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A Study on Plant Diversity of Iringole Kavu, Ernakulam, Kerala State

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Sacred groves are the patches of pristine forest that nurture rich biodiversity and play a principal role in the conservation of endemic and rare species. The present study was conducted to identify and enumerate the plant diversity of Iringole Kavu (sacred grove) of Ernakulum district of the state of Kerala. A total of 142 plant species were documented which include three vulnerable species and 18 endemic species. Among them 129 are angiosperms, two are gymnosperms, seven are pteridophytes and four belong to fungi. Angiosperms include 36 herbs, 23 shrubs, 41 trees and 29 climbers. Fabaceae, Rubiaceae, Moraceae, Acanthaceae and Apocynaceae are the dominant angiosperm families. The study revealed the occurrence of two critically endangered plant species viz. Ixora johnsonii (Rubiaceae) and Vateria indica (Dipterocarpaceae).

Keywords: Biodiversity; Conservation; Endemic; Kavu; Sacred Groves.

Biodiversity is the natural event comprising of various types of ecosystems, different species of organisms with full range of their genetic variations and environmental adaptations as well as their connections and processes. It forms the web of life that we depend on for so many things such as food, water, medicine, a stable climate and economic growth. Around the world, anthropogenic interventions have altered the composition and operation of many ecosystems. The extinction of species as a result of habitat degradation, overexploitation, pollution, global climate change, and exotic species invasion is happening so quickly than at any other point in the history. Therefore, protecting biological diversity in all of its forms is crucial.[1]

The idea of wielding virgin forest goes back to the pre-vedic era (between 3000 and 5000 BC) when human civilization was in the primeval phase of progress and development. There are copious traditional exercises that support biodiversity protection and conservation including the preservation and maintenance of tiny patches of lands via versatile groups by dedicating them to regional deities. These swaths of forest are known as "Sacred Groves." The local population protects sacred groves because they believe the deities live there, according to their cultural and

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religious taboos, and because they are uninhabited tracts of virgin forest that have a rich biodiversity. Such cultural, traditional, and religious beliefs help people feel more connected to the natural world. Thus, sacred groves are a way to honour nature. The majority of indigenous or tribal communities who practise this kind of worship have beliefs that diverge from those of icon-oriented religions. The sacred groves can also act as a tool for climate change mitigation.[2,3,4]

The historic liaison between sacred groves and pre-agricultural, hunting and gathering stages of societies has been established. Sacred groves can be as small as a few square metres or as large as many hectares of greenery and it is culturally connected to deities, rituals, and taboos. Sacred groves spotlight the inextricable relationship between modern society to the past in terms of biodiversity, culture, religious and ethnic legacy.[5,6] A summary of the subsistence of sacred groves in Asia, Africa, Europe, North America and different regions of India are acknowledged by various scientific reports.[7,8,9,10] India is unique in its biogeographical location with extensive and diverse biodiversity legacy. This has led to its recognition as one of the twelve mega diverse countries of the world. Such species-rich places are preserved by the government by designating them as national parks, wildlife refuges, biosphere reserves, and ecologically fragile and sensitive zones. This is done for both biodiversity conservation and sustainable use.[11,12]

Sacred groves known as 'Kavukal' are seen right through Kerala, having diverse forms, coupled with various cultural practices and belief systems. The vegetation and the deities revered are highly characterised in each one of them. Some of the groves may be devoted to serpent god and serpent worship, commonly known by the name "Sarpakavu". *'Kavu* 'in Malayalam vernacular means a garden or a consortium of trees generally dedicated to God and Serpents. Around 2,000 well protected sacred groves in Kerala, and are usually associated with Hindu temples and ancestral homes of old Hindu and Muslim families.[13] Iringol kavu, Kunnathurpadi kavu, Theyyottu kavu are some of the large *Kavus* in Kerala. In Kerala, all the districts have plenteous sacred groves and which are ecologically and economically very imperative.

Iringole Kavu is located in Perumbavoor of Ernakulam District in the state of Kerala. The total area of the 'Kavu' is about 110 acres and lies at 10°6'31"N/ 76°30'2"E. The temple in the forest was once possessed by 32 illoms (residence of Brahmins). It is now owned by the Travancore Dewaswom Board. There is no specific information about the origin of Iringole temple. In 1986, it is found, through astrological calculations, that the temple is 2746 years old. But the religious offerings, rituals and the visits of devotees commenced only 1200 years ago. The history of the temple is entrenched in a legendary mythology. In Dwaparayuga, Kamsa, the demon king learned that his assassination would be effected by Lord Krishna, the eighth son of Vasudeva and Devaki. He was worried and put his pregnant sister Devaki and husband Vasudeva in jail. Vasudeva and Devaki exchanged the baby with the girl child born to Nandagopan and Yasoda in Gokulam. The girl child got away from Kamsa's challenge to kill her and gleamed like a glittering light in the night sky. The place where the light first fell on earth was named 'Irinnol' in the notion that the girl child goddess came to dwell there. The name of the place slowly became Iringole.

MATERIALS AND METHODS

Study Area

Iringol Kavu (Iringol Sacred Grove), Perumbavoor, Ernakulam, Kerala State.

Floristic analysis

Plants were collected from various locations of Iringole Kavu during different seasons of the year. Voucher herbarium specimens of important plants of the study area were prepared and deposited in the accredited Herbarium of CMS College Kottayam. Collected plants were identified by using standard floras.[14,15,16]and expert consultations. Besides voucher specimens, photographs of various plants were also taken by using Canon 12.1 Mega pixel powershot Digital Camera. The plants were enumerated according to Bentham and Hooker system of classification and the nomenclature and citations follow IPNI[17] verified with the online databases of WCSP[18] and WFO.[19] Unresolved names were treated according to the regional checklist.[16] Endemism and the

distribution of species were treated according to standard literature.[20,21] RET (Rare, Endangered and Threatened) status of the species was treated as global scale based on IUCN.[22]

RESULTS AND DISCUSSION

The present study investigated the floristic diversity assessment of Iringole Kavu, Perumbavoor, Ernakulam district. The methodology included survey, identification and classification based on Bentham and Hooker's system of classification. A total of 142 plants are described. Among them 129 angiosperms, two gymnosperms, seven pteridophytes and four fungi are reported (Fig.1). Angiosperms include 36 herbs, 23 shrubs, 41 trees and 29 climbers (Fig.2). Fabaceae, Rubiaceae, Moraceae, Acanthaceae and Apocynaceae are the leading families (Table 1 & Fig. 3).

Protection and preservation plant and animal species is the primary function of sacred groves.[23] There are several endemic plant species that can only be found in sacred groves. Out of 5725 endemics in India, endemics of Kerala comprise 22.6% of Indian endemics. The number of Rare, Endangered and Threatened (RET) plants is 658 and plants specifically found in sacred groves are 134 (www.eflorakerala.com). *Hydnocarpus macrocarpa, Bulbophyllum aureum, Calamus travancoricus, Dysoxylum beddomei, Litsea travancorica, Schefflera bourdillonii, Holigarna beddomei, Moullava spicata*, *Hemidesmus indicus, Syzygium travancoricum* etc. are some of the endemic species of plants found predominantly in the sacred groves of North Kerala.[24] Rare species of orchids are also found in groves. The majority of Kerala's estimated orchid species are found in the sacred forests and these groves are therefore seen as a refuge for genetic variety.

According to IUCN,[22] a taxon is 'Critically Endangered' when the best available evidence indicates that it is facing an extremely high risk of extinction in the wild. A taxon is 'Endangered' when the best available evidence indicates that it is facing a very high risk of extinction in the wild. A taxon is 'Vulnerable' when the best available evidence indicates that it is facing a high risk of extinction in the wild. The documentation of plant diversity in the study area ensued in the identification of three vulnerable species based on IUCN red list status (*Hopea ponga, Myristica malabarica,* and *Saraca asoca*). Among the listed plants, 13% of the species are endemic to the Western Ghats.

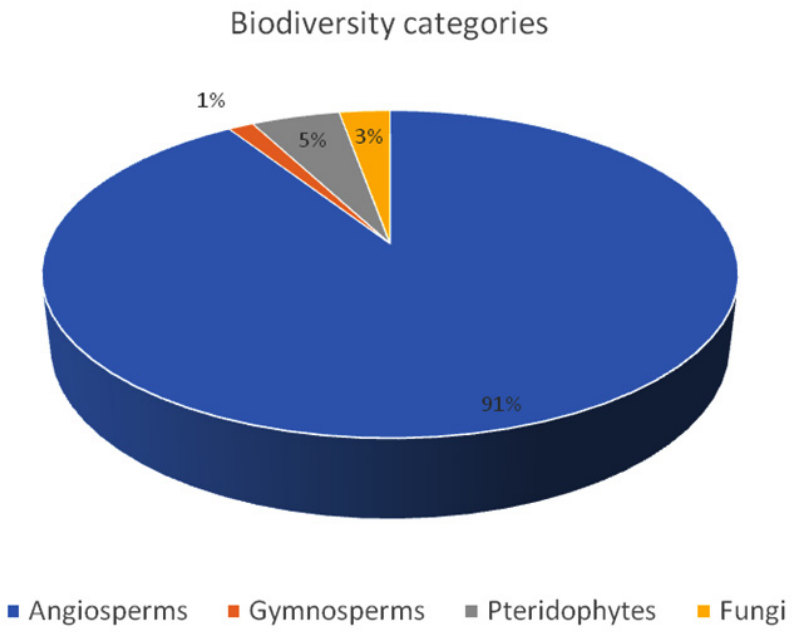

Fig. 1. Biodievsity cateories of Iringole Kavu, Perumbavoor, Kerala

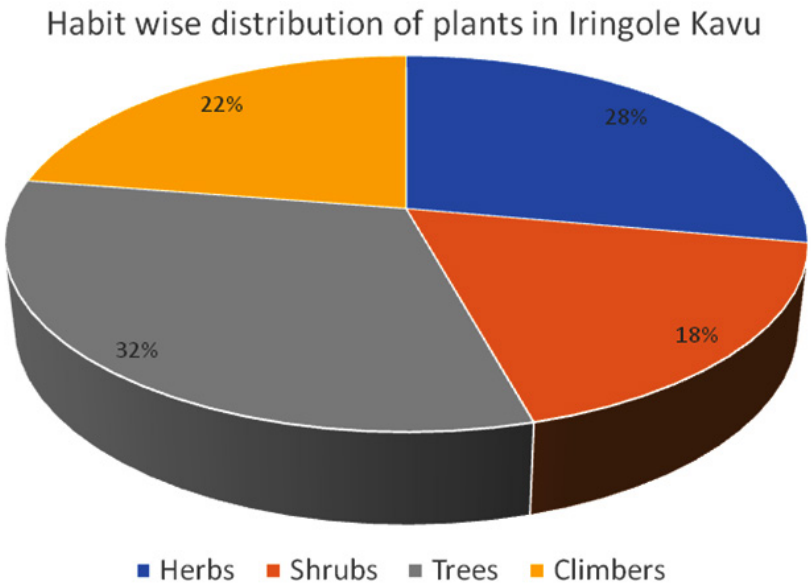

Fig. 2. Habit wise distribution of plants in Iringole Kavu, Perumbavoor, Kerala

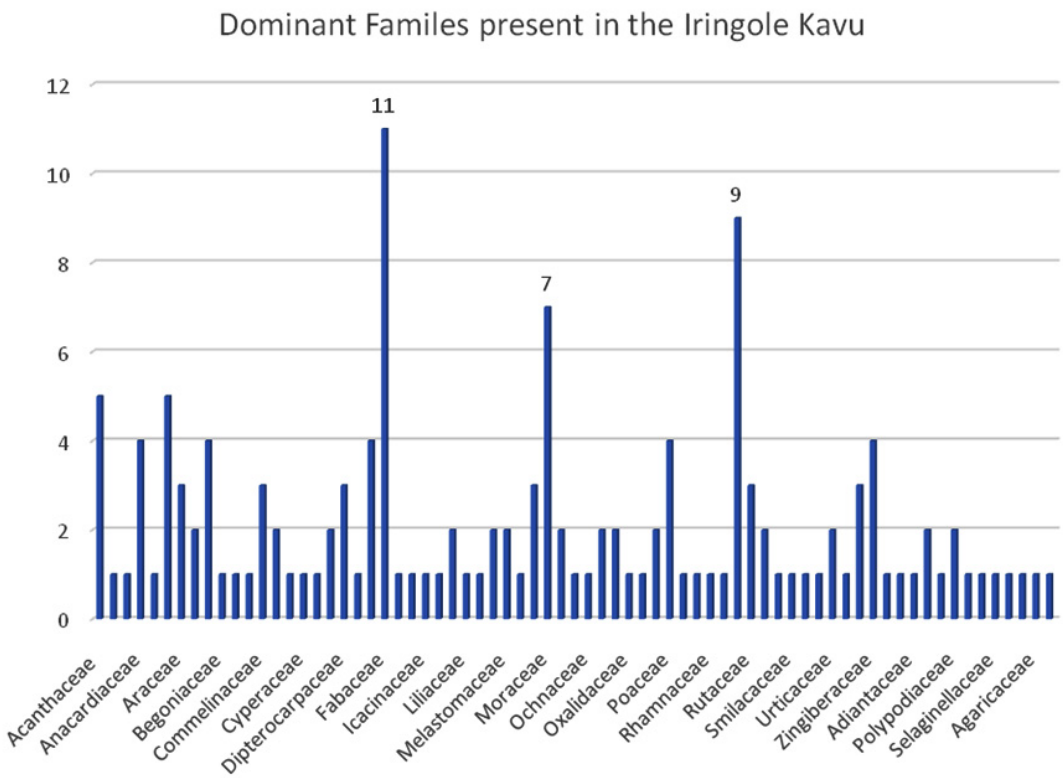

Fig. 3. Dominant plant families present in the Iringole kave (Including Fungi)

Table 1. List of familes and number of speceis found in the Iringole Kavu, Perumbavoor, Kerala

No.	Family	Number of species observed	Percentage of Occurrence
	Angiosperms		
1	Acanthaceae	5	3.875
2	Alangiaceae	1	0.775
3	Amaranthaceae	1	0.775
4	Anacardiaceae	4	3.1
5	Annonaceae	1	0.775
6	Apocynaceae	5	3.875
7	Araceae	3	2.325
8	Asclepiadaceae	2	1.550
9	Asteraceae	4	3.1
10	Begoniaceae	1	0.775
11	Caricaceae	1	0.775
12	Combretaceae	1	0.775
13	Commelinaceae	3	2.325
14	Convolvulaceae	2	1.550
15	Cucurbitaceae	1	0.775
16	Cyperaceae	1	0.775
17	Dichopetalaceae	1	0.775
18	Dioscoreaceae	2	1.55
19	Dipterocarpaceae	3	2.325
20	Ebenaceae	1	0.775
21	Euphorbiaceae	4	3.1
22	Fabaceae	11	8.527
23	Flacourtiaceae	1	0.775
24	Guttiferae	1	0.775
25	Icacinaceae	1	0.775
26	Lamiaceae	1	0.775
27	Lauraceae	2	1.55
28	Liliaceae	1	0.775
29	Loganiaceae	1	0.775
30	Malvaceae	2	1.55
31	Melastomaceae	2	1.55
32	Meliaceae	1	0.775
33	Menispermaceae	3	2.325
34	Moraceae	7	5.42
35	Myristicaceae	2	1.55
36	Myrtaceae	1	0.775
37	Ochnaceae	1	0.775
38	Oleaceae	2	1.55
39	Orchidaceae	2	1.55
40	Oxalidaceae	1	0.775
41	Palmae	1	0.775
42	Piperaceae	2	1.55
43	Poaceae	4	3.1
44	Polygalaceae	1	0.775
45	Ranunculaceae	1	0.775
46	Rhamnaceae	1	0.775
47	Rhizophoraceae	1	0.775
48	Rubiaceae	9	6.976
49	Rutaceae	3	2.325

50	Scrophulariaceae	2	1.55
51	Simaroubaceae	1	0.775
52	Smilacaceae	1	0.775
53	Sterculiaceae	1	0.775
54	Ulmaceae	1	0.775
55	Urticaceae	2	1.55
56	Verbenaceae	1	0.775
57	Vitaceae	3	2.325
58	Zingiberaceae	4	3.1
	Gymnosperms		
59	Araucariaceae	1	50
60	Gnetaceae	1	50
	Pteridophytes		
61	Adiantaceae	1	11.11
62	Pteridaceae	2	22.22
63	Thelypteridaceae	1	11.11
64	Polypodiaceae	2	22.22
65	Lindsaeaceae	1	11.11
66	Dennstaedtiaceae	1	11.11
67	Selaginellaceae	1	11.11
	Fungi		
68	Ganodermataceae	1	25
69	Polyporaceae	1	25
70	Agaricaceae	1	25
71	Xylariaceae	1	25

Endemic species include *Artocarpus hirsutus, Ficus beddomei* (Moraceae), *Cinnamomum malabatrum* (Lauraceae), *Derris brevipes* (Fabaceae), *Bulbophyllum aureum* (Orchidaceae), *Hydnocarpus pentandrus* (Flacourtiaceae), *Ixora lanceolaria* (Rubiaceae), *Myristica malabarica* (Myristicaceae), *Polyalthia fragrans* (Annonaceae), *Tabenaemontana gamblei* (Apocynaceae), *Vateria indica*, *Hopea parviflora*, *Hopea ponga* (Dipterocarpaceae), *Holigarna arnottiana*, *Nothopegia travancorica* (Anacardiaceae), *Hemidesmus indicus* (Asclepiadaceae), *Xanthophyllum arnottianum* (Polygalaceae) and *Zingiber neesanum* (Zingiberaceae). Two critically endangered plant species viz. *Vateria indica* (Dipterocarpaceae) and *Ixora johnsonii* belonging to the family Rubiaceae are also reported from the study area.

CONCLUSION

The sacred groves are significant repositories of flora and fauna diversity that have been maintained by local communities in a sustainable mode. Conventionally, they are considered as common property resource systems linked with culture-based approach of protection. The role of sacred groves is drawing in escalating concern for the implementation and exercise of traditional wisdom and practices for protection and sustainable use of biological diversity. In India, it is a conventional method of *in situ* biodiversity conservation, whereby small areas of relic forest are maintained by local populations on the basis of their religious viewpoint. Various indigenous communities devote holy groves to their local gods or ancestors' spirits. Depending on the history of the vegetation, such a grove may include a multi-species, multi-tier primary forest or a collection of trees.

Sacred groves are patches of forests of special spiritual significance to humans, offering also a diverse range of ecological and environmental services such as recharging aquifers, protection and conservation of plant and animal species, improving the soil stability etc. They play a significant role in maintaining and preserving numerous cultural traditions, deities, especially the "Nagatharakal," (serpent deities). In sacred groves, the well-known Theyyam (ritualistic dance

forms) of Malabar region of Northern parts of Kerala is performed. Conventionally a pond is also conserved in connection with the sacred groves. Sacred grove helps in rendering knowingness about biodiversity conservation. This awareness has been passed down through generations of local people and has emphatically helped them in conservation of flora and fauna around their abode.

The sacred groves are being more and more exposed to a variety of threats leading to either qualitative dilapidation or entire vanishing. The present study has been carried out to identify and classify the plant diversity of Iringole Kavu, Perumbavoor, Ernakulam district. Floristic surveys were conducted and the plants were identified using standard floras and expert consultations. The plants were enumerated according to Bentham and Hooker system of classification and the nomenclature and citations follow IPNI verified with the online databases of *WCSP*.

A total of 142 plants were identified, classified and the percentage of occurrence of species was recorded. Among them 129 angiosperms, two gymnosperms and seven pteridophytes and four fungi are documented. Angiosperms comprise 36 herbs, 23 shrubs, 41 trees and 29 climbers. Fabaceae, Rubiaceae Moraceae, Acanthaceae and Apocynaceae are the predominant families. The documentation of plant diversity in the study area resulted in the identification of three vulnerable (*Hopea ponga, Myristica malabarica* and *Saraca asoca*), two critically endangered (*Vateria indica* and *Ixora johnsonii*) and 18 endemic species. About 13% of the listed species are endemic. The species richness of Iringole Kavu is found to be similar to other evergreen formations in the Western Ghats of India. The present study supports the view articulated by various workforces that sacred groves are the treasure houses of rare and endemic species. Further studies are considered necessary in order to conserve the rare, endangered, vulnerable and endemic species found in the study area.

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Conflict of Interest

We hereby declare that all the authors do not have any conflict of interest.

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