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DIVERSITY OF PTERIDOPHYTES OF PONMUDI HILLS

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ABSTRACT

The Western Ghats is one of the hot spot of biodiversity (8° and 21° N and 73° and 78° E) that harbours wide array of RET, endemic and medicinal species. Most of the diversity studies are centralized around flowering plants and lower groups of plants are neglected. Pteridophytes form a conspicuous flora and significant in terms of phylogeny of plants. More than 12,000 species of pteridophytes are estimated and distributed along different biogeographical regions of India. In the present study documentation is attempted related with pteridophyta species that distributed along Ponmudi hills of Thiruvananthapuram district. The major families of pteridophytes found areAthyriaceae, Polypodiaceae, Selaginellaceae and Pteridaceae. Similarly, at generic level, maximum diversity is noticed in *Selaginella, Pteris,Nephrolepis. Athyrium,* and *iplazium*. Similarly, the region also harbours endemic species like *Cyatheanilgiriensis* and *Bolbitissemicordata*. The preferred habitat includes microclimatic conditions with special preference for moist and shady places. Even though many species of pteridophytes are moist loving, there are species which tolerate extreme drought conditions, located growing under direct sunlight. Pteridophytes belonging to Pteridaceae and Selaginellaceae in the documentation are categorized as resurrection plants. Minor disturbance may lead to loss of these species. Further, urbanization, high utilization factors have caused fragmentation of the habitats which is posing serious alarm to the pteridophytes especially endemic species. Currently, pteridological studies have geared due to its economic and therefore, more studies are required for developing *in situ* and *ex situ* conservation strategies for this primitive vascular species.

Keywords: Pteridophytes, Ponmudi hills, Conservation

INTRODUCTION

Pteridophytes (comprises ferns and fern allies) represent the earliest vascular land plants originated some 3000 million years ago and still some of them are luxurious irrespective of all the geological and climatological disturbances which occurred from time to time, without many changes in their morphology. They form a conspicuous element of vegetation all over the earth's surface. Pteridophytes are important from the evolutionary point of view, because they show the evolution of vascular system in plants and also clearly show the process of evolution of seed habit in plants. They are considered as connecting link between higher vascular plants and lower non vascular plants. They remain primitive tracheophyteslacking flowers and seeds and propagate through haploid spores and exhibit independent alternation of generations.

Ecologically they are adapted to almost all possible situations from tropics to temperate regions except in the Polar regions and deserts. They grow luxuriantly in moist tropical and temperate forests and their occurrence in different eco-geographically threatened regions from sea level to the highest mountains are of much interest [11].

Biodiversity of pteridophytesin Western Ghats

The world flora consists of approximately 12,000 species of pteridophytes of which around 1000 species distributed in 70 families and 192 genera are likely to occur in India [11]. Most of the pteridophytes diversity in India is observed in the Himalayas, Easternand Western Ghats. The Western Ghats, is rich with more than 300pteridophytes.Western Ghatis the 1600 km long chain of hills of Peninsular India, ranging from the Tapti river basin of thesouthern Gujarat to the Kanyakumari of Tamil Nadu. It is one of the most significant geological structures, whichcontrols the climate and culture of the Peninsular Indian states of Gujarat, Maharashtra, Karnataka, Kerala andTamil Nadu. It offers innumerable microhabitats for the luxuriant growth of flora, including the pteridophytes.

The first reference on the pteridophytes of Southern India could be traced back to Van Rheede's (1703)monumental work,'HortusMalabaricus'. It contains illustrated account of 15 pteridophytes[24]. Later Linnaeus (1753) referred them in his'Species Plantarum'. Col. Richard Henry

Beddome, a British Botanist and an ardent lover of ferns, published his outstanding works as Ferns of Southern India (1863),Ferns of British India (1865-1870), Handbook of Ferns of British India, Ceylon and Malaya Peninsula (1883). Theseworks still remain as authentic source books on the pteridophytes of the area. Alston (1945) has recordedabout 58 species of*Selaginella* from India, of which 14 species were from the Western Ghats.Mainly due to the arid nature, the diversity of the pteridophytes is comparatively lesser in the northernpart of the Western Ghats. The forests of Gujarat and Maharashtra, are deciduous, and hence not suitable for themoisture dependant pteridophytes. The diversity of the group is maximum in the moist southern part of theWestern Ghats, especially in the states of Kerala and Tamil Nadu.

Prof. Madhusoodanan,studied on various aspects of pteridophytes of Southern India [22] . He listed the rare and endangered ferns and fern allies of the WesternGhats of Kerala, and discussed its conservation. Revisionary studies of several families done by Madhusoodanan and his students resulted in recording many novelties. They have brought out documents on pteridophyte groups such as Adiantaceae [23], Polypodiaceae [39,40] Thelypteridaceae [18,19,20] Cheilanthoid ferns [17], Lomariopsidaceae [27, 28], Hymenophyllaceae [15], Aspleniaceae [4], Pteridaceae [43], etc. Nampy [38] described a new species of fern, *Bolbitisthom mankuthiana*, from Kerala, which Fraser-Jenkins [13,14] consider synonymous with B. semicordata (Baker) Ching. In the recent years, Nisha et al. [41] described a *Selaginella* from Lakkidi, as *S. lakkidiana.*

The scientists of Botanical Survey of India, led by N.C. Nair also made invaluable contribution towardsthe documentation of the pteridophyte diversity of Kerala. Nair and Bhargavan[37] prepared a detailed review on the pteridological studies of the Peninsular India. It contains references of many old literatures onpteridophytes of South India. Nair et al. [33,34,35,36] had brought out a detailed account on the fernsand fern-allies of Kerala, which contains 250 taxa. Scientist from other research institutions such as Kerala Forest Research Institute (KFRI), Jawaharlal Nehru TropicalBotanical Garden & Research Institute (JNTBGRI) also contributed their share towards the documentation ofthe pteridophyte diversity of the area. Sequiera [42] made a detailed study on the epiphytic pteridophytes of Kerala part of the Western Ghats. Mathew et al[32] provided an account of the ethnomedical importance of some pteridophytes of Kerala. Antony et al. [37] described 18 rare, endangered and threatened ferns fromChemunji hills of the Western Ghats in Kerala. Antony et al. described two new species of *Selaginella* from theAgasthyamala hills of Thiruvananthapuram district as *Selaginellacamusii* (2002) and *Selaginella agastyamalayana* (2007), which Fraser-Jenkins doubts as synonymous with *S. reticulta* or *S. proniflora*and *S. cataractarum* respectively. Easa[12] summarised data on the pteridophyte diversity of Kerala. Sujanapal and Sasidharan [44] recorded ethnobotanical information on 17 taxa of pteridophytes from Parambikulam wild life sanctuary.

Father Manickam and his team carried out extensive studies on the Pteridophyte diversity of the TamilNadu state. The fern flora of Palni hills, South India (1986) and Ecological studies on the fern flora of the PalniHills, South India (1984) have been published by him. He (1989) also presented an account on the ferns of theWestern Ghats. Manickam and Irudayaraj [29] studied the cytology of 100 species of ferns from the WesternGhats of South India. Pteridophytic flora of the Western Ghats-South India by Manickam and Irudayaraj (1992) is one of the best source book on the subject from the area. It presents illustrated accounts of256 pteridophytes from the Western Ghats, South of Palghat gap. Benniamin and Manickam [8] made a phytogeographical analysis of the pteridophytes of the Western Ghats. Irudayaraj and Ganapathi [16] discussed the conservation status of the rare and endangered fern *Elaphoglossum commutatum* from Kothayar hills in Kaniyakumari district of Tamil Nadu. A new species, *Polystichum manickamianum*, was described by Benniamin et al. [9] from the Agasthyamala hills of TamilNadu. It was later reported from the Kerala part of the Western Ghats also. Maridasand Raju[31] reviewed the conservation status of 272 species of ferns and fern-allies distributed in theWestern Ghats. However, the pteridophytes of the extreme southern part of Kerala State have not received much attention by plant explorers. In this scenario, the aim of the present study was to document the pteriophyte diversity of Ponmudi Hills in Thiruvananthapuram.

MATERIALS AND METHODS

Study area

Ponmudi hills is apart of Western Ghats mountain range that runs parallel to the Arabian sea.It lies in the Southernmost part of the Western Ghats region at an altitude of

1100m (3600ft).Study area is lies between8° 45′ 37″ N latitude and 77° 7′ 0″ Eand longitude (Figure 1). Ponmudi has a carpet of thick tropical forest that rolls down to the foot of the hill range.

The climate is primarily monsoonal and rains were received mainly by southwest monsoon during June- September. During the monsoons, the region receives the heavy rainfalls. The annual temperature varies between 25° C to 30° C. As a result, the region has densely covered with flora and fauna. The dominant forest type in this region are tropical evergreen, moist deciduous and, above 900m,low tropical evergreen. Survey was carried out in the tropical evergreen forest regions of the study area. Specimens were collected with their fertile parts and herbarium-specimens were prepared according to Jain and Rao(1976). Specimens were identified by referring keys and descriptions from taxonomic literature such as Pteridophytic Floras, manuals, monographs [5, 6, 7, 10, 30].Botanical names were authenticated by consulting with the Department of Botany, University of Calicut, Kerala. The herbarium collections are deposited in the Department of Botany, University College, Thiruvananthapuram. The nomenclature of taxa and species has been given according to Fraser-Jenkins (2008, 2010). Species were arranged alphabetically and categorized into rare, common and very common on the basis of their occurrence in the study area (Table 1).

Figure 1) Location of study area

RESULTS AND DISCUSSION

A total of 28 species of Pteridophytes belonging to 17 genera and 14 families have been observed in the study area. Taxonomically Pteridaceae was the dominant family with six species. Similarly, the other families of pteridophytes of the Western Ghats are Thelypteridaceae, Aspleniaceae, Pteridaceae, Selaginellaceae and Polypodiaceae [Sumeshet al.,45]. Out of 17 genera, 10 genera were represented by a single species each, two species each represented four generaviz., *Athyrium*, *Diplazium, Pteris* and *Lycopodium* and three species each represented three genera viz., *Adiantum*, *Selaginella* and *Nephrolepis*. According to habitats, 23 species of terrestrial ferns, two species of epiphytic ferns and three species of aquatic ferns were documented.Climbing ferns are represented by a single species i.e. *Lygodium flexosum*(L.) Sw. Similar observation is also supported by many reports on pteridophytes of the Western Ghats [46].Terrestrial plants predominantly occurred in exposed areas, shady areas, stream banks and hill slopes. Two endemic species *Bolbitissemicordata* and the tree species *Cyatheanilgiriensis* were also observed. Rare species such as *Psilotumnudum, Pterisquadriaurita* and *Diplaziumsylvaticum* need to be conserved.

The pteridophytes documented preferred habitats which includes microclimatic conditions with special preference for moist and shady places. Even though many species of pteridophytes are moist loving, there are species which tolerate extreme drought conditions and were located growing under direct sunlight.Pteridophytes belonging to Pteridaceae and Selaginellaceae in the documentation are categorized as resurrection plants. Pteridophytes belonging tofive families Actiniopteridaceae, Aspleniaceae, Pteridaceae, Selaginellaceae, and Sinopteridaceae been reported to show resurrection property. The species *Dicranopterislinearis* collected from the base of hills grow along the road side cuttings and survived in minimal amount of water. *Pteris* and *nephrolepis* species belonging to pteridaceae are resurrection species. *Selaginella* species are well studied resurrection plants.

Many pteridophytes are known to be usedby humankind in various ways, forexample, *Adiantum*sp. is usedas a medicine in fever, dysentery, jaundice[42].*Azollapinnata*R.Br. subsp.*asiatica* iswell known for its nitrogen-fixationcapacity used in rice fields [42]. Fronds of *Selaginellabryopteris* is used to treat neurological disorders[42].Currently many pteridophytic species are under threat to a large extent due tovarious anthropogenic activities. The mostcommonly identified causes of globalpteridophytes extinction are fragmentation, degradation and habitatdestruction, commercial collection,pathogens, predators and invasive species,climate change and pollution.In the study area Ponmudi hills the threat to pteridophyte diversity is mainly due to the developing tourism activities which include large scale construction of resorts. Pollution caused due to human intervention is also alarming. Moreover extensive collection of the plants for academic and other purposes threaten their existence. Present work helps to make a database to undertakeconservation strategies. During the lastfive years, most botanical exploration in Ponmudi hills has been focused onangiospermic plants and usually excluded detailed studies of pteridophytes. Present data on pteridophytes in the area is a small stepto fulfil the lacunaregarding the taxonomical distribution of pteridophytes. The present preliminarysurvey also may be a helpful tool for thefurther depth study on pteridophytes and conservation aspects.

Table 1: Enumeration of pteridophytes in Ponmudi hills of Thiruvananthapuram district, Southern most Western Ghats, Kerala

Name of species	Family	Status
	Pteridaceae	Very common
Adiantumpedatum	Pteridaceae	Very common
Adiantumtenerum	Pteridaceae	Very common
Athyriumfilix-femina	Athyriaceae	Very common
Athyriumghost	Athyriaceae	Common
Azollapinnata	Azollaceae	Very common
Bolbitissemicordata	Dryopteridaceae	Rare
Cyatheanilgiriensis	Cyatheaceae	Rare
Dicranopteris linearis	Gleicheniaceae	Very common
Diplaziummuricatum	Athyriaceae	Common
Diplaziumsylvaticum	Athyriaceae	Common
Drymoglossumpiloselloides	Polypodiaceae	Very common
Drynariaquersifolia	Polypodiaceae	Very common
Lycopodiumcernnum	Lycopodiaceae	Common
Lycopodiumclavatum	Lycopodiaceae	Common
Lygodiumflexosum	Lygodiaceae	Very common
Marseliaminuta	Marseliaceae	Very common
Nephrolepisbiserrata	Oleandraceae	Very common
Nephrolepiscordifolia	Oleandraceae	Very common
Nephrolepismultiflora	Oleandraceae	Very common
Psilotumnudum	Psilotaceae	Rare
Pterismultifida	Pteridaceae	Common
Pterisquadriaurita	Pteridaceae	Rare
Pterisvittata	Pteridaceae	Common

Salvinia minima	**Salviniaceae**	**Very common**
Selaginellabryopteris	**Selaginellaceae**	**Common**
Selaginellakraussiana	**Selaginellaceae**	**Common**
Selaginellawilldenwii	**Selaginellaceae**	**Common**

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