

DIVERSITY OF PTERIDOPHYTES IN MINIATURE SACRED FORESTS OF KANYAKUMARI DISTRICT, SOUTHERN WESTERN GHATS

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Abstract: Pteridophytes do not form dominant vegetation anywhere on the earth surface now, but have been replaced by the seed bearing plants. Their occurrence in several small patches relays the message of richness. During the present study, 24 species of Pteridophytes were inventoried from Vilavancode, Kalkulam and Thovalai sacred groves of Kanyakumari district, Southern Western Ghats, India. Some of them are well known for their economic values. The species richness was more or less similar in the first two sacred groves, however, it was reduced to 6 in Thovalai. The terrestrial Pteridophytes were dominant over epiphytes. The lithophytic species were least in number. As a result of rapid urbanization and biotic interference these important plants are under threat and their population is being reduced, due to the ever-increasing human population. Some rare, endangered and endemic species are still present only in some pockets of this district and are conserved by indigenous people in the form of sacred groves.

INTRODUCTION

Pteridophytes form a conspicuous element of vegetation all over the earth's surface. They are a group of plants important from phylogenetic and evolutionary point of view, because these plants not only show the evolution of vascular system but also vividly reflect the processes that have gone into the emergence of seed habit in plants. They provide a link with the higher vascular and lower non-vascular plants. These plants grown abundantly in the Himalaya and the hilly regions of Central and South India. About 110 genera and 600 species are found in India. The only authoritative taxonomic works on this group of plants are by Beddome (1863 – 1864, 1865 – 1870, 1883, 1892), Clarke (1880) and Hope (1899 – 1904) on ferns, and by Baker (1887), Chowdhury (1937), Alston (1945), Chakravorthy (1951), Balakrishnan *et al.* (1960), Mahabale (1962), Pant and Srivastava (1962) and Panigrahi and Dixit (1966, 1967, 1968) on fern-allies.

The first illustrated account on the ferns of peninsular India is that of van Rheede (1703) who has included illustrations of a few ferns and ferns allies from the Malabar Coast. It was Linnaeus who

referred and named them in his book, *Species Plantarum* (Linnaeus, 1753). The first taxonomic book devoted to ferns was written by Swartz (1806), who mentioned some species from peninsular India. Christensen's Index Filicum (1906) is very useful for taxonomic researches on ferns of the region. Subramanyam *et al.* (1960, 1961), Bir and Vasudeva (1971, 1979) and Manickam and Ninan (1976) have described present Pteridophytic flora of South Indian Peninsula containing notes on ecology, distribution, synonymy and correct nomenclature of Indian Pteridophytes. Pteridophytes of Pachmari and Mahendragiri were studied by Sharma *et al.* (1973) and Namby and Madhusoodhanan (1998). Sharma *et al.* (1977) have enumerated the ferns of Nilgiri district. Chandrasekhar (1972) illustrated the wild ferns of Madras City and its immediate neighborhood.

The indigenous communities of the state have an age-old tradition of preserving small patches of old growth forests as a part of their culture and religious beliefs. These forests popularly known as sacred forests are biodiversity rich communities, which provide refuge for a large number of endemic and rare plant taxa of the region (Jeeva *et al.*, 2006).

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The present investigation denotes the diversity of Pteridophytes in the miniature sacred groves of Kanyakumari district, Southern Peninsular India. This is the first of a series of collection trips planned for preparing Pteridophytic Flora of the sacred forests of Kanyakumari District.

Study Area

The study was conducted in Vilavancode, Kalkulam and Thovalai sacred groves in Kanyakumari District of Tamil Nadu, which is situated in the Southern part of the Indian Peninsula. It covers an area about 1672 km² and lies within 77°7' – 77°35'E and 8°5' – 8°35'N, surrounded by three seas (Gulf of Mannar, Indian Ocean and Arabian Sea), Southern Western Ghats and plains of Kerala. The annual rainfall varies between 103 cm to 310 cm (Kiruba *et al.*, 2006, 2007). The area is dominated by preponderance gneissic rocks (Foote, 1884), and red soil, apart from ferruginous element that varied greatly. Soil physicochemical parameters were analyzed by the method of Allen *et al.*, 1974 (Table-1).

The main rivers of this district are Kodayar, Tambaraparani, Kalikesam, Valliyar and Palayar. Tambarabarani and Palayar are wide and deep. At Manakudy, Palayar forms a major estuary (near Puthalam salt pan) and it flows into the Arabian Sea (Jeeva *et al.*, 2005).

METHODOLOGY

An extensive floristic survey of three sacred groves was carried out between May 1999 and April 2001. Specimens of Pteridophytes were collected and identified with the help of different floras (Beddome, 1868 – 1874; Chandra and Kaur, 1987, Chandra, 2000; Dixit, 1984; Manickam and Irudayaraj, 1992; Namby and Madhusoodanan, 1998). The Herbaria of Botanical Survey of India, Southern Circle, Coimbatore, and Botany Department, Scott Christian College, Nagercoil, were consulted for correct identification of plant specimens. The voucher specimens were deposited at the herbarium of Scott Christian College, Nagercoil.

Table-1: Soil (0–15 cm depth) characters of three sacred groves

Parameters	Vilavancode	Kalkulam	Thovalai
Area (ha)	5.6	3.0	1.7
Soil type	Red soil	Red loamy soil	Black soil
pH	6.4	7.3	5.3
EC	0.2	0.6	0.2
Moisture Content (%)	15.6	13.5	11.7
<i>Macronutrients</i> (kg/ha ⁻¹)			
Total Kjeldahl Nitrogen	106.2	124.6	104.6
Available Phosphorus	2.4	2.2	0.8
Potassium	68.5	85.0	78.6
<i>Micronutrients</i> (ppm)			
Iron	9.99	8.98	10.6
Copper	0.52	0.68	0.49
Zinc	0.24	0.2	0.2
Manganese	3.96	3.82	3.85

RESULTS

A total of 24 species were collected. Among these, 19 species were identified in Vilavancode, 18 species in Kalkulam and 6 species in Thovalai sacred groves (Table-2). This is significant because for the first time these species were collected from sacred groves of this District. Polypodiaceae was the dominant family with 4 species and it was followed by Pteridaceae (3 species). Thirteen families were monospecific.

The endemic species recorded from the sacred groves may not necessarily be endemic to Kanyakumari district, rather they are endemic to the entire Tamil Nadu and the Southern Western Ghats. Out of 24 species, 3 were endemic and 3 were endangered. The endemic species, were *Drymoglossum heterophyllum*, *Pteris confusa* and *Tectaria zeilanica* (endemic to Silent Valley). The endemic and endangered species, *Tectaria zeilanica*,

was rediscovered after a lapse of 138 years. The endangered species namely were, *Pteris vittata* (endangered, very rare in Tamil Nadu) and *Psilotum nudum* (endangered throughout the world).

There were 8 rare species (*Acrostichum aureum*, *Adiantum latifolium*, *Blechnum orientale*, *Ceratopteris thalictroides*, *Cheilanthes thwaitesii*, *Pyrrosia lanceolata*, *Tectaria zeilanica* and *Vittaria elongata*), which were collected, and 2 species were endemic (*Drymoglossum heterophyllum* and *Pteris confusa*).

Compared with flowering plants, Pteridophytes are largely neglected by researchers. But the ferns are becoming popular in horticulture for the beauty and variety of their frond forms. Some of them are widely cultivated as ornamental pot plants (*Actiniopteris radiata*, *Blechnum orientale*, *Drynaria quercifolia*, *Hemionitis arifolia*, *Lygodium flexuosum*, *Pityrogramma colomelanos* and *Psilotum nudum*). Several ferns are traditionally used as medicine, vegetable and green manure. Fronds of *Adiantum* sp. are used as a medicine by indigenous people.

Table-2: Pteridophytes observed in the sacred groves of Kanyakumari District

Species	Family	Distribution			Conservation Status
		V	K	T	
<i>Acrostichum aureum</i> L.	Pteridaceae	+	+	-	VR
<i>Actiniopteris radiata</i> Sw.	Actiniopteridaceae	-	-	+	O
<i>Adiantum incisum</i> Forsk.	Adiantaceae	+	+	-	C
<i>Adiantum latifolium</i> Lam.	Adiantaceae	+	+	+	R
<i>Blechnum orientale</i> L.	Blechnaceae	+	+	-	R
<i>Ceratopteris thalictroides</i> L.	Parkeriaceae	+	-	-	R
<i>Cheilanthes thwaitesii</i> Mett.	Sinopteridaceae	-	-	+	R
<i>Christella parasitica</i> (L.) Lev.	Thelypteridaceae	+	+	+	C
<i>Dicranopteris linearis</i> Burm.f.	Gleicheniaceae	+	+	-	C
<i>Drymoglossum heterophyllum</i> (L.) Trim.	Polypodiaceae	+	-	-	R/E
<i>Drynaria quercifolia</i> L.	Polypodiaceae	+	+	-	C
<i>Hemionitis arifolia</i> (Burm.) T. Moore.	Hemionitidaceae	+	+	-	C
<i>Lindsaea ensifolia</i> Sw.	Dennstaedtiaceae	+	+	-	C
<i>Leptochilus decurrens</i> Bl.	Polypodiaceae	+	-	-	C
<i>Lygodium flexuosum</i> (L.) Sw.	Schizaeaceae	+	+	-	C
<i>Marsilea minuta</i> L.	Marsileaceae	+	+	+	C
<i>Nephrolepis multiflora</i> Roxb.	Oleandroideae	+	+	-	C
<i>Pityrogramma colomelanos</i> L.	Hemionitidaceae	+	+	+	C
<i>Psilotum nudum</i> (L.) Beauv.	Psilotaceae	-	+	-	En
<i>Pteris confusa</i> T. G. Walter	Pteridaceae	+	+	-	VR/E
<i>Pteris vittata</i> L.	Pteridaceae	-	+	-	En
<i>Pyrrosia lanceolata</i> L. Far.	Polypodiaceae	+	+	-	R
<i>Tectaria zeilanica</i> (Hout.)	Tectarioideae	+	-	-	R
<i>Vittaria elongata</i> Sw.	Vittariaceae	-	+	-	R

V = Vilavancode; K = Kalkulam; T = Thovalai; E = Endemic to Western Ghats;

En = Endangered; R = Rare, VR = Very Rare; O = Occasional; C = Common; + = present; - = absent.

Habitat wise, 13 species were terrestrial, 6 epiphytic, 3 found in shady and moist places and 2 were lithophytic species (Fig. 1). The terrestrial climber *Lygodium flexuosum* (Schizaeaceae) is also reported in the present study.

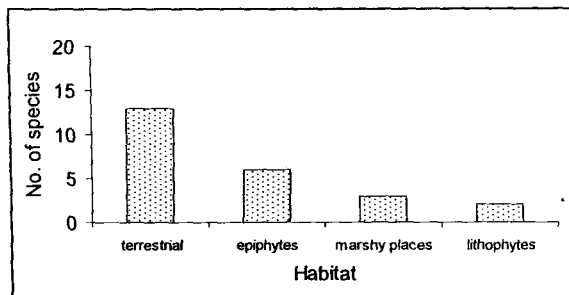


Fig. 1: Habitat wise distribution of species in three sacred groves.

DISCUSSION

Pteridophytes are the oldest land plant groups and they are mostly terrestrial, epiphytic or lithophytic. From the present study, it was found that seven species were rare in Tamil Nadu, three species endemic to Western Ghats, three species given were endangered and one species, earlier reported by Beddome (1864), was again rediscovered in the region. Majority of species showed luxuriant growth during rainy season but retarded growth during winter months. Bir *et al.* (1983) reported that at lower altitudes, some species are found throughout the year but *Marsilea minuta* was abundant only during rainy months. Our results, therefore, is in conformity with the work of Bir and Vasudeva (1971) and D'Almeida (1926 a, b). It is interesting to note that, generally, the distribution of Pteridophytes occurs at higher elevations, it may vary due to edapho-climatic conditions of the region however in the sacred groves present at a lower elevation, the rare, endangered and endemic species were safely protected due to moist shady condition inside the grove.

The genus *Tectaria* consists of 23 species, of which 10 species are reported from Sri Lanka (Sledge, 1982). Specimens of *Tectaria zeilanica* are neither available in the Herbarium of Botanical Survey of

India, Southern Circle, Coimbatore nor in the reprinted version of "Fern Flora of South India" (Namby and Madhusoodhanan, 1998) and the "Pteridophyte flora of the Western Ghats – South India" (Manickam and Irudayaraj, 1992). Recently this species was collected from Vilavancode sacred grove and the present collection, after about 138 years of its first collection. This demonstrates that the species is very rare and may be threatened and could be extinct in a few years if proper conservation measures are not adopted.

CONCLUSION

As the rich flora and fauna from various parts of the District were subjected to unscientific exploitation particularly for agriculture, construction of hydroelectric project, raising monoculture plantations and other developmental activities several fern taxa are fast disappearing or becoming extremely rare or extinct in these localities. The sacred groves are the only sites for *in situ* conservation of a few ferns. The conservation measures should also be extended for *ex situ* conservation (in gardens and parks). Several places in Southern Western Ghats are extensively explored, but some only partially, so therefore, increased efforts should be made in organising field trips and expeditions not only to increase the wealth of our herbaria and prepare our fern flora, but also to locate threatened species, and introduce them for conservation purposes.

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