

ANGIOSPERMS IN POIYAMOZHI AYYANAR SACRED GROVE, KURUMALAI HILLS, THOOTHUKUDI DISTRICT, TAMIL NADU, INDIA**Sureshkumar T*, Saravana Ganthi A****

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ABSTRACT

In India and across the globe, many communities practice diverse forms of nature worship. One prominent tradition involves protecting forest areas maintained as sacred groves, consecrated to various deities. This ancient practice was once widespread, and the protected ecosystems now harbour numerous threatened, endangered, and rare plant and animal species. In the present study, angiosperm flora was reported in the Poiyamozhi Ayyanar Sacred Grove located at the foothills of Kurumalai Hills, Thoothukudi District, Tamil Nadu, India. Plant species were collected with flowers, fruit, or both at frequent intervals and were identified and confirmed with the available literature. The present study enumerated a total of 186 species belonging to 147 genera in 49 families from 29 orders, according to the Angiosperm Phylogeny Group IV classification. This study indicated that Poiyamozhi Ayyanar Sacred Grove is floristically rich but remains botanically underexplored.

KEYWORDS: Deities, Endemic plants, Exotic plants, Field survey, Flora, Kurumalai,

INTRODUCTION

India is one of the world's 17 mega-biodiverse countries (Rintelen *et al.*, 2017), with 25 hotspots of the world's richest and most threatened ecoregions (Kandari *et al.*, 2014). Forest management is a difficult challenge due to increasing population pressure, forest degradation, and depletion. Sacred groves are vast expanses of broad, virgin woods that have long been preserved by the local population because of taboos, cultural practices, and religious beliefs that deities live there and preserve the locals from various catastrophes, and they are living representations of rural indigenous societies' spiritual and environmental values (Khan *et al.*, 2008; Sharma and Devi, 2014; Jeeshna, 2021). The Sacred Groves are crucial for maintaining ecosystem services like a clean environment, which includes the preservation of water, air, and soil, the preservation of flora and fauna, the sequestration of carbon, the regulation of temperature, and the preservation of traditional knowledge. As a result, they serve as the focal point for ecological conservation research and legislation about the preservation and management of forests at the state and federal levels (Ray and Ramachandra, 2010).

Numerous endangered, unique, and unusual plant and animal species that are in a region are protected by sacred groves. People in this region have enacted strong restrictions

against deforestation. There was no federal law in India that protected sacred trees. Additionally, they preserve a variety of medicinal and economically important plants that are associated with socio-cultural and religious feelings and reside in unaltered areas. However, today's human activities harm them. Such sacred groves are not solely found in India, though (Jeeshna, 2021). It is incredibly interesting to note that they may be found in every region of every continent, including Africa, Asia, Europe, Australia, and America (Chandran and Hughes, 1997). There are reportedly between 100,000 and 150,000 sacred groves in India (Malhotra *et al.*, 1999). These sacred groves may range in size from a few plants to a large forest of plants. Even small groves harbor some keystone species and larger groves harbour many plants and animals. Such resourceful ecosystem conservation is a crucial need for this generation. In this view, the present study is conducted to survey the diversity of plants in the Poiyamozhi Ayyanar sacred grove in the Kurumalai hills of Tamil Nadu.

MATERIALS AND METHODS

Study area

Kurumalai village is located in Kovilpatti taluk of Thoothukudi district in Tamil Nadu. It is situated 12 km away from the sub-district headquarters Kovilpatti. The Kurumalai reserve forest spans a total forest cover of 12.48 km. It was declared a reserve forest in 1980. The climate is tropically hot, and red sandy soil is present at the foothills of Kurumalai. The sacred grove receives an average annual rainfall of 734.8 mm. The annual temperature of the sacred grove is 26° C in winter and 41° C in summer.

The Poiyamozhi Ayyanar sacred grove is in the foothills of the Kurumalai hills, Thoothukudi district of Tamil Nadu India. Folk village deities Poiyamozhi Ayyanar, Karuppusamy, Muniyasamy and Rakkachiamman, present at the sacred grove. The people celebrate the festival in Chithirai Tamil month every year. There is a fountain called Thanoothu that carries water from the foothills of Kurumalai to inside the grove. The vegetation of the sacred grove is tropical dry deciduous forest and tropical southern thorn forest.

Data collection

Field surveys were conducted for one year at regular intervals. Plants with flowers, fruits, or both were collected and identified with regional floras (Gamble 1915-1936; Matthew, 1983; Nair and Henry, 1983; Henry *et al.*, 1987; Kabeer and Nair, 2009; Britto, 2019) and recent literature. The phenology, ecology, and traditional uses of the plants were recorded. The nomenclature was strictly followed by the Senchen code and updated using online resources like Plants of the World Online (POWO) and World Flora Online (WFO) etc. The standard herbarium techniques of Fosberg and Sachet (1965) were followed for the preparation of herbarium specimens. For further reference, the herbarium specimens were deposited at Rani Anna Government College for Women, Tirunelveli. Oral history about the sacred groves was collected from elder generations to document the change that has taken place within a specific period.

RESULTS AND DISCUSSION

Sacred groves in Kurumalai

Poyyamozhi Ayyanar Temple is located in the Kurumalai Reserve Forest. It was first built by the Ettayapuram Jamin family. Historically, this Kurumalai is said to have been a part of the stone that fell during the voyage of Lord Hanuman to Sri Lanka. At the entrance of a sacred grove, an age old banyan tree is present. Poyyamozhi Ayyanar Temple is a small temple, where people worship and offer prayers throughout the year. There are many small shrines attached to the main temple. Sacred groves exist as holy places for worshipping Gods and Goddesses. Village deities such as Ayyanar, Akkamal Amman, and Karuppasamy are present. Many small village deities are also present. A Thambiran Siddhar Cave is also present at the top. The annual Kurumalai Chithirai Vishu Festival at Poyyamozhi Ayyanar Temple attracts several thousand pilgrims every year. There is diversity in the deities worshipped. Each has a presiding deity and most of them have associated deities too. A presiding deity may be a God, Goddess, or Serpent. Snake is also the associated deity in these sacred groves. Thannuthu is a sacred perennial water source located near the temple. Many deities are present around Thannuthu. Pilgrims worship the deities and sacred trees by lighting lamps (Fig: 1).

Fig: 1 Poiyamozhi Ayyanar Kovil, Kurumalai Hills, Thoothukudi

	
Thambiran Siddhar Cave	Poyyamozhi Ayyanar temple
	
Paintings of village God and Godness	Main Temple

	
Lord Ganesh temple	Small deities
	
Serpent	Akkamal Amman
	
Thannuthu	Lighting lamps.

Vegetation analysis

According to APG IV, (2016), the angiosperms of sacred groves in the study area (Table 1) recognized 147 genera and 29 orders of phylogenetic groups. The repeated field visits resulted in the collection of 186 species. Basal angiosperms are recognized by one family (Nymphaeaceae). APG IV recognized 6 families and 47 species of monocots in the study area.

Among the monocots, the most dominant family is *Poaceae* (30 species, 20 genera). Order Alismatales represented by the family Aponogetonaceae, Liliales by Liliaceae, Asparagales by Asparagaceae, Commelinales by Commelinaceae, Poales by Cyperaceae and Poaceae. The eudicots in the sacred grove include 41 families. Ranunculales represented by Menispermaceae and Proteales represented by Nelumbonaceae. Among the eudicots, Rosids consist of 69 genera covering 91 species and Fabaceae is the most dominant family. Rosids represented by families such as Vitaceae (Vitales), Zygophyllaceae (Zygophyllales) Fabaceae

and Polygalaceae (Fabales), Moraceae, Rhamnaceae, Ulmaceae (Rosales), Cucurbitaceae (Cucurbitales), Oxalidaceae (Oxalidales), Euphorbiaceae, Passifloraceae, Phyllanthaceae, Putranjivaceae, Violaceae, Erythroxylaceae (Malpighiales), Combretaceae, Lythraceae, Onagraceae (Myrtales), Rutaceae, Sapindaceae, Burseraceae, Meliaceae (Sapindales), Malvaceae (Malvales) and Capparaceae, Cleomaceae (Brassicales). Superasterids are represented by Loranthaceae, Amaranthaceae, Molluginaceae and Nyctaginaceae. Among the eudicots, 34 species are Asterids and the family Asteraceae is the most dominant, with 7 genera and 7 species. Asterids include Sapotaceae, Apocynaceae Gentianaceae, Rubiaceae, Boraginaceae, Convolvulaceae, Solanaceae, Acanthaceae, Lamiaceae, Scrophulariaceae, Verbenaceae, and Asteraceae.

Among a total of 49 families, 3 families are represented by more than 10 taxa. Among these, concerning the number of genera and taxa, Poaceae is the largest family with 20 genera and 30 taxa. It is followed by Fabaceae, with 24 genera and 28 taxa followed by the Malvaceae family with 8 genera and 13 taxa, and Euphorbiaceae are represented by 8 taxa, families are Commelinaceae, Apocynaceae, Rubiaceae, Acanthaceae Lamiaceae are represented by five taxa each, and Amaranthaceae family has 6 taxa. One species of Lichen (*Rocella*), one species of Pteridophytes (*Marselia*) and one species of Bryophyte (*Riccia*) are also recorded in the area of study.

Table: 1 Angiosperm flora of Poiyamozhi Ayyanar sacred grove

	<i>Abrus precatorius</i> L.	Fabaceae	Straggler
	<i>Abutilon indicum</i> (L.) Sweet	Malvaceae	Shrub
	<i>Acalypha ciliata</i> Forssk.	Euphorbiaceae	Herb
	<i>Acalypha fruticosa</i> Forssk.	Euphorbiaceae	Shrub
	<i>Acalypha indica</i> L.	Euphorbiaceae	Herb
	<i>Achyranthes aspera</i> L.	Amaranthaceae	Herb
	<i>Aegle marmelos</i> (L.) Correa		
	<i>Aerva lanata</i> (L.) Juss. ex Schult.	Amaranthaceae	Herb
	<i>Albizia lebbek</i> (L.) Benth	Fabaceae	Tree
	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC	Amaranthaceae	Herb
	<i>Alysicarpus glumaceus</i> (Vahl) DC.	Fabaceae	Herb
	<i>Alysicarpus monilifer</i> (L.) DC.	Fabaceae	Herb
	<i>Ammannia baccifera</i> L.	Lythraceae	Herb
	<i>Andrographis serpyllifolia</i> (Vahl) Wight	Acanthaceae	Herb
	<i>Apluda mutica</i> L.	Poaceae	Herb
	<i>Aponogeton natans</i> (L.) Engl. & K. Krause	Aponogetonaceae	Aquatic Herb
	<i>Aristida hystix</i> L.f.	Poaceae	Herb
	<i>Aristida setacea</i> Retz.	Poaceae	Herb
	<i>Asparagus racemosus</i> Willd.	Asparagaceae	Climbing Herb
	<i>Atalantia monophylla</i> DC.		
	<i>Azadirachta indica</i> A.Juss.	Meliaceae	Tree
	<i>Barleria cuspidata</i> B.Heyne ex Nees	Acanthaceae	Sub shrub
	<i>Biophytum sensitivum</i> (L.) DC.	Oxalidaceae	Herb

<i>Blumea obliqua</i> (L.) Druce.	Asteraceae	Herb
<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Herb
<i>Boerhavia erecta</i> L.	Nyctaginaceae	Herb
<i>Brachiaria distachya</i> (L.) Stapf	Poaceae	Herb
<i>Brachiaria reptans</i> (L.) C.A Gardner & C.E. Hubb	Poaceae	Herb
<i>Calotropis gigantea</i> (L.) R.Br. ex W.T. Aiton	Apocynaceae	Shurb
<i>Canthium coromandelicum</i> (Burm.f.) Alston	Rubiaceae	Shurb
<i>Capparis sepiaria</i> L.	Capparaceae	Shrub
<i>Cardiospermum halicacabum</i> L.		
<i>Carissa carandas</i> L.	Apocynaceae	Shurb
<i>Cascabela thevetia</i> (L.) Lippold	Apocynaceae	Shurb
<i>Celosia polygonoides</i> Retz.	Amaranthaceae	Herb
<i>Ceratophyllum demersum</i> L.	Certophyllaceae	Aquatic Herbs
<i>Chamaeaista absus</i> (L.) H.S. Irwin & Barneby.	Fabaceae	Herb
<i>Chloris barbata</i> Sw.	Poaceae	Herb
<i>Chloroxylon swietenia</i> DC.		
<i>Cissampelos pareira</i> L.	Menispermaceae	Climber
<i>Cissus quadrangularis</i> L.	Vitaceae	Shrub
<i>Cleome felina</i> L.f	Cleomaceae	Herb
<i>Cleome spinosa</i> Jacq.	Cleomaceae	Herb
<i>Cleome viscosa</i> L.	Cleomaceae	Herb
<i>Clitoria ternatea</i> L.	Fabaceae	Vine
<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	Climber
<i>Cocculus hirsutus</i> (L.) W. Theob.	Menispermaceae	Straggler
<i>Coffea wightiana</i> Wall.	Rubiaceae	Shurb
<i>Combretum albidum</i> G.Don	Combretaceae	Climber
<i>Commelina benghalensis</i> L.	Commelinaceae	Herb
<i>Commelina ensifolia</i> R.Br.	Commelinaceae	Herb
<i>Commiphora caudata</i> (Wight & Arn.) Engl.		
<i>Corchorus olitorius</i> L.	Malvaceae	Herb
<i>Corchorus tridens</i> L.	Malvaceae	Herb
<i>Cordia monoica</i> Roxb	Boraginaceae	Tree
<i>Crateva adansonii</i> DC.	Capparaceae	Tree
<i>Crotalaria angulata</i> Mill.	Fabaceae	Herb
<i>Crotalaria medicaginea</i> Lam. var. <i>medicaginea</i>	Fabaceae	Herb
<i>Croton bonplandianum</i> Baill.	Euphorbiaceae	Herb
<i>Cryptolepis dubia</i> (Burm.f.) M.R. Almeid	Apocynaceae	Climber

<i>Cucumis trigonous</i> Roxb.	Cucurbitaceae	Climber
<i>Cyanotis axillaris</i> (L.) D.Don ex Sweet	Commelinaceae	Herb
<i>Cyanotis tuberosa</i> (Roxb.) Schult & Schult.f.	Commelinaceae	Herb
<i>Cymbopogon flexuosus</i> (Nees ex Steud.) W. Watson,	Poaceae	Herb
<i>Cymbopogon travancorensis</i> Bor	Poaceae	Herb
<i>Cynanchum viminalis</i> (L.) Bassi ex L.	Apocynaceae	Climber
<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Herb
<i>Cyperus difformis</i> L.	Cyperaceae	Herb
<i>Cyperus iria</i> L.	Cyperaceae	Herb
<i>Cyperus rotundus</i> L.	Cyperaceae	Herb
<i>Cyphostemma setosum</i> (Roxb.) Alston	Vitaceae	Vine
<i>Dactyloctenium aegyptium</i> (L.) Willd.	Poaceae	Herb
<i>Dalbergia coromandeliana</i> Prain	Fabaceae	Shrub
<i>Dendrophthoe falcata</i> (L.f.) Ettingsh.	Loranthaceae	Subshrub
<i>Derris scandens</i> (Roxb.) Benth.	Fabaceae	Liana
<i>Desmodium triflorum</i> (L.) DC.	Fabaceae	Herb
<i>Dichrostachys cinerea</i> (L.) Wight & Arn.	Fabaceae	Shrub
<i>Dicliptera paniculata</i> (Forssk.) I. Darbysh	Acanthaceae	Herb
<i>Digera muricata</i> (L.) C. Mart.	Amaranthaceae	Herb
<i>Digitaria bicornis</i> (Lam.) Roem. & Schult.	Poaceae	Herb
<i>Digitaria longiflora</i> (Retz.) Pers.	Poaceae	Herb
<i>Drimys raogibikei</i> (Hemadri) Hemadri	Asparagaceae	Herb
<i>Echinochloa colona</i> (L.) Link	Poaceae	Herb
<i>Eclipta prostrata</i> (L.) L.	Asteraceae	Herb
<i>Ehretia microphylla</i> Lam.	Boraginaceae	Shrub
<i>Orthosiphon thymiflorus</i> (Roth) Sleesen	Lamiaceae	Shrub
<i>Enteropogon dolichostachyus</i> (Lag.) Keng	Poaceae	Herb
<i>Eragrostiella brachyphylla</i> (Stapf.) Bor	Poaceae	Herb
<i>Eragrostis ferruginea</i> (Thunb.) P.Beauv.	Poaceae	Herb
<i>Eragrostis cilianensis</i> (All.) Janch.	Poaceae	Herb
<i>Eragrostis unioides</i> (Retz.) Nees ex Steud.	Poaceae	Herb
<i>Eragrostis viscosa</i> (Retz.) Trin.	Poaceae	Herb
<i>Erythroxylum monogynum</i> Roxb.	Erythroxylaceae	Shrub
<i>Euphorbia antiquorum</i> L.	Euphorbiaceae	Tree
<i>Euphorbia hirta</i> L.	Euphorbiaceae	Herb
<i>Euphorbia rosea</i> Retz.	Euphorbiaceae	Herb
<i>Evolvulus alsinoides</i> (L.) L.	Convolvulaceae	Herb
<i>Ficus benghalensis</i> L.	Moraceae	Tree
<i>Ficus macrocarpa</i> L.f.		

0.	<i>Ficus religiosa</i> L.	Moraceae	Tree
1.	<i>Fimbristylis argentea</i> (Rottb.) Vahl	Cyperaceae	Herb
2.	<i>Fimbristylis ovata</i> (Burm.f.) Kern	Cyperaceae	Herb
3.	<i>Fimbristylis quinquangularis</i> (Vahl) Kunth	Cyperaceae	Herb
4.	<i>Flueggea leucopyrus</i> Willd.	Phyllanthaceae	Shrub
5.	<i>Grewia oppositifolia</i> Buch. -Ham. ex DC.	Malvaceae	Shrub
6.	<i>Grewia tillifolia</i> Vahl	Malvaceae	Tree
7.	<i>Heteropogon contortus</i> (L.) P.Beauv	Poaceae	Herb
8.	<i>Hibiscus micranthus</i> L.f.	Malvaceae	Shrub
9.	<i>Hibiscus vitifolius</i> L.	Malvaceae	Shrub
0.	<i>Holoptelea integrifolia</i> (Roxb.) Planch.	Ulmaceae	Tree
1.	<i>Hybanthus enneaspermus</i> (L.) F.Muell.	Violaceae	Herb
2.	<i>Hyptis suaveolens</i> (L.) Poit.	Lamiaceae	Herb
3.	<i>Indigofera aspalathoides</i> Vahl ex DC.	Fabaceae	Subshrub
4.	<i>Indigofera linnaei</i> Ali	Fabaceae	Herb
5.	<i>Ipomea obscura</i> (L.) Ker Gawl.	Convolvaceae	Twiner
6.	<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	Shrub
7.	<i>Justicia simplex</i> D. Don	Acanthaceae	Herb
8.	<i>Ledebouria revoluta</i> (L.f.) Jessop	Asparagaceae	Herb
9.	<i>Lepidagathis barberi</i> Gamble	Acanthaceae	Sub shrub
0.	<i>Leucaena leucocephala</i> (Lam.) de Wit	Fabaceae	Tree
1.	<i>Leucus aspera</i> (Willd.) Link.	Lamiaceae	Herb
2.	<i>Ludwigia perennis</i> L.	Onagraceae	Herb
3.	<i>Malvastrum coromandelianum</i> (L.) Garcke	Malvaceae	Shrub
4.	<i>Merremia marginata</i> (Burn.f. Hallier f.)	Convolvulaceae	Herb
5.	<i>Mimosa pudica</i> L.	Fabaceae	Herb
6.	<i>Mimusops elengi</i> L.	Sapotaceae	Tree
7.	<i>Mollugo cerviana</i> (L.) See.	Molluginaceae	Herb
8.	<i>Mollugo nudicaulis</i> Lam.	Molluginaceae	Herb
9.	<i>Morinda coreia</i> Buch.-Ham.	Rubiaceae	Tree
0.	<i>Mundulea seicea</i> (Willd.) A.Chev.	Fabaceae	Shrub
1.	<i>Murdannia nudiflora</i> (L.) Brenan	Commelinaceae	Herb
2.	<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	Aquatic Herb
3.	<i>Nymphaea rubra</i> L.	Nymphaeaceae	Aquatic Herb
4.	<i>Ocimum americanum</i> L.	Lamiaceae	Herb
5.	<i>Ocimum teuiflorum</i> L.	Lamiaceae	Herb
6.	<i>Oldenlandia corymbosa</i> L.	Rubiaceae	Herb
7.	<i>Oropetium thomaeum</i> (L.f.) Trin.	Poaceae	Herb
8.	<i>Oxalis corniculata</i> L.	Oxalidaceae	Herb
9.	<i>Pancratium triflorum</i> Roxb.	Amaryllidaceae	Herb
0.	<i>Panicum flexuosum</i> Retz.	Poaceae	Herb

1.	<i>Panicum maximum</i> Jacq.	Poaceae	Herb
2.	<i>Parthenium hysterophorus</i> L.	Asteraceae	Herb
3.	<i>Passiflora foetida</i> L.	Passifloraceae	Climber
4.	<i>Pavonia procumbens</i> (Wight & Arn.) Walp.	Malvaceae	Shrub
5.	<i>Perotis indica</i> (L.) Kuntze	Poaceae	Herb
6.	<i>Phyllanthus amarus</i> Schumach. & Thonn.	Phyllanthaceae	Herb
7.	<i>Phyllanthus maderaspatensis</i> L.	Phyllanthaceae	Herb
8.	<i>Phyllanthus reticulatus</i> Poir.	Phyllanthaceae	Shrub
9.	<i>Polycarpaea corymbosa</i>	Caryophyllaceae	Herb
0.	<i>Polygala erioptera</i> DC.	Polygalaceae	Herb
1.	<i>Prosopis juliflora</i> (Sw.) DC.	Fabaceae	Tree
2.	<i>Pterolobium hexapetalum</i> (Roxb.) Santapau & Wagh	Fabaceae	Straggler
3.	<i>Pupalia lappacea</i> (L.) Juss.	Amaranthaceae	Herb
4.	<i>Putranjiva roxburghii</i> Wall.	Putranjivaceae	Tree
5.	<i>Rhynchosia minima</i> (L.) DC.	Fabaceae	Herb
6.	<i>Rivea hypocrateriformis</i> (Desr.) Choisy.	Convolvulaceae	Climber
7.	<i>Scleria lithosperma</i> (L.) Sw.	Cyperaceae	Herb
8.	<i>Senna uniflora</i> (Mill.) H.S. Irwin & R.C. Barneby	Fabaceae	Herb
9.	<i>Setaria verticillata</i> (L.) P. Beauv	Poaceae	Herb
0.	<i>Setaria pumila</i> (Poir) Roem. ex Schult.	Poaceae	Herb
1.	<i>Sida acuta</i> Burm.f.	Malvaceae	Subshrub
2.	<i>Sida cordata</i> (Burm.f.) Borssum Waalkes	Malvaceae	Subshrub
3.	<i>Sida rhombifolia</i> L.	Malvaceae	Subshrub
4.	<i>Solanum trilobatum</i> L.	Solanaceae	Climber
5.	<i>Spermacoce hispida</i> L.	Rubiaceae	Herb
6.	<i>Sporobolus maderaspatanus</i> Bor.	Poaceae	Herb
7.	<i>Synedrella nodiflora</i> (L.) Gaertn.	Asteraceae	Herb
8.	<i>Tamarindus indica</i> L.	Fabaceae	Tree
9.	<i>Tephrosia purpurea</i> (L.) Pers	Fabaceae	Subshrub
0.	<i>Tephrosia villosa</i> (L.) Pers	Fabaceae	Herb
1.	<i>Teramnus labialis</i> (L.f.) Spreng.	Fabaceae	Climber
2.	<i>Themeda triandra</i> Forssk.	Poaceae	Herb
3.	<i>Tinospora cordifolia</i> (Willd.) Miers	Menispermaceae	Woody Climber
4.	<i>Trachys muricata</i> (L.) Pers. ex Trin.	Poaceae	Herb
5.	<i>Tragus mongolorum</i> Ohwi	Poaceae	Herb
6.	<i>Tribulus terrestris</i> L.	Zygophyllaceae	Herb
7.	<i>Tridax procumbens</i> L.	Asteraceae	Herb
8.	<i>Trigastrotheca pentaphylla</i> (L.) Thulin	Molluginaceae	Herb
9.	<i>Vachellia nilotica</i> subsp. <i>indica</i> (Benth.)	Fabaceae	Tree

	Kyal. & Boatwr.		
0.	<i>Vernonia cinerea</i> (L.) Less	Asteraceae	Herb
1.	<i>Vicoa indica</i> (L.) DC.	Asteraceae	Herb
2.	<i>Vigna trilobata</i> (L.) Verdc.	Fabaceae	Herb
3.	<i>Waltheria indica</i> L.	Malvaceae	Herb
4.	<i>Zizyphus mauritiana</i> Lam.	Rhamnaceae	Tree
5.	<i>Zizyphus oenoplia</i> (L.) Mill	Rhamnaceae	Shrub
6.	<i>Zornia gibbose</i> Span.	Fabaceae	Herb

Habit-wise distribution

The diversity of habit forms of species at different taxonomic levels is given in Table 1. In the Eudicots 21 species are trees, 35 shrubs, 68 herbs, and 14 climbers. Monocots have 46 herbs and 1 climber. Among the dicots, the maximum number of species is found in the herb and shrub categories, while the minimum are under climbers. The notable feature is that in the case of monocotyledons, out of 47 species studied, 46 are herbaceous forms, largely falling under the category of grasses. The grass population comes up as soon as the monsoon springs and gets dried slowly along with the withdrawal of the monsoon and the inverse of temperature.

Table: 2 Habit-wise distribution of Angiosperm flora of Poiyamozhi Ayyanar sacred grove

Habit	Basal Angiosperms	Eudicot	Monocot	Total
Herb	1	68	46	115
Shrub	-	35	-	35
Tree	-	21	-	21
Climber	-	14	1	15

Endemics

In the present study of the 139 angiosperms, 10 species were found to be endemic in the study area. *Dalbergia coromandeliana* is a poorly known endemic species in Tamil Nadu (Ahmedullah and Nayar, 1986; Nayar, 1996; Thothathri, 1987). The species *Cleome felina* is endemic to peninsular India (Hooker and Thomson, 1872; Sundararaghavan, 1993; Kundu, 2007; Cochrane and Iltis, 2016). *Lepidagathis pungens* is endemic to Peninsular India (Muthukumar 2017; Daniel and Umamaheshwari 2001). *Drimia raogibikei* (Hemadri) species is endemic to India. *Cyanotis tuberosa* (Roxb.) Schult & Schult. f. and *Barleria cuspidata* F. Heyne ex Nees is endemic to Peninsular India (Natesan Balachandran *et al.*, 2018; <http://keralaplants.in/index.html>). *Andrographis serpyllifolia* (Vahl) Wight is endemic to Southern India (Natesan Balachandran *et al.*, 2018). *Eragrostiella brachyphylla* (Stapf.) Bor and *Cymbopogon travancorensis* Bor is endemic to Tamil Nadu (<http://tnenvi.nic.in/writereaddata/Endemic%20Plants%20of%20Tamil%20Nadu.pdf>).

Geophytes

Geophytes are plants with underground perennial organs (bulbs, corms, tubers, or rhizomes) which enable them to survive in unfavorable seasons (Raunkiaer, 1934). During

the present work, 12 geophyte taxa have been recorded from Kurumalai Hills forest. They belong to nine families, among these, the Dicotyledons are represented by four species and monocot represented by seven species. *Coccinia grandis* (rhizome), *Cyphostemma setosum* (tuber), *Nelumbo nucifera* (rhizome), *Fimbristylis ovata* (rhizome), *Setaria geminata* (rhizome), *Cyperus rotundus* (rhizome), *Cyanotis tuberosa* (tuber), *Ledebouria revoluta* (bulb), *Asparagus racemosus* (tuber), *Pancratium triflorum* (bulb), *Aponogeton natans* (tuber) and *Nymphaea rubra* (rhizome) are geophytic plants in the groove.

Exotic plant species recorded from the study area

Nearly 18% (34 non-indigenous taxa) were identified in 13 geographical nativity records for the plants studied. Of these, 17 were from Tropical America, followed by Tropical Africa (5 species), Trop. South America (3 species each) and Brazil, Europe, Mexico, North America, South West Asia, Trop. Central America, Trop. North America, Tropical West Asia, and the West Indies (1 species each). Herbs (67.64%) formed the predominant life form, followed by shrubs (8.82%), climbers (5.88%), trees (5.88%), and grasses (11.76%). In the above results, the predominance of herbaceous alien vegetation in the study area is similar to earlier findings by Naidu *et al.* (2015) for the tropical forests of Northern Andhra Pradesh and Sekar *et al.* (2015) for Himachal Pradesh. The ENVIS database on floral diversity in Tamil Nadu (<http://tnenvis.nic.in/>) reports a total of 1226 taxa as introduced. This accounts for 22% of the total flora of Tamil Nadu. About 79% of the alien flora of Tamil Nadu exists only under cultivation; 200 alien species occur as naturalized weeds, and another 56 species are found both in cultivation and as escapes. A total of 17 families of invasive alien flora were recorded, among these, Fabaceae constituted the predominant family with 6 species, followed by Asteraceae and Malvaceae (5 species and 4 species).

Table: 3 Exotic flora of Poiyamozhi Ayyanar sacred grove

S. No.	Botanical name of the invasive plant	Family	Nativity
	<i>Blumea obliqua</i>	Asteraceae	Trop. America
	<i>Boerhavia erecta</i>	Nyctaginaceae	North America
	<i>Calotropis gigantea</i>	Apocynaceae	Trop. Africa
	<i>Chamaeaista absus</i>	Fabaceae	Trop. America
	<i>Chloris barbata.</i>	Poaceae	Trop. America
	<i>Cleome viscosa</i>	Cleomaceae	Trop. America
	<i>Corchorus tridens</i>	Malvaceae	Trop. Africa
	<i>Croton bonplandianum</i>	Euphorbiaceae	South America
	<i>Cyperus difformis</i>	Cyperaceae	Trop. America
	<i>Cyperus iria</i>	Cyperaceae	Trop. America
	<i>Digera muricata</i>	Amaranthaceae	South West Asia
	<i>Echinochloa colona</i>	Poaceae	Trop. South America
	<i>Eclipta prostrata</i>	Asteraceae	Trop. America
	<i>Euphorbia hirta</i>	Euphorbiaceae	Trop. America

<i>Hyptis suaveolens</i>	Lamiaceae	Trop. America
<i>Indigofera linnaei</i>	Fabaceae	Trop. Africa
<i>Ipomea obscura</i>	Convolvaceae	Trop. Africa
<i>Jatropha gossypifolia</i>	Euphorbiaceae	Tropical West Asia
<i>Leucaena leucocephala</i>	Fabaceae	Trop. America
<i>Ludwigia perennis</i>	Onagraceae	Trop. Africa
<i>Malvastrum coromandelianum</i>	Malvaceae	Trop. America
<i>Mimosa pudica</i>	Fabaceae	Brazil
<i>Ocimum americanum</i>	Lamiaceae	Trop. America
<i>Oxalis corniculata</i>	Oxalidaceae	Europe
<i>Parthenium hysterophorus</i>	Asteraceae	Trop. North America
<i>Passiflora foetida</i>	Passifloraceae	Trop. South America
<i>Prosopis juliflora</i>	Fabaceae	Mexico
<i>Senna uniflora</i>	Fabaceae	Tropical America
<i>Sida acuta</i> Burm.	Malvaceae	Trop. America
<i>Spermacoce hispida</i>	Rubiaceae	Trop. America
<i>Synedrella nodiflora</i>	Asteraceae	West Indies
<i>Tribulus terrestris</i>	Zygophyllaceae	Trop. America
<i>Tridax procumbens</i>	Asteraceae	Trop. Central America
<i>Waltheria indica</i>	Malvaceae	Trop. America

Economic importance of the recorded plants

Medicinal importance

During the field survey, 17 species of medicinal plants belonging to 12 families were collected (Table: 4).

Table: 4 Medicinal Plants in Poiyamozi Ayyanar sacred grove

Botanical Name	Medicinal use
<i>Boerhavia erecta</i>	The root is used as a diuretic, stomachic, cardiotonic, laxative, expectorant, anthelmintic, hepatoprotective, and febrifuge.
<i>Calotropis gigantea</i>	Used to treat skin, digestive, respiratory, circulatory, and neurological disorders and fevers, elephantiasis, nausea, vomiting, and diarrhea.
<i>Cleome viscosa</i>	Rheumatic arthritis, hypertension, malaria, neurasthenia, and wound healing.
<i>Croton bonplandianum</i>	Treat liver disorders, and skin diseases including ringworm infection, to cure the swelling of the body, bronchitis, and asthma.
<i>Eclipta prostrata</i>	Treat asthma and other respiratory illnesses.
<i>Euphorbia hirta</i> .	Respiratory ailments (cough, coryza, bronchitis, and asthma), worm infestations in children, dysentery, jaundice, pimples, gonorrhea, digestive problems, and tumors.
<i>Hyptis suaveolens</i>	Used as a local seasoning and diabetes mellitus, fever, eczema, flatulence, cancers.

<i>Jatropha gossypifolia</i>	Anti-inflammatory and antimicrobial properties. The seeds and fruits used against influenza and as sedative, analgesic.
<i>Mimosa pudica</i>	Treatment of urogenital disorders, piles, dysentery, sinus, and also applied on wounds.
<i>Ocimum americanum</i>	Decoctions are used for coughs, pounded leaves are used for respiratory problems.
<i>Oxalis corniculata</i>	Anti-inflammatory, anxiolytic, anticonvulsant, antifungal, antiulcer, antinociceptive, anticancer, antidiabetic, hepatoprotective.
<i>Sida acuta</i>	Treat headaches, abnormal vaginal discharge, tuberculosis, diabetes, and malaria.
<i>Spermacoce hispida</i>	Treat urinary infections, oliguria, venereal diseases, conjunctivitis, hemorrhoids, gallstones, and stomach ailments.
<i>Synedrella nodiflora</i>	Treat inflammatory diseases, including liver disease, asthma, rheumatism, and earache.
<i>Tribulus terrestris</i>	Chest pain, heart problems, dizziness, skin, and eye disorders, to expel kidney stones and as a diuretic and tonic.
<i>Tridax procumbens</i>	Treat bronchial catarrh, diarrhea, and dysentery, and liver diseases.
<i>Waltheria indica</i>	Used against cough, and dysentery.

Other economically important plants

The grains of *Echinochloa colona* and the fruits of *Tamarindus indica*, *Ziziphus mauritiana* are edible. In *Cissus quadrangularis* stem and in the *Alternanthera sessilis* leaf are used as vegetable. *Albizia lebbbeck*, *Azadirachta indica* and *Tamarindus indica* are the timber yielding trees recorded in the study area. *Cynodon dactylon* and *Calotropis gigantea* is used in worshipping God “Ganesh”. *Aegle marmelos* and *Ficus religiosa* are sacred trees. *Eclipta prostrata* and *Oldenlandia corymbosa* are dye-yielding plants. *Aristida setacea* culms are extensively used for making brooms. *Eragrostiella bifaria* dried inflorescence is used in making bouquets. *Cyperus iria* culms are used to weave mats. *Echinochloa colona*, *Chloris barbata*, and *Panicum flexuosum* are valuable fodder.

DISCUSSION

The custom of establishing sacred groves originated in the remote past. Several inscriptions on stone slabs and copper plates record that rulers granted land to maintain temple gardens, which were called *thirunandavana*. A great variety of flowering plants were cultivated in these gardens, and flowers from them were offered to the deity to perform pujas (Hindu prayers). Sacred groves occur in almost every part of Tamil Nadu. Many villages have more than one. Their area ranges from a few trees to hundreds of hectares. Most of the sacred groves represent the natural climax vegetation of their geographical location (Table 1).

Pilgrims tie toy cradles to the branches of peepal, neem, and tamarind to favour child growth. The red pieces of cloth are tied to the trees. Similarly, people tie bangles to the trees to favour childbirth. Two big terracotta horses occur at the entrance of the Ayyanar Temple and many small, of various sizes, terracotta images of dogs, cows, and bulls are lined up in

one corner of the sacred grove. A few deities lie under a tree or shrub, smeared with turmeric powder and kunkuma dye powder. The rural people sacrifice goats and fowl as an offering to the deity. The people believe that any damage to the sacred grove, harm to the fauna residing in it, or felling of any tree from it may invite the wrath of the local deity, causing diseases and the failure of crops. In the Ayyanar temple sacred grove, people collect dead wood and twigs to cook the Pongal. This pongal is offered to the goddess and other deities. Later, the food is distributed to all those who are gathered in the temple.

Facus microcarpa, *Tamatindus indica*, and *Aegle marmelos* are treated as the most important sacred trees. During the rainy season, aquatic ephemerals such as *Ludwigia Lindernia*, *Bacopa*, *Marsilea*, etc. come up. *Prosopis*, an introduced plant, is progressively encircling patches of natural vegetation and strangling them extending inward. Medicinal plants like *Aegle marmelos*, *Phyllanthus emblica*, *Tinospora cordifolia*, *Capparis zeylanica*, *Mucuna pruriens*, *Asparagus racemosus*, *Solanum trilobatum*, *Phyllanthus amarus* and *Aloe vera* are very common in groves. The herbaceous flora in a sacred grove is rain-dependent, and most of it is annual. The number of herbaceous plants is less in the dry season. Besides, the sacred groves help the animals, like deer, snakes pigs, birds, and other lower organisms for shelter and drinking water.

The Ayyanar temple sacred grove is the repository of medicinal and endemic plants. This grove is the home of many insects, birds, reptiles, animals, and a storehouse of diverse natural wealth. In most regions of Tamil Nadu, scrub jungles are disappearing and are protected by sacred groves due to religious and traditional beliefs. Similarly, many old trees in the Kurumalai reserve forest are protected by the sacred grove. This sacred grove helps retain the subsoil water of the area. This grove is left untouched by the local inhabitants and protected by the local deity. It is preserved out of belief, fear or reverence. It is a kind of conservation and spiritual retreat. The local people around this hillock preserved this sacred grove by their traditional customs, rituals, ceremonies, and folk beliefs.

Similar to the present study, many observations are made in sacred groves in different areas of India. Taxonomical studies on sacred groves reported by Deepa *et al.* (2017), endemic plants in the sacred groves by Vartak (1983), Phytosociological studies of the sacred grove by Sukumaran *et al.* (2018), medicinal plants present in sacred groves by Singh *et al.* (2014), role of sacred groves in Biodiversity conservation by Mgumia and Oba (2003), ethnomedicinal plants of the sacred groves by Baidya *et al.* (2020), fodder, fuelwood species in sacred groves by Chandra *et al.* (2020). Ayyanar Temple sacred grove sustains rich plant diversity, which is similar with many sacred groves of India (Anoop *et al.*, 2017; Pallavi *et al.*, 2001; Harsh Singh and Vaibhav Kumar, 2020; Sayantani Chanda and Ramachandra, 2019; Savinaya Malve *et al.*, 2020; Jeeshna, 2020; Abhinand *et al.*, 2020; Deepanshu and Manju, 2021; Padma Sorna Subramanian *et al.*, 2020).

CONCLUSION

The present study aimed to record the plant wealth of Poyyamozhi Ayyanar Temple's sacred grove, Kovilpatii in the Tuticorin district of Tamil Nadu. 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 186 species of flowering plants belong to 147 genera and

29 orders were collected during the study. Among the 186 species documented in the present study, 8 species are Indian endemics. 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. Invasive alien species like *Prosopis julifera*, *Chamaeaista absus*, *Parthenium hysterophorus*, etc. are also a threat to the native flora. Pressure from the ever increasing human population and agriculture related activities in the adjacent private properties is 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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REFERENCES

- Abhinand NR, Arya S. Nair and Abhinav NR. 2020. Floristic Diversity of Sreedharan Chumarath Mana Sacred Grove in Muthuthala Panchayath, Palakkad District, Kerala, India. *Int. J. Adv. Res.* 8(05): 418-427.
- Anoop P. Balan, Bibin Thomas and Joseph Michael 2017. Floristic Diversity of Thevaramala Sacred Grove in Western Ghats, Kerala, India. *International Journal of Advanced Research in Botany (IJARB)* 3(1): 1-11.
- APG IV 2016. An Update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants. *Botanical Journal of the Linnean Society* 181: 1-20.
- Baidya S, Thakur B, and Devi A. 2020. Ethnomedicinal plants of the sacred groves and their uses by Karbi tribe in Karbi Anglong district of Assam, Northeast India. *Indian Journal of Traditional Knowledge.* 19(2):277-287.
- Britto SJ. 2019. The flora of Central and North Tamil Nadu parts 1-3. The Rapinat Herbarium, St. Joseph's College, Tiruchirappalli, South India.
- Chandra N, Joshi VC Mishra AP. 2020. Ecological status of fodder and fuelwood species in Banari Devi sacred grove of Kumaun Himalaya, Uttarakhand. *Indian Journal of Ecology.* 47(4):1044-1048.
- Chandran MDS and Hughes JD. 1997. The Sacred Groves of South India: Ecology, Traditional Communities and Religious Change. *Social Compass* 44: 413-427.
- Deepa MR, Udayan PS and Anilkumar KA 2017. Taxonomical and phytosociological studies on ChithalikavuA sacred grove, Thrissur district, Kerala. *Tropical Plant Research* 4(1): 20–30.
- Deepanshu, Manju 2021. Role of Sacred Groves in Phytodiversity Conservation of Block Nud, District Samba (J&K). *International Journal of Science and Research* 10(11): 1390 – 1395.
- Fosberg FR and Sachet H 1965. *Manual of Tropical Herbaria. RegnumVeg. Volume 39. The Netherlands. International Bureau for Plant Taxonomy and Nomenclature.* 132.

- Gamble JS 1915 – 1936. Flora of the Presidency of Madras. 11 Parts. (Parts 1–7 by Gamble and 8–11 by C.E.C. Fischer), London. Repr. Ed.1957. Calcutta: Botanical Survey of India.
- Harsh Singh and Vaibhav Kumar Dhawaj 2020. Sacred Grove: A unique example of cultural beliefs and traditional conservation. *Tropical Plant Research* 7(3): 553–564.
- Henry AN, Kumari GR and Chithra V 1987. Flora of Tamil Nadu, India Series 1: Analysis. Volume 2. Coimbatore: Botanical Survey of India.
- Jeeshna MV 2020. Floristic and Phytosociological Studies of the Sacred Grove, Kayyath Nagam Kavu, Kannur District Kerala. *India Research in Plant Sciences*. 8(1): 1-6.
- Jeeshna MV 2021. Phytosociological and Floristic Survey of the Sacred Grove Thekkumbhad Thazhe Kavu, Kannur District, Kerala, India. *Applied Ecology and Environmental Sciences* 9(4): 477-483.
- Kabeer KAA and Nair VJ 2009. Flora of Tamil Nadu Grasses. Botanical Survey of India, Kolkata.
- Kandari LS Bisht VK, Bhardwaj M. and Thakur AK 2014. Conservation and management of sacred groves, myths, and beliefs of tribal communities: a case study from north India. *Environ Syst Res* 3, 16. <https://doi.org/10.1186/s40068-014-0016-8>.
- Khan ML, Khumbongmayum AD and Tripathi RS 2008. The sacred groves and their significance in conserving biodiversity-an overview. *Int. J. Ecol. Environ. Sci.* 34(3): 277-291.
- Malhotra KC, Gokhale Y, Chatterjee S and Srivastava S 1999. Cultural and ecological dimensions of Sacred Groves in India, Indian National Science Academy.
- Mathew KM 1983. Flora of the Tamilnadu and Carnatic, The Rapinat Herbarium, St. Joseph's College, Trichy, Tamilnadu,
- Mgumia FH and Oba G 2003. Potential role of sacred groves in Biodiversity conservation in Tanzania. *Environmental conservation* 30(3): 259–265.
- Naidu MT, Kumar OA and Venkaiah M 2015. Invasive alien species in tropical forests of Eastern Ghats in Northern Andhra Pradesh, India. (4): 428-432.
- Nair, NC and Henry AN 1983. *Flora of Tamil Nadu Series 1: Analysis* Vol. 1. Botanical Survey of India, Southern Circle, Coimbatore, India.
- Natesan Balachandran, Krishnamurthy Rajendiran and Walter Gastmans 2018. Endemic plants of tropical dry evergreen forest, Southern India. *Biodiv. Res. Conserv.* 52: 11-23,
- Padma Sorna Subramanian M. Saravana Ganthi A and Subramonian K 2020. Sacred groves of Point Calimere Wildlife and Bird Sanctuary – Ideal centres for biodiversity conservation. *Int. J. Curr. Res. Biosci. Plant Biol.* 7(6): 45-54.
- Pallavi P. Borate and Meena S. Rao 2018. Floristic Diversity of Sacred Grove in Kudap Village in Ratnagiri District, Maharashtra. *Interdisciplinary Research Journal*, 08(02): 24 – 30.
- Raunkiaer, C 1934. *The life forms of plants and statistical plant geography*. Oxford: Clarendon Press.
- Ray R and Ramachandra TV 2010. Small sacred groves in local landscape: are they really for conservation. *Curr Sci* , 98(9):1178–1180.

- Rintelen KV, Arida E and Hauser C 2017. A review of biodiversity-related issues and challenges in megadiverse Indonesia and other Southeast Asian countries. *Res Idea Outcomes* 3: e20860. DOI: 10.3897/rio.3.e20860.
- Savinaya Malve Sathish, Narayana Jogattappa and Krishna Venkatarangaiah 2020. Endemic and threatened flowering plants of sacred Kaanu forests of Sharavathi River basin, Central Western Ghats, Karnataka *Asian Journal of Conservation Biology*, 9(2): 246-257.
- Sayantani Chanda and Ramachandra TV 2019. Vegetation in the Sacred Groves Across India: A Review Research & Reviews: *Journal of Ecology* 8(1): 29-38.
- Sharma S and Devi R 2014. Sacred groves: Traditional way of conserving plant diversity in Bhalwal block of Jammu district (J&K). *Int. J. Sci. Res.* 3(2): 239-242.
- Singh H, Husain T, Agnihotri T, Pande PC and Khatoon S 2014. An ethnobotanical study of medicinal plants used in sacred groves of Kumaon Himalaya, Uttarakhand, India. *Journal of Ethnopharmacology* 154(1): 98– 108.
- Sukumaran S, Pepsi A, SivaPradesh DS and Jeeva S 2018. Phytosociological studies of the sacred grove of Kanyakumari district, Tamilnadu, India. *Tropical Plant Research* 5(1): 29–40.
- Vartak VD 1983. Observation on rare imperfectly known and endemic plants in the sacred groves of Western Maharashtra.