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PTERIDOPHYTE FLORA OF KOLLAM (ERAVIPURAM) AND THIRUVANANTHAPURAM (VARKALA) DISTRICT OF KERALA — A PRELIMINARY ANALYSIS

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Abstract

The Western Ghats also known as Sahyadri is known for its immense biodiversity (8° and 21° N and 73° and 78° E) that harbors most of the endemic and medicinal plants found in peninsular India.Mostly lower plants like pteridophyte are often excluded from the studies and angiosperms are given utmost priority in research purposes.When we analyze the phylogeny of plants, pteridophyte form a significant conspicuous flora since they are the connecting link between lower plants and higher plants. More than 1,000species of pteridophyte are distributed among the geographical regions of India, in which more than 300 species are found in WesternGhats. In the present study, pteridophyte species found in the southern part of Kerala namely from Varkala and Eravipuram region in Thiruvananthapuram and Kollam district of Kerala are documented. A total of 20 species are identified and the major families found areAthyriaceae, Polypodiaceae andSelaginellaceae. Most of the species were found in wetlands and humid regions which harbors a wide variety of biodiversity. According to local people most of the ferns are disappearing from these regions rapidly.Apart from minor disturbances,urbanization and fragmentation of the habitats are often considered as a serious threat to the pteridophyte, especially endemic species. Currently, pteridological studieshave gained more importance due to their ecological importance.Hence more studies related to this are required for developing in situand ex situ conservation strategies for preserving these primitive vascular

Key words: Pteridophytes, Varkala, Eravipuram, Conservation

Introduction

Pteridophytes are vascular cryptogams originated around 3000 million years ago. With the development of vascular system, they provided the connecting link between lower and higher plants. Another important characteristic is the independent gametophytic and sporophytic generation that showcased the evolution of seed process in plants. Since these species provide significant evolutionary evidence theyare considered as the integral part of plant diversity. During the late Paleozoic eras such as Devonian, Mississippian, and Pennsylvanian, they were the dominating flora on the planet, and the period was known as the 'Age of Pteridophyta.' The majority of them were wiped off in due course of time. The surviving species have diversified through time and could be found in every ecosystem on the planet. They possess a diverse array of variations in form, structure, habitat, and so on. These species occur in almost all part of the planet, except as parasites. Around 12,000 species of pteridophytes are estimated to be present in the world flora, of which 1000 species are distributed in 70 families and genera have 192 numbers are found in India (Dixit, 2000).

The Western Ghats is the most significant biodiversity hotspots in the Indian subcontinent comprising of tropical rain forests that consist of some of the endemic and rare species of plants and animals. The mountain ranges comprises 1600km long chain of hills, ranging from the Tapti river basin of the southern Gujarat to the Kanyakumari of Tamil Nadu that forms the geographical division between the northern and southern region of India. Even though it only covers 180,000 sq.km, that constitute only 6 percent of the total land area of India, the Western Ghats harbors more than 30 percent of all flora

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and fauna found in India. It is a major geological feature that influences the climate and culture of the Peninsular Indian states such as Gujarat, Maharashtra, Karnataka, Kerala, and Tamil Nadu. It provides a plethora of microhabitats for the luxuriant growth of plants, including pteridophytes.An estimate of 1000 species of pteridophytes occur in India (Fraser-Jenkins 2012), of which 300 are found in the Western Ghats.

The first mention of pteridophytes in Southern India can be found in Van Rheede's (1703) monumental book, Hortus Malabaricus. Illustrated account of 15 pteridophytes could be found in this book (Madusoodanan, *et.al,*1994). Carl Linnaeus (1753) referred them in his famous work 'Species Plantarum'. British Botanist,Col. Richard Henry Beddome was an ardent lover of ferns and he published a number of outstanding works on ferns such as Ferns of Southern India(1863),Ferns of British India (1865-1870),Handbook of Ferns of British India, Ceylonand Malaya Peninsula (1883). These works are still considered to be the authentic source of information about the pteridophytes of India. About 58 Indian species of *Selaginella* were reported by Alston (1945), of which 14 species were from the Western Ghats.Mainly due to the dry and arid nature,the diversity of the pteridophytes is comparatively lesser in the northern region ofthe Western Ghats. The deciduous forests covers the major part of Gujarat and Maharashtra, hence the moisture dependent pteridophytes are scarcely found. The maximum pteridophyte biodiversity could be observed in the wet and humid southern part of theWestern Ghats, especially in the states of Kerala and Tamil Nadu.

A study on various aspects of pteridophytes of Southern India was conducted by Madhusoodanan (1991). The rare and endangered ferns and fern allies of the Western Ghats of Kerala were listed during his research, and he also discussed about the conservation of their natural habitat. Many novelties were recorded by Madhusoodanan and his students during their revisionary studies of several families. Their combined effort brought out several documents on pteridophyte groups such as Adiantaceae (Madhusoodanan and Sevichan 1991),Polypodiaceae (Nampy, S. and Madhusoodanan, P.V. 1992&1998),Thelypteridaceae (Leena, K.R. and Madhusoodanan,P.V.1992, 1994& 1998),Cheilanthoid ferns (Jyothi, . and Madhusoodanan,. 1993),Lomariopsidaceae (Majeed, *et.al* 1994&1995),Hymenophyllaceae (Hameed *.et. al.,*2003),Aspleniaceae(Azeez 2008), Pteridaceae (Sequiera, 1998), *etc.* A new species of fern from kerala named, Bolbitisthommankuthiana was described by Nampy (2000) which Fraser Jenkins (Fraser-Jenkins 2008 a& 2008b) considered synonymous with B. semicordata (Baker) Ching. In the recentyears, Nisha et al. explained about a Selaginella from Lakkidi,known as S. lakkidiana.The scientists of Botanical Survey of India,led by . Nair also made significant contributionsfor the documentation of thepteridophyte diversity of Kerala. A detailed review on the pteridological studies of the PeninsularIndia was prepared by Nair and Bhargavan (Nair and Bhargavan 1981). It consists of several references of oldliteratures that describes pteridophyte flora of South India.Nair et.al (1988, 1992&1994)had conducted extensive research on the pteridophyte flora and brought out a detailed data of the fernsand fernalliesof Kerala, which contained 250 taxa in total. Scientist from other research institutions such asKerala Forest Research Institute (KFRI) and Jawaharlal Nehru TropicalBotanical Garden& Research Institute (JNTBGRI) had alsocontributed their research analysis and documentation ofthe pteridophyte diversityof the area. Sequiera (Sen and Ghosh, 2011) conducted an extensive study on the epiphytic pteridophytes focusing on Kerala region of Western Ghats. Mathew et.al conducted a detailed studied on the ethnomedical importance of various pteridophytes in Kerala.Antony *et.al* (2000) described 18 rare, endangered and threatened species of Pteridophytes from the Chemunji hills of the WesternGhats. Antony *et al.* described twonew species of Selaginella, namely Selaginella camusii(2002) and Selaginella agastyamalayana (2007) from the Agasthyamala hills

of Thiruvananthapuram district, which Fraser Jenkins doubts as synonymous with S. reticulta or S. proniflora and and S. cataractarum respectively. Easa (2003) formulated a complete data on the pteridophyte diversity of Kerala. Sujanapal and Sasidharan (2009) recorded ethnobotanical properties of 17 taxa ofpteridophytes from Parambikulam wild life sanctuary.

Pteridophytes are of incredible economic importance, hence relevant studies to know about their economic utility in our day to day life is indeed necessary. Ferns have a wide range of economic benefits, including food and fodder, biological indicators, bio fertilizer, insect repellants, medicine, and traditional remedies. However, the issue of whether the full potential of these fascinating plants has ever been exploited by humans remains uncertain. Due to their delicate beauty and elegance, many of these species are cultivated as ornamentals, either within in the residences or in botanical gardens. The hybrids of different pteridophyte species are now exquisite, expensive, delegate members in horticulture.Another major economic impact of pteridophytes is that their fossil remnants contribute to the coal depositions around the globe. As we can see, ferns are a distinct category of plants with enormous potential for research that could be utilised in a wide range of economic and academic fields.

Most of the plant explorers have turned a blind eye towards the pteridophyte flora of Kerala's farthest southern region. Therefore the present study is a humble attempt to enumerate and analyse the pteridophytic flora found in Varkala and Eravipuram regions of Thiruvananthapuram and Kollam district of Kerala.

Material and Methods

Study area

Varkala is a coastal region located in the Thiruvananthapuram district of Kerala. It lies in the southern region of Western Ghats at an altitude of 190ft (58m). Our study area lies in between 8° 44' 38N latitude and 76° 42' 6Elongtitude. The second study area is Eravipuram located in the Kollam district of kerala. It also lies in the Southern region of Western Ghats at an altitude of 19.69ft (6.0m). The study area is between 8.86 N Latitude and 76.62 ELongitude.

Both regions have monsoon climate and rains were received mainly by southwest monsoonduring the months of June- September. During themonsoons, both region receives the heavy rainfall, which helps different plant species to thrive in these areas. The annual temperature varies between 25° C to 35° C. The dominance of tropical plant species could be observed due to favorable climatic conditions. Survey was carried out mainly in the wetlands, river banks and freshwater canals of both studyareas. Specimens were identified and were collected with theirfertile parts for the herbarium preparation. Herbarium of the specimens wereprepared and preserved according to Jain and Rao (1976).Specimens were identified with the help of referring keysand descriptions from taxonomic literaturesuch as Pteridophytic Floras, manuals and various websites.The herbarium collections are preserved and deposited at SNCW, Kollam. Species were categorized on the basis of their occurrence in both regions (Table 1).

Result And Discussion

The present study records 31 species of Pteridophytes from the regions of Varkala and Eravipuram. Of which 29 species are terrestrial and 2 species were aquatic.*Pteridaceae* family dominated among the 13 families identified. *Adiantum* species was the most common pteridophyte observed in both regions. *Adiantum* and *Lygodium*species are the most common pteridophytes in Varkala region while Pteris and Adiantum species were the most found in Eravipuram.Very rare species *Psilotum nudum*is found at Eravipuram which needs to be conserved. Even though both places have almost similar climatic conditions, the variation in soil texture, humidity and the pollution levels might have been the deciding factors that showcased the increase or decrease of certain species in a -

particular area.Despite the fact that many pteridophyte species prefer damp environments, there are a few that can thrive in extremely dry conditions and have even been observed growing in direct sunlight. Pteridophytes belonging to Pteridaceae and Selaginellaceae in the records are categorised as resurrection plants. From Table 1, Aspleniaceae, Pteridaceae, and Selaginellaceae are three families of Pteridophytes that have been claimed to have resurrection properties.Among these Sellaginella species are well studied resurrection plants.

Many pteridophytes are known for its ethnomedical uses, forexample, *Adiantum sp*. is used as a medicine in fever, dysentery, jaundice (Sen, A., and Ghosh, P. D. 2011) . *Azollamicrophylla* iswell known for its nitrogen fixing capacity in rice fields and is used widely in agriculture sector as a bio fertilizer.

Extinction of pteridophytic species have increased dramatically as a consequence of innumerous anthropogenic activities. Several factors have been cited as an important threat to the extinction of pteridophytes, that includes habitat fragmentation, deterioration and destruction due to commercial activities, diseases, predators,invasive species, climate change and so on. Human-induced pollution is also a reason for concern. Furthermore, the plants' continued existence is jeopardized by widespread collection of endemic species for academic and other purposes.

Our study in both regions also revealed the loss of plant species within a decade. When we consulted the local residents they have also testified this statement. They have disclosed their concern regarding the disappearance of many wild varieties that used to thrive in these regions. They also affirm that pteridophyte population has reduced drastically and many familiar species are nowhere to be seen.The study being done now contributes to the creation of a database to be used in conservation projects.

Angiospermic plants have received the majority of the attention in south Kerala's botanical exploration, with little attention paid to pteridophytes. A small step has been taken to fulfill the data deficit on the taxonomical distribution of pteridophytes using the resources presently available. The results of this preliminary survey may prove useful in subsequent research on pteridophytes.

The Pteridophyte species we have collected during our study is mentioned below in Table 1, along with their family name and the state of occurrence in the study area. The name of species are arranged according to the alphabetic order.

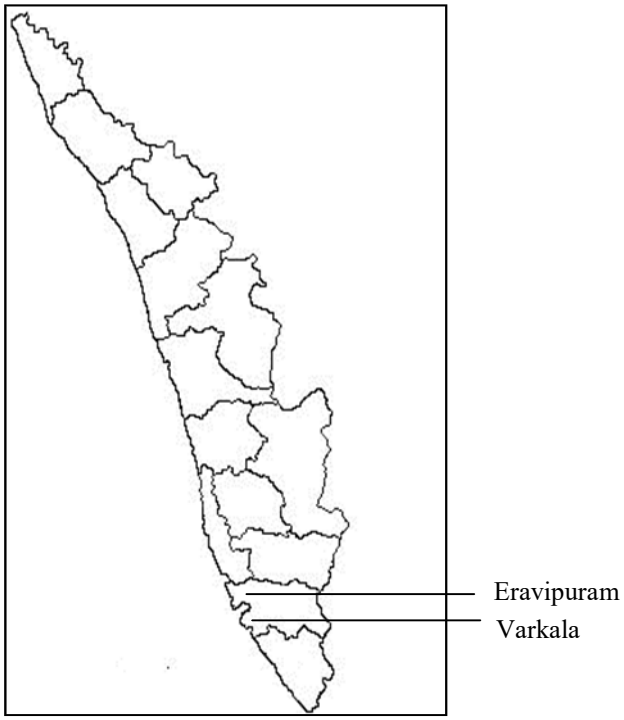

Figure 1. Map shows selected area for study

Table 1. Enumeration of pteridophytes in Varkala and Eravipuram regions of Thiruvananthapuram and Kollam District respectively

	NAME OF SPECIES	FAMILY	STATUS
1.	*Acrostichum aureum*	Pteridaceae	common
2.	*Adiantum capillus-veneris*	Pteridaceae	very common
3.	*Adiantum abscissum*	Pteridaceae	common
4.	*Adiantum caudatum*	Pteridaceae	common
5.	*Adiantum incisum*	Pteridaceae	common
6.	*Adiantum latifolium*	Pteridaceae	common
7.	*Adiantum lunulatum*	Pteridaceae	common
8.	*Adiantum raddianum*	Pteridaceae	rare
9.	*Asplenium adiantum-nigrum*	Aspleniaceae	common
10.	*Athyrium filix-femina*	Athyriaceae	rare
11.	*Azolla microphylla*	Salviniaceae	common
12.	*Blechnum cartilagineum*	Blechnaceae	common
13.	*Blechnum orientale*	Blechnaceae	rare
14.	*Ceratopteristhalictroides*	Pteridaceae	common
15.	*Chelianthestenufolia*	Pteridaceae	rare
16.	*Cystopteris fragilis*	Dryopteridaceae	common
17.	*Gleicheniadicarpa*	Gleicheniaceae	very common
18.	*Lygodium flexuosum*	Lygodiaceae	common
19.	*Lygodiummicrophyllum*	Lygodiaceae	common
20.	*Marsilea minuta*	Marsileaceae	common

21.	*Marsilea quadrifolia*	Marsileaceae	common
22.	*Ophioglossomreticulatum*	Ophioglossaceae	rare
23.	*Osmunda huegeliana*	Osmundaceae	rare
24.	*Psilotum nudum*	Psilotaceae	very rare
25.	*Pteris chilensis*	Pteridaceae	common
26.	*Pteris vittata*	Pteridaceae	common
27.	*Rumohraadiantiformis*	Dryopteridaceae	common
28.	*Salvinia minima*	Salviniaceae	common
29.	*Selaginella ciliaris*	Selaginellaceae	rare
30.	*Selaginella involvens*	Selaginellaceae	rare
31.	*Selaginella kraussiana*	Selaginellaceae	rare

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