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Floristic diversity of Shenduruny Wildlife Sanctuary, Southern Western Ghats, Kerala

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Abstract

A study on the flora with emphasis on endemic and threatened species was carried out recently in the Shenduruny Wildlife Sanctuary located along the Arienkavu-Kulathupuzha valley in Kollam (Quilon) district of Kerala state. The Sanctuary has an area of 100 km^2 including the Kallada Reservoir having an extent of 13.75 km^2. The study resulted in documenting the occurrence of 951 species of flowering plants belonging to 581 genera under 118 families. The analysis shows that the flora of the Sanctuary is rich in endemic species. Out of the 951 species, 310 are W. Ghat Endemics which form 32 per cent of the flora. The Arienkavu-Kulathupuzha valley is the type locality of several endemic arborescent species and most of them were relocated in the Sanctuary. During the present study two new species, one distribution record for South India and five for Kerala were also discovered. The Sanctuary possesses several rare and threatened species. One hundred species belonging to the threatened categories including 8 species considered 'possibly extinct' were also located.

INTRODUCTION

The need for conserving the biodiversity has been increasingly understood in the recent years for the sustenance of life on earth. Ever since the earth summit meeting at Rio de Janeiro in June 1992, biodiversity conservation has gained priority in tropical countries. A thorough knowledge on the diversity at macro and micro levels is essential for formulating conservation measures. Preparation of inventories of living organism with their distribution, occurrence, dynamics, etc. are also very important for the successful implementation of management practices.

The W. Ghats, one of the biodiversity hotspots in India is highly significant in terms of biodiversity. It is estimated that the W. Ghats has about 4,000 species of flowering plants (Nayar, 1997) which from about ¼th of the total estimated flowering plants of the country. The W. Ghats has a relatively high percentage of endemism with 1,500 species out of the total 4,000 species. With in the W. Ghats, the Southern W. Ghats is the richest in terms of floristic diversity and endemism. Among the 4,000 species found in the W. Ghats, 3,900 of them occur in this region which has an area of 12,000 km^2 spread over the southern parts of the states of Karnataka, Kerala and Tamil Nadu (Nayar, 1996).

The flora of W. Ghats is under severe threat due to various reasons. The various aspects of the problem have been highlighted by authors like Nair and Daniel (1986); Ahmedullah and Nayar (1987); Gadgil and Meher-Homji (1990) and Nayar (1996). As a measure of conservation programme, parts of the W. Ghats have been declared as protected areas through the establishment of Biosphere Reserve, National parks, Wildlife Sanctuaries, etc. The state of Kerala has declared about 20 per cent of the forests, a relatively higher percentage, as protected areas. This includes two National parks and 12 Wildlife Sanctuaries. Shenduruny Wildlife Sanctuary is one among them.

The Shenduruny Wildlife Sanctuary is part of the erstwhile Travancore state. The forests of this region have been reasonably well-explored by forest botanists like R.H. Beddome, T.F. Bourdillon, C.A. Barber and C.E.C. Fischer during the late 19th and early 20th centuries (Burkil, 1965). Their studies resulted in the discovery of several new taxa, most of which are endemics. Though the flora of Kollam (Quilon) (Mohanan, 1984), Thiruvananthapuram (Mohanan & Henry, 1994) and Pathanamthitta (Anilkumar, 1994) districts and Thenmala Forest Division (Subramaniyan, 1995) were studied recently, many of the endemic taxa reported earlier from this region could not be relocated. The Shenduruny Wildlife Sanctuary is a protected area in the Arienkavu-Shenduruny valley, the type locality of several endemic and threatened species. Under the programme of the documenting flora and fauna of protected areas in Kerala, a study on the flora of Shenduruny Wildlife Sanctuary was taken up with emphasis on endemic and threatened species.

STUDY AREA

The Shenduruny Wildlife Sanctuary is located between 77°4' and 77°14' East longitude and 8°48' and 8°58' North latitude, in the Thenmala Forest Division in Kollam (Quilon) Revenue District of Kerala. The Sanctuary has an area of 100 km^2, including the Kallada Reservoir which has an extent of 13.75 km^2. The

altitude varies from 120 to 1550 m, the highest peak being Alvarakurichi. The Sanctuary is drained by the Shenduruny river and its tributaries like *Aruvi ar*, *Uruli ar* and *Umi ar*. The Shenduruny river drains into the Kallada Reservoir, formed by the construction of a dam across the Kallada river at Thenmala. The other rivers which drain into Kallada Reservoir are the Kulathupuzha and Kazhuthuruthy.

The area has a fairly equable climate and seasonal variations in temperature is not much. The average annual rainfall is about 3000 mm. From October to January the Sanctuary experiences strong winds blowing from the plains of Tamil Nadu and passing through the Arienkavu gap. The high altitude places like Alvarakurichi and Pandimotta experience very strong winds during this period.

VEGETATION

By following Chandrasekharan (1962) and Champion and Seth (1968), the vegetation of the Sanctuary can be classified into the following types.

West coast tropical evergreen forest (evergreen)
West coast semi-evergreen forest (semi-evergreen)
Southern moist mixed deciduous forest (moist deciduous)
Southern hill top tropical evergreen forest (sholas)
Myristica swamp forest (swamp)

The forests of Thenmala Division have been subjected to heavy extraction of timber in the past. Forests were also cleared for raising rubber, oil palm, sugar cane, etc. People from the Kallada reservoir area were rehabilitated at Rosemala, inside the Sanctuary after clear felling.

MATERIALS AND METHODS

Collection of specimens in the generative stages were carried out for about 3 years in different seasons. Data on altitude, habit, habitat, occurrence, phenology, etc. were recorded. The specimens were prepared as per standard specification (Bridson & Forman, 1991) and identified with pertinent literature and authentic specimens. The specimens requiring further study were referred to experts at Kew and Leiden Herbaria.

RESULTS

1. Floristic analysis

During the present study 951 species of flowering plants belonging to 118 families were collected and recorded. Occurrence of another 42 species, mostly under cultivation were also recorded. Dicotyledons dominate with 715 species belonging to 432 genera and 100 families. Monocotyledons are represented by 236 species under 149 genera and 18 families. Among the families, Leguminosae and Orchidaceae have 70 species each, the former with 43 genera and the latter with 44 genera. Rubiaceae and Poaceae have 66 species each, the former has 32 genera and the latter has 49 genera. Euphorbiaceae comes next with 49 species and 25 genera. Cyperaeae and Asteraceae have 29 species each, the former with 10 genera and the latter with 29 genera. Acanthaceae is the eighth largest family with 28 species under 16 genera. Both Lauraceae and Annonaceae have 19 species each, there are 8 genera in the former, while Annonaceae has 13 genera. Among the 118 families, 23 Dicot and 7 Monocot families are represented by one species each. About 45 per cent of the species are belonging to 10 families.

A comparison of the relative dominance of families of South India and that of the Sanctuary shows that the first 8th families of South India are dominant in the Sanctuary also. The 9th and 10th dominant families in the Sanctuary are Annonaceae and Lauraceae. Lamiaceae and Asclepiadaceae are the 9th and 10th dominant families respectively in South India, while they are 16th and 20th dominant families in the study area.

2. Endemic plants

Nayar (1997) estimated that there are about 3,800 species of flowering plants in Kerala and 1,272 are Southern W. Ghat endemics. There are 102 species which are reported only from Kerala. He has identified three hotspots of endemic centres in Kerala, viz., Agasthyamala, Anamala-High Ranges and Silent Valley-Wyanad. From Agasthyamala region it is reported that there are 189 endemics restricted to this centre. Shenduruny Sanctuary comes under Agasthyamala centre of endemism.

Of the 951 species recorded from the Sanctuary, 310 are W. Ghat endemics. Among the families, Rubiaceae has the highest number of endemics with 29 species, followed by Orchidaceae (22 species), Lauraceae (16 species), Euphorbiaceae (15 species), Annonaceae and Leguminosae (13 species each),

Melastomataceae (12 species), Acanthaceae (11 species), Poaceae (10 species) and Arecaceae (8 species). In Kerala the first ten families with respect to endemic species are Rubiaceae, Poaceae, Orchidaceae, Acanthaceae, Leguminosae, Balsaminaceae, Asteraceae, Euphorbiaceae, Lamiaceae and Lauraceae (Nayar, 1997). Among these 10 families, except Balsaminaceae, Asteraceae and Lamiaceae, all the others are among the top ten families in the Sanctuary, though their ranks are slightly altered. Most of the endemic species of Balsaminaceae, Asteraceae and Lamiaceae are confined to the Anamala-High Range centre.

3. Rare and threatened plants

The rare and threatened plants of India are relatively well documented by Joseph (1977), Henry *et al.* (1979), Jain and Sastry (1984), Ahmedullah and Nayar (1987) and Nayar and Sastry (1987, 1988, 1990). Nayar (1997) listed out 1272 endemic taxa in Kerala of which 460 are placed under threat categories.

The Shenduruny Wildlife Sanctuary is the type locality of several endemic and threatened species. During the present study one hundred of such species were collected from the Sanctuary. The rare and threatened species collected from the area are listed in Table 1. From the present study it is evident that some of the species that were considered 'possibly extinct' are still surviving in the Sanctuary.

IUCN (1994) has provided a new set of guidelines for assessing the threat categories based mainly on quantitative data. During the present study to assess the structural composition of trees in the Myristica Swamp forests, enumeration of trees in two transects (Point centered quadrate sampling method) was carried out in two localities. *Syzygium travancoricum* (reported as extinct from Kulathupuzha - the type locality) was found to be the 4th dominant tree and another threatened species, *Kingiodendron pinnatum* as the 16th dominant tree among the 22 species enumerated in the first transect. In yet another transect *Syzygium travancoricum* was found to be the 6th dominant tree among the 13 tree species in the transect. These data indicate that quantitative studies are also essential to have a real status of plants on their distribution.

Table 1. Rare and threatened species collected from the area

Species	Family	Status	Reference
1	2	3	4
Acranthera grandiflora Bedd.	Rubiaceae	Vulnerable	Nayar, 1997
Actinodaphne campanulata Hook. f.	Lauraceae	Rare	Nayar, 1997
A. malabarica Balakr.	Lauraceae	Rare	Nayar, 1997
Aglaia barberi Gamble	Meliaceae	Rare	Ahmedullah & Nayar, 1997
A. bourdillonii Gamble	Meliaceae	Rare	Nayar, 1997
Anaphyllum beddomei Engl.	Araceae	Threatened	Nayar, 1997
A. wightii Schott	Araceae	Threatened	Nayar, 1997
Arisaema barnesii Fischer	Araceae	Threatened	Nayar, 1997
Ardisia blatteri Gamble	Myrsinaceae	Rare	Nayar, 1997
Aspidopterys canarensis Dalz.	Malpighiaceae	Vulnerable	Nayar, 1997
Atuna travancorica (Bedd.) Kosterm.	Chryso-balanaceae	Vulnerable	Nayar, 1997
Begonia albo-coccinea Hook. f.	Begoniaceae	Vulnerable	Nayar, 1997
B. cordifolia (Wt.) Thw.	Begoniaceae	Threatened	Nayar & Sastry, 1987
Bentinckia condapanna Berry ex Roxb.	Arecaceae	Threatened	Nayar, 1997
Blepharistemma serratum (Dennst.) Suresh	Rhizophoraceae	Vulnerable	Nayar, 1997
Boesenbergia pulcherrima (Wall.) O. Ktze.	Zingiberaceae	Threatened	Nayar, 1997
Buchanania lanceolata Wt.	Anacardiaceae	Threatened	Ahmedullah & Nayar, 1987
Bulbophyllum aureum (Hook. F.) J. J. Sm.	Orchidaceae	Endangered	Nayar, 1997
Calamus brandisii Becc.	Arecaceae	Threatened	Nayar & Sastry, 1988
C. nagbettai Fernadez & Dey	Arecaceae	Vulnerable	Nayar, 1997

1	2	3	4
Calliandra cynometroides Bedd.	Leguminosae	Possibly extinct	Nayar, 1997
Canthium pergracile Bourd.	Rubiaceae	Critical	Nayar, 1997
Capparis fusifera Dunn	Capparaceae	Rare	Nayar, 1997
C. rheedei DC.	Capparaceae	Rare	Nayar & Sastry, 1987
Ceropegia maculata Bedd.	Asclepiadaceae	Possibly extinct	Nayar & Sastry, 1988
C. metziana Miq.	Asclepiadaceae	Rare	Nayar & Sastry, 1988
Cinnamomum filipedicellatum Kosterm.	Lauraceae	Rare	Nayar, 1997
Cissampelopsis ansteadii (Tadul. & Jacob) Jeffrey & Chen	Asteraceae	Not recorded after type collection	Nayar, 1996
Claoxylon anomalum Hook. f.	Euphorbiaceae	Rare	S.Rani & Balakrishnan, 1995
Cleistanthus travancorensis Jablonsky	Euphorbiaceae	Rare	Nayar, 1997
Cordia octandra DC.	Boraginaceae	Possibly extinct	Nayar, 1997
Cryptocarya anamalayana Gamble	Lauraceae	Endangered	Nayar, 1997
Cynanchum alatum Wt. & Arn.	Asclepiadaceae	Rare	Nayar, 1997
Cynometra travancorica Bedd.	Leguminosae	Rare	Nayar, 1997
Drypetes confertiflora (Hook. f.) Pax & Hoffm.	Euphorbiaceae	Rare	Nayar, 1997
D. malabarica (Bedd.) Airy Shaw	Euphorbiaceae	Rare	Ahmedullah & Nayar, 1987

1	2	3	4
Didymocarpus repens Bedd.	Gesneriaceae	Vulnerable	Nayar, 1997
Elaeocarpus venustus Bedd.	Elaeocarpaceae	Vulnerable	Nayar, 1997
Ellipanthus tomentosus O.Ktze.	Connaraceae	Not located recently	Henry *et al.*, 1979
Eugenia discifera Gamble	Myrtaceae	Endangered	Nayar, 1997
Euonymus paniculatus Wt. ex Laws.	Celastraceae	Critical	Nayar, 1997
Garcinia imberti Bourd.	Clusiaceae	Endangere, Possibly extinct	Nayar, 1997 Henry *et al.*, 1979
G. rubro-echinata Kosterm.	Clusiaceae	Rare	Ahmedullah & Nayar, 1987
G. travancorica Bedd.	Clusiaceae	Rare	Ahmedullah & Nayar, 1987
Glycosmis macrocarpa Wt.	Rutaceae	Rare	Ahmedullah & Nayar 1987
Goniothalamus rhynchantherus Dunn	Annonaceae	Rare	Nayar, 1997
Hedyotis eualata (Gamble) Henry & Subram.	Rubiaceae	Rare	Nayar, 1997
H. purpurascens Hook. f.	Rubiaceae	Indeterminate	Nayar, 1997
H. ramarowii (Gamble) Rao. & Hemadri	Rubiaceae	Rare	Nayar, 1997
Hopea racophloea Dyer	Dipterocarpaceae	Rare	Nayar, 1997
H. erosa (Bedd.) van Sloot.	Dipterocarpaceae	Endangered	Nayar, 1997
Humboldtia decurrens Bedd. ex Oliver	Leguminosae	Rare	Nayar, 1997
Hydnocarpus macrocarpus (Bedd.) Warb.	Flacourtiaceae	Endangered	Nayar, 1997
Impatiens wightiana Bedd.	Balsaminaceae	Endangered	Nayar, 1997

1	2	3	4
Kingiodendron pinnatum (Roxb. ex DC.) Harms	Leguminosae	Rare	Nayar, 1997
Kunstleria keralensis Mohanan & Nair	Leguminosae	Rare	Nayar, 1997
Lasianthus cinereus Gamble	Rubiaceae	Endangered	Nayar, 1997
L. oblongifolius Bedd.	Rubiaceae	Endangered	Nayar, 1997
Litsea travancorica Gamble	Lauraceae	Not located recently	Nayar, 1997
Madhuca bourdillonii (Gamble) H. J. Lam	Sapotaceae	Possibly extinct Endangered	Nayar & Sastry, 1987 Nayar, 1997
Marsdenia raziana Yoga. & Subram.	Asclepiadaceae	Vulnerable	Henry *et al.*, 1979
M. tirunelvelica Henry & Subram.	Asclepiadaceae	Rare	Nayar & Sastry, 1988
Memecylon gracile Bedd.	Melastomataceae	Rare	Henry *et al.*, 1979
M. lawsonii Gamble	Melastomataceae	Rare and endangered	Ahmedullah & Nayar, 1987
Morinda reticulata Gamble	Rubiaceae	Rare	Nayar, 1997
Myristica malabarica Lamk.	Myristicaceae	Rare	Ahmedullah & Nayar, 1987
M. fatua var. *malabarica* (Bedd.) Sinclair	Myristicaceae	Rare	Ahmedullah & Nayar 1987
Nostolachma crassifolia (Gamble) Deb & Lahiri	Rubiaceae	Not collected since 1910	Henry et al 1979
Nothopegia aureo-fulva Bedd. ex Hook. f.	Anacardiaceae	Not located after type collection	Henry et al 1979
Octotropis travancorica Bedd.	Rubiaceae	Rare	Ahmedullah & Nayar, 1987
Ophiorrhiza roxburghiana Wt.	Rubiaceae	Rare	Nayar, 1997

1	2	3	4
Orophea uniflora Bedd.	Annonaceae	Rare	Nayar & Sastry, 1988
Palaquium bourdillonii Brandis	Sapotaceae	Possibly extinct	Nayar, 1997
Pavetta oblanceolata Bremk.	Rubiaceae	Critical	Nayar, 1997
P. praeiterita Bremk.	Rubiaceae	Possibly extinct	Nayar, 1997
Phaeanthus malabaricus Bedd.	Annonaceae	Vulnerable	Nayar & Sastry, 1990
Phyllanthus gageana (Gamble) Mohanan	Euphorbiaceae	Rare	Henry *et al.*, 1979
Piper barberi Gamble	Piperaceae	Vulnerable	Henry *et al.*, 1979
Popowia beddomeana Hook. f. & Thoms.	Annonaceae	Vulnerable	Henry *et al.*, 1979
Pothos armatus Fischer	Araceae	Threatened	Nayar, 1997
Psychotria macrocarpa Hook. f.	Rubiaceae	Rare	Nayar, 1997
Pterospermum reticulatum Wt. & Arn.	Sterculiaceae	Rare	Nayar, 1997
Rauvolfia hookerii Chithra & Srinivas.	Apocynaceae	Rare	Nayar, 1997
Rhynchosia acuminata Thw.	Leguminosae	Rare	Rudd, 1991
Sageraea grandiflora Dunn	Annonaceae	Endangered	Nayar, 1997
Salacia beddomei Gamble	Celastraceae	Rare	Nayar, 1997
Saprosma corymbosum Wt.	Rubiaceae	Rare	Nayar, 1997
Semecarpus auriculata Bedd.	Anacardiaceae	Vulnerable	Nayar, 1997
Solenocarpus indica Wt. & Arn.	Anacardiaceae	Rare	Nayar, 1997
Smithia gracilis Benth	Leguminosae	Rare	Nayar, 1997

1	2	3	4
Symplocos macrocarpa Wt. ex Cl.	Symplocaceae	Vulnerable	Nayar, 1997
S. macrocarpa ssp. *kanarana* (Talb.)Nooteb.	Symplocaceae	Rare	Nayar, 1997
S. wynaadense (O. Ktze.) Nooteb.	Symplocaceae	Rare	Ahmedullah & Nayar, 1987
Syzygium bourdillonii (Gamble) Rathakr. & Nair	Myrtaceae	Possibly extinct	Nayar, 1997
S. mundagam (Bourd.) Chitra	Myrtaceae	Rare	Ahmedullah & Nayar, 1987
S. travancoricum Gamble	Myrtaceae	Vulnerable	Nayar, 1997
Tarenna monosperma (Wt. & Arn.) Raju	Rubiaceae	Critical	Nayar, 1997
Trichosanthes anamalaiensis Bedd.	Cucurbitaceae	Rare	Nayar, 1997
Vernonia beddomei Hook. f.	Asteraceae	Critical	Nayar, 1997
V. heynei Bedd. ex Gamble	Asteraceae	Vulnerable	Nayar, 1997

DISCUSSION

During the study two new species viz. *Polyalthia shendurunii* Basha & Sasi. (1994) and *Ardisia stonei* Sasi. & Sivar. (1994) were described. *Zeuxine affinis* (Lindl.) Benth. ex Hook. f. is a new record for South India and species like *Bulbophyllum xylophyllum* Par. & Reichb., *Calamus nagbettai* Fernandez & Dey, *Cissampelopsis ansteadii* (Tadl. & Jacob) Jeffrey & Chen, *Marsdenia raziana* Yoga. & Subram. and *M. tirunelvelica* Henry & Subram. are new records of occurrence for Kerala (Sasidharan & Swarupanandan, 1995; Sasidharan & Anto, 1997).

The following species categorised as possibly extinct, viz., *Calliandra cynometroides* Bedd., *Cissampelopsis ansteadii* (Tadl. & Jacob) Jeffrey & Chen., *Cordia octandra* DC., *Garcinia imberti* Bourd. *Madhuca bourdillonii* (Gamble) H. J. Lam, *Palaquium bourdillonii* Brandis, *Pavetta praeiterita* Bremek., *Sageraea grandiflora* Dunn, *Syzygium bourdillonii* (Gamble) Rathakr. & Nair, could be located in the Sanctuary.

The heavy rains during November 1992 caused considerable damage to the terrain as well as vegetation. All the streams and rivers overflowed and the rocks and boulders were washed away by the flood. Despite the destruction and degradation at certain places, the existing forests still support a species rich vegetation containing several rare, threatened and considered possibly extinct species.

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