KF3
51	<i>Cinnamomum malabatum</i> (Burm.f.) Blume	T/SI/NE	-	All stations
52	<i>Cryptocarya wightiana</i> Thwaites	T/WG/NE	-	KF3
53	<i>Litsea floribunda</i> (Blume) Gamble	T/WG/NE	KUBPHS35	All stations
54	<i>Litsea stocksii</i> var. <i>glabrescens</i>	T/WG/NE	KUBPHS37	KF3
55	<i>Luvunga sarmentosa</i> (Blume) Kurz	S/IM/NE	-	All stations
56	<i>Persea macrantha</i> (Nees) Kosterm	T/IS/NE	-	All stations
	<b>Malvaceae</b>			
57	<i>Pterospermum reticulatum</i> Wight & Arn.	T/SI/LC	KUBPHS45	All stations
	<b>Melastomataceae</b>			
58	<i>Memecylon malabaricum</i> (C.B. Clarke) Cogn.	T/WG/NE	KUBPHS40	All stations
59	<i>Memecylon randerianum</i> S.M. Almeida & M.R. Almeida	S/SWG/NE	-	All stations
60	<i>Memecylon talbotianum</i> Brandis	T/SWI/NE	KUBPHS85	KF2, KF3, KF4
61	<i>Memecylon umbellatum</i> N. Burman	T/IS/NE	-	All stations
	<b>Meliaceae</b>			
62	<i>Dysoxylum malabaricum</i> Bedd. ex Hiern	T/WG/NE	-	All stations
	<b>Moraceae</b>			
63	<i>Artocarpus hirsutus</i> Lam.	T/SWI/NE	-	All stations
64	<i>Ficus beddomei</i> King	T/SI/NE	-	KF2, KF3
	<b>Myristicaceae</b>			
65	<i>Gymnacranthera canarica</i> (Bedd. ex King) Warb.	T/WG/VU	-	KF3
66	<i>Knema attenuata</i> (Hook.f. & Thomson) Warburg	T/PI/LC	KUBPHS47	All stations
67	<i>Myristica fatua</i> var. <i>magnifica</i> (Bedd.) Sinclair	T/WG/NE	-	KF3
68	<i>Myristica malabarica</i> Lamarck	T/WG/VU	-	KF2, KF4
	<b>Myrtaceae</b>			
69	<i>Syzygium caryophyllatum</i> (L.) Alston	T/IS/EN	-	All stations
70	<i>Syzygium gardneri</i> Thwaites	T/IS/NE	-	KF2, KF4
71	<i>Syzygium laetum</i> (Buch.-Ham.) Gandhi	T/WG/NE	-	All stations
72	<i>Syzygium stocksii</i> (Duthie) Gamble	T/WG/CR	-	KF1, KF3
	<b>Oleaceae</b>			
73	<i>Jasminum malabaricum</i> Wight	CS/SWI/NE	KUBPHS48	All stations
74	<i>Linociera malabarica</i> Wall. ex G. Don	T/PI/NE	-	All stations
75	<i>Olea dioica</i> Roxb.	T/PI/NE	KUBPHS49	All stations
	<b>Orchidaceae</b>			
76	<i>Bulbophyllum neilgherrense</i> Wight	EH/PI/EN	-	All stations
77	<i>Kingidium deliciosum</i> (Reichb.f.) Sweet	EH/PI/NE	-	KF3
78	<i>Malaxis versicolor</i> (Lindl.) Abeywickr.	H/IS/NE	-	All stations
	<b>Passifloraceae</b>			
79	<i>Adenia hondala</i> (Gaertn.) W.J. de Wilde	L/SI/R	-	KF1, KF2, KF3
	<b>Piperaceae</b>			
80	<i>Piper hookeri</i> Miq.	BC/WG/NE	-	All stations
	<b>Pittosporaceae</b>			
81	<i>Pittosporum dasycaulon</i> Miq.	T/WG/NE	KUBPHS86	All stations
	<b>Poaceae</b>			
82	<i>Ochlandra scriptoria</i> (Dennst.) C.E.C. Fisch.	S/WG/NE	-	KF3, KF4
	<b>Proteaceae</b>			
83	<i>Helicia nilagirica</i> Bedd.	T/SWI/NE	KUBPHS77	All stations
	<b>Rhamnaceae</b>			
84	<i>Gouania microcarpa</i> DC.	L/IS/NE	-	All stations

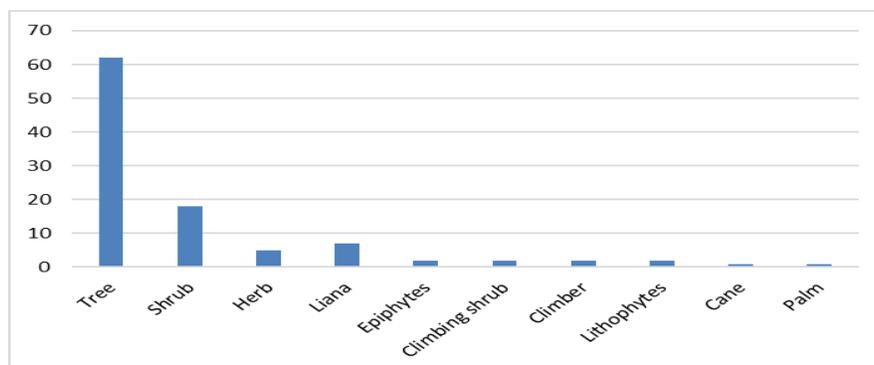
Table 2 contd.

<b>Rubiaceae</b>				
85	<i>Chassalia curviflora</i> var. <i>ophioxylodes</i> (Wall.) Deb & B.Krishna	S/IM/NE	KUBPHS87	All stations
86	<i>Ixora brachiata</i> Roxb	T/WG/NE	KUBPHS54	All stations
87	<i>Ixora elongata</i> Heyne ex G. Don	S/WG/NE	-	All stations
88	<i>Ixora nigricans</i> R.Br. ex Wight & Arn.	S/IM/NE	KUBPHS55	All stations
89	<i>Ophiorrhiza hirsutula</i> Wight ex J. Hooker	H/WG/NE	KUBPHS109	KF1
90	<i>Psychotria dalzellii</i> J. Hooker	S/WG/NE	KUBPHS58	All stations
91	<i>Psychotria flavida</i> Talbot	S/PI/NE	KUBPHS59	All stations
92	<i>Psychotria nigra</i> (Gaertn.) Alston	S/WG/NE	-	KF3
93	<i>Psychotria octosulcata</i> Talbot	S/WG/NE	-	KF3
<b>Rutaceae</b>				
94	<i>Acronychia pedunculata</i> (L.) Miq.	T/IM/NE	KUBPHS61	KF3
95	<i>Vepris bilocularis</i> (Wight & Arn.) Engl.	T/WG/LC	-	KF1, KF3
<b>Salicaceae</b>				
96	<i>Flacourtia montana</i> Graham	T/WG/NE	-	All stations
97	<i>Homalium zeylanicum</i> (Gardner) Benth.	T/IS/NE	-	KF2, KF4
98	<i>Hydnocarpus pentandrus</i> (Buch.-Ham.) Oken	T/WG/LC	-	KF2, KF3
<b>Santalaceae</b>				
99	<i>Scleropyrum pentandrum</i> (Dennst.) Mabb.	T/IS/NE	-	KF3
<b>Sapindaceae</b>				
100	<i>Harpullia arborea</i> (Blanco) Radlk.	T/IM/NE	-	KF3
<b>Sapotaceae</b>				
101	<i>Chrysophyllum roxburghii</i> Don	T/IM/NE	-	KF2, KF3, KF4
<b>Vitaceae</b>				
102	<i>Leea indica</i> (Burm. f.) Merr.	S/SI/NE	KUBPHS122	All stations
<b>Zingiberaceae</b>				
103	<i>Curcuma karnatakensis</i> Amalraj, Velay. & Mural.	H/WGK/NE	-	KF1, KF5

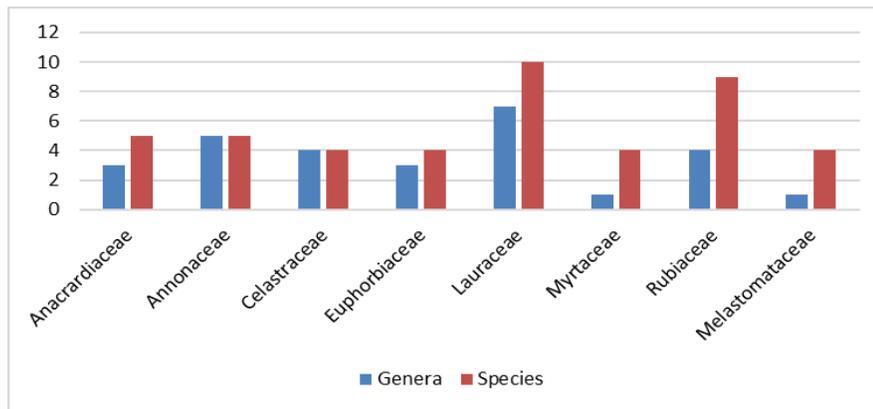
[H-Herb, EH-Epiphytic Herb, LH-Lithophytic Herb, US-Under Shrub, CS-Climbing shrub, S-Shurb, L-Liana, C-Climber, BC-Bole Climber, Ca-Cane, P-Palm, T-Tree; WG-Western Ghats, WGK-Western Ghats Karnataka, SI-South India, SWI-South West India, IM-Indo Malayan, IS-Indo Srilanka, PI-Peninsular India, WPI-Western Peninsular India; NE-Not Evaluated, CR-Critically Endangered, EN-Endangered, VU-Vulnerable, LC-Least Concern]



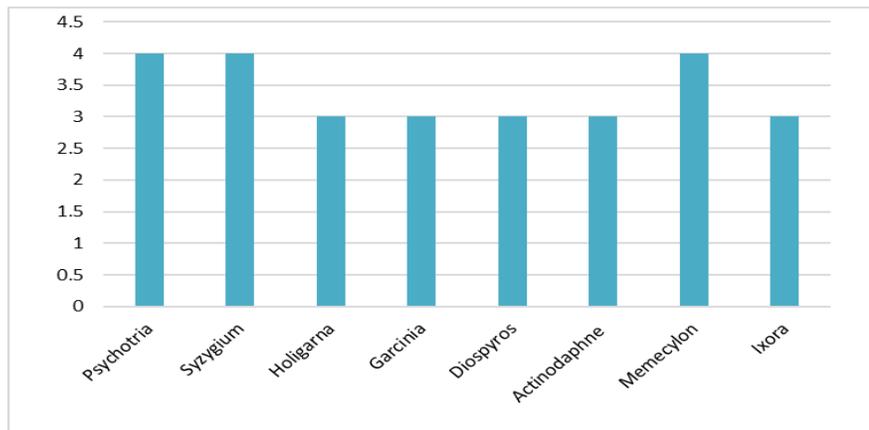
**Figure 3.** Graphical representation of flowering plants recorded in the study stations which are endemic to different geographical regions.



**Figure 4.** Comparison of habit type contribution



**Figure 5.** Comparison of number of genera and species of top 8 dominated families recorded in the study area.



**Figure 6.** Dominated genera with respect to species contribution

### Dominated families

The family Lauraceae dominated the list with 10 species and 7 genera and Rubiaceae being second dominated family with 9 species and 4 genera. The Lauraceae family also dominated endemism with 7 species endemic to Western Ghats while Rubiaceae contributed 6 endemic species. The Anacardiaceae and Annonaceae family contributed five species each while the Celastraceae, Euphorbiaceae, Melastomataceae and Myrtaceae each in 4 species each. The family dominance with respect to genera and species contribution is clearly demonstrated in Figure 5.

### Dominated genera

The genera *Memecylon*, *Psychotria* and *Syzygium* dominated the list each with 4 species. *Actinodaphne*, *Diospyros*, *Garcinia*, *Holigarna* and *Ixora* being next dominated genera contributing 3 species each. The genus *Memecylon* contributed one endemic species of Western Ghats which is recorded in all stations. *Psychotria* genus contributed 3 endemic species of Western Ghats among them *Psychotria dalzellii* J. Hooker Talbot recorded in all stations while *Psychotria nigra* (Gaertn.) Alston and *Psychotria octosulcata* Talbot found only in KF3 station. *Syzygium* genus contributed 2 endemic species of Western Ghats in which *Syzygium stocksii* (Duthie) Gamble is a critically endangered species recorded in only 2 stations (KF1 & KF3). The distribution of three species from *Diospyros* genus recorded in study stations is limited to Western Ghats and one of them is categorized as vulnerable species (*Diospyros candolleana* Wight) recorded in all stations. The species contributions of dominated genera are graphically represented in the Figure 6.

## CONCLUSION

The sacred forests in Sharavathi river basin is a house for number of rare, endemic and threatened species. The population of recorded individuals are less but even in the isolated patches of six different sacred groves, the existence of 103 endemic & threatened species is admirable. Though they are conserving by ethnic communities, the forests facing severe anthropogenic threats along the borders during recent days and most of the fragile habitats are under disturbance continuously because of attempts of encroachments. In the near future, it may lead to cause local extinction of those rare, endemic plants of micro habitats of sacred groves. However, high floral endemism and threats in the habitats deserves strict conservation.

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**Plate 1a.** Endemic species of Western Ghats recorded in the study stations.



Plate 1b. Endemic species of Western Ghats recorded in the study stations.



*Glochidion ellipticum* Wight



*Mallotus beddomei* Hook. f.



*Litsea stocksii* var. *glabrescens*



*Litsea floribunda* (Blume) Gamble



*Memecylon malabaricum* (C.B. Clarke) Cogn.



*Ochlandra scriptoria* (Dennst.) C.E.C. Fisch.



*Hopea ponga* (Dennst.) Mabb.



*Ophiorrhiza hirsutula* Wight ex J. Hooker



*Beilschmiedia dalzellii* (Meisn.) Kosterm.



*Garcinia indica* (Dupetit-Thouars) Choisy



*Pittosporum dasycaulon* Miq.



*Ixora brachiata* Roxb.



*Ixora elongata* Heyne ex G. Don



*Psychotria dalzellii* J. Hooker



*Psychotria octosulcata* Talbot



*Flacourtia montana* Graham

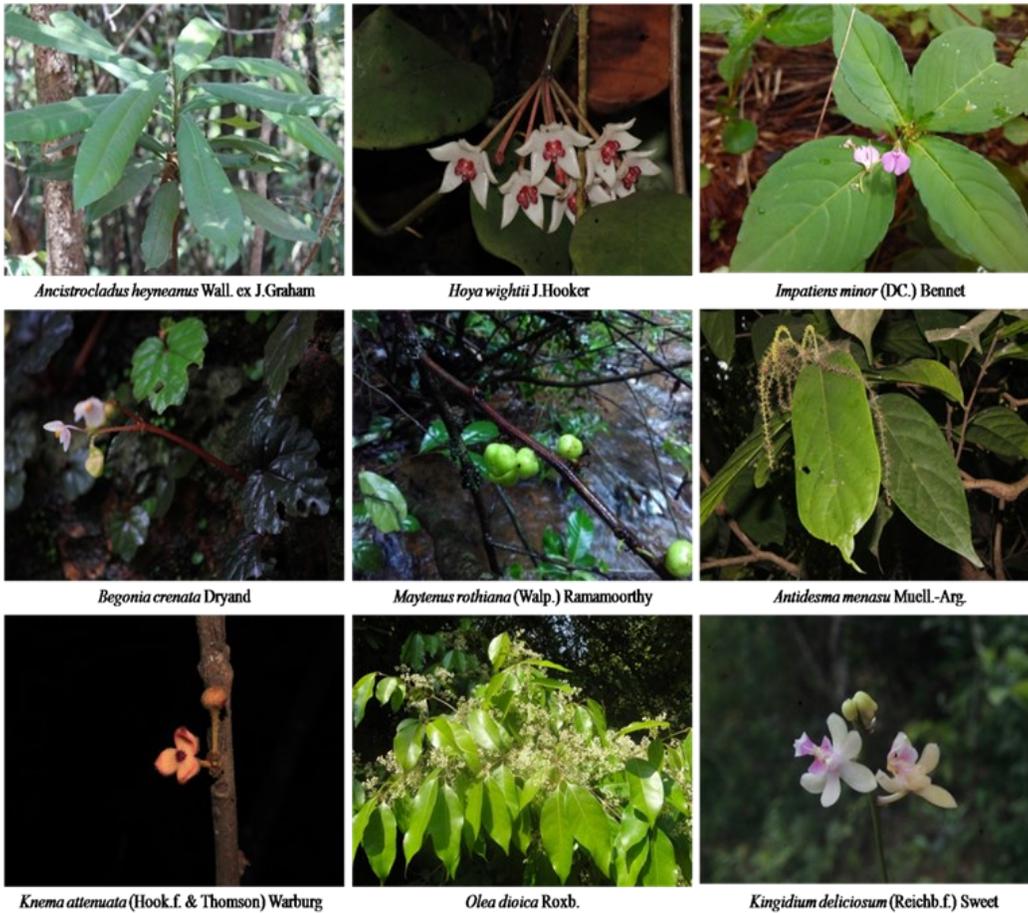


*Hydnocarpus pentandrus* (Buch.-Ham.) Oken



*Actinodaphne malabarica* N.P. Balakr.

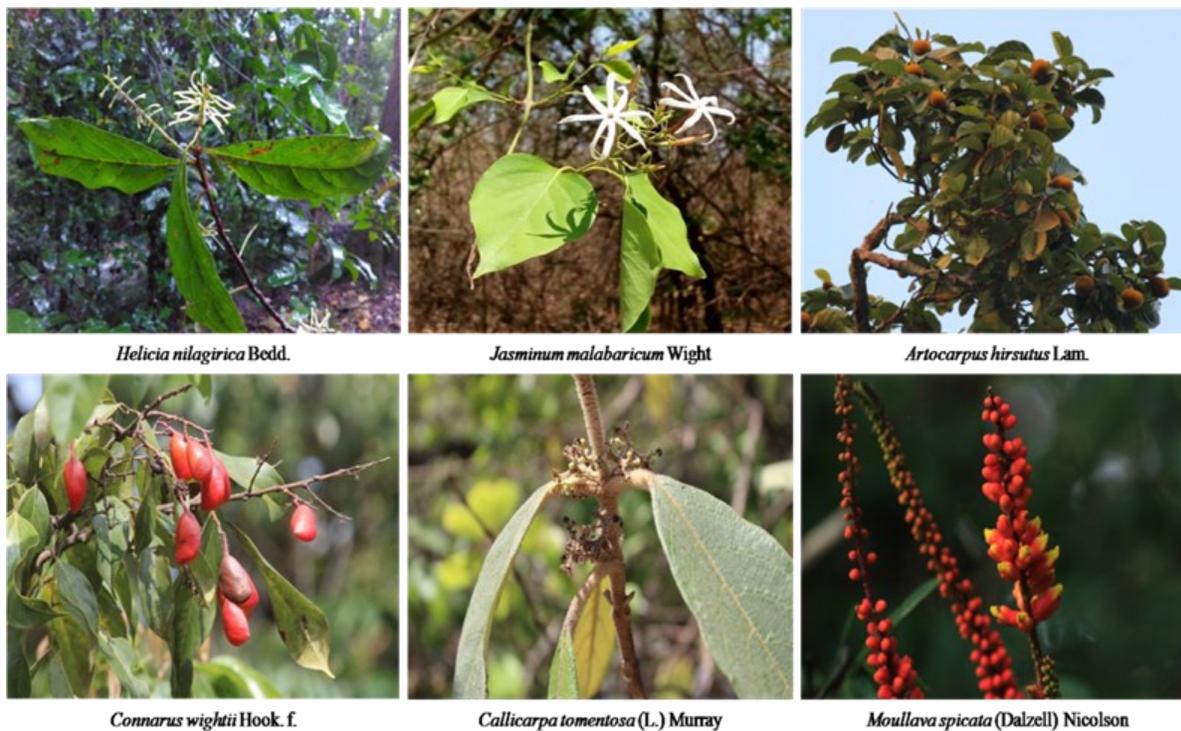
**Plate 2.** Endemic species of Peninsular India recorded in study stations



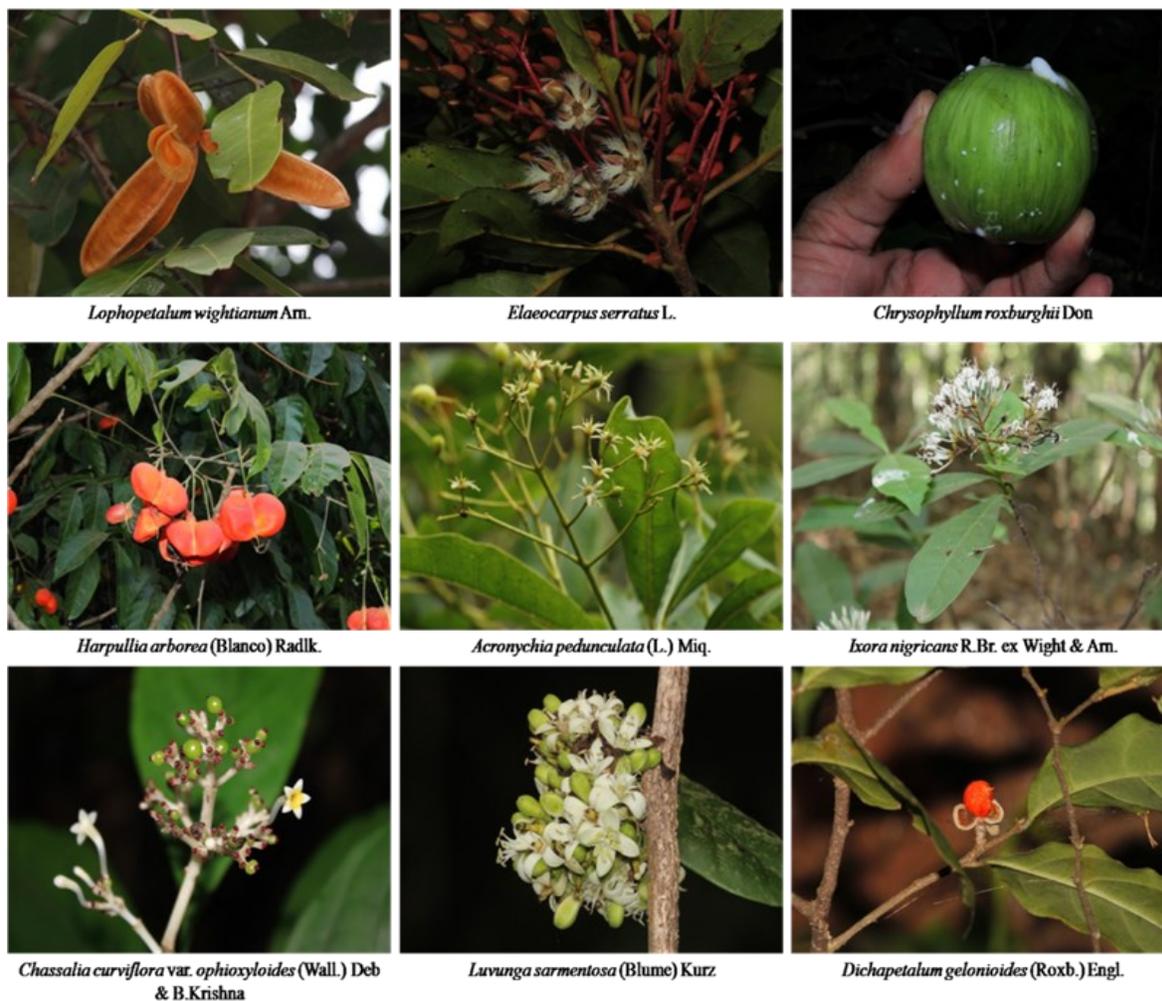
**Plate 3.** Endemic species of South India recorded in the study stations.



**Plate 4.** Endemic species of South-West India recorded in the study stations.



**Plate 5.** Endemic species of Indo-Malayan region recorded in the study stations



**Plate 6.** Endemic species of Indo-Srilankan region recorded in the study station.



*Syzygium caryophyllatum* (L.) Alston



*Saraca asoca* (Roxb.) Willd.



*Persea macrantha* (Nees) Kosterm



*Scleropyrum pentandrum* (Dennst.) Mabb.



*Malaxis versicolor* (Lindl.) Abeywickr.



*Orophea zeylanica* J. Hooker & Thoms.



*Desmos lawii* (Hooker f. & Thomson) Safford



*Ariabotrys zeylanica* J. Hooker & Thoms.



*Nothopegia racemosa* (Dalzell) Ramamoorthy

**Plate 7.** Threatened species recorded in the study stations.



*Impatiens pulcherrima* Dalzell



*Diospyros candolleana* Wight



*Gymnacranthera canarica* (Bedd. ex King) Warb



*Dipterocarpus indicus* Bedd.



*Myristica malabarica* Lamarck



*Semecarpus kathalekanensis* Dasappa & Swam.



*Syzygium travancoricum* Gamble



*Bulbophyllum neilgherrense* Wight

