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Taxonomic Documentation of Pteridophytes of Pananchery Panchayath (Thrissur District), with Special Reference to Stem/Stipe Anatomy

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Abstract

Pteridophytes, one of the oldest plant groups, are a fascinating member among the plant kingdom. It occupies an intermediate position in between lower and higher plant groups, because of the presence of vascular elements and reproduction through spores. Pteridophytes have got a wide range of economic and ecological importance, but enough attention has not been paid towards their useful aspects. This is an attempt to document the pteridophytes of Pananchery Panchayath, Thrissur District with a detailed taxonomic account. The morphological and stem/stipe anatomical characters of the collected plants were studied. Repeated collection was done for a period of five months (January – May, 2016) in the study area, both in its vegetative and reproductive stages. The present study revealed the occurrence of 18 species of pteridophytes belonging to 15 genera comes under 13 families. Out of them, 1 species belongs to the class Lycopsida and the remaining 17 species represent Filicopsida. Out of the 18 species, 13 species (72%) are terrestrial, 4 species (22%) are aquatic and 1 species (6%) is epiphytic. The anatomical features show varied characters in the distribution of ground tissue and vascular elements.

Keywords: Pteridophytes, Pananchery Panchayath, Morphological characters, Anatomical characters.

Introduction

Pteridophytes are flowerless, seedless and spore bearing cryptogamic vascular plants currently with about 1200 known species reported from India (Manickam and Irudayaraj 1992, Manickam and Rajkumar 1999, Chandra 2000). Generally pteridophytes are from two phylogenetically distinct groups: the lycophytes and the ferns (PPG I 2016). They are widely distributed, from the tundra to tropical forests, being more diverse in the equatorial region (Tryon & Tryon 1982, Moran 2008). It occupies an intermediate position between bryophytes and higher land plants in requirements of life cycle and complex internal organization with vascular elements. It has got a wide range of ecological and economic importance, but enough attention has not been paid towards their useful aspects. This is an attempt to document the pteridophytes of Pananchery Panchayath, Thrissur District with a detailed account on taxonomy and anatomy.

Materials and Methods

For the present study, the area selected was Pananchery Panchayath of Thrissur district, Kerala. It has a total geographical area of 141.71sq.Km and the area spread two villages namely Pananchery and Peechi. Pteridophyte specimens were collected repeatedly both in its vegetative and reproductive stages from the study area for a period of five months from January to May 2016. All the field observations such as habit, habitat, structure of rhizome, nature of leaves, branching patterns *etc.* were noted in the field book and dried specimens were mounted on herbarium sheets. The plants were identified with available literatures and flora (Manickam and Irudayaraj, 1992). For the anatomical studies, sections of stem and stipe were taken from the live specimens and observed under microscope and also photographed using camera attached trinocular research microscope.

Results and Discussion

As part of the documentation of Pteridophytes, 18 species belonging to 15 genera under 13 families were collected and identified. The Pteridophytes of this area falls under two main classes, namely Lycopsida and Filicopsida. Out of the 18 species, only a single species belongs to Lycopsida and the remaining 17 represent Filicopsida. The single family coming under Lycopsida is Selaginellaceae. The families represent among Filicopsida in this area are Polypodiaceae, Lygodiaceae, Pteridaceae, Adiantaceae,Hemionitidaceae, Parkeriaceae, Marsileaceae, Thelypteridaceae, Nephrolepidaceae, Azollaceae and Salviniaceae. The identified species were given in Table 1.

Sl. No.	Family	Genus	Species	Habitat
1	Adiantaceae	1. *Adiantum*	1. *Adiantum latifolium*	T
			2. *Adiantum lunulatum*	T
2	Azollaceae	2. *Azolla*	3. *Azolla pinnata*	A
3	Gleicheniaceae	3. *Dicranopteris*	4. *Dicranopteris linearis*	T
4	Hemionitidaceae	4. *Parahemionitis*	5. *Parahemionitis cordata*	T
		5. *Pityrogramma*	*6. Pityrogramma calomelanos*	T
5	Lygodiaceae	6. *Lygodium*	7. *Lygodium flexuosum*	T
6	Marsileaceae	7. *Marsilea*	8. *Marsilea minuta*	A
7	Nephrolepidaceae	8. *Nephrolepis*	9. *Nephrolepis multiflora*	T
			10. *Nephrolepis exaltata*	T
8	Parkeriaceae	9. *Ceratopteris*	11. *Ceratopteris thalictroides*	A
9	Polypodiaceae	10.*Drynaria*	12.*Drynaria quercifolia*	E

10	Pteridaceae	11. *Pteris*	13. *Pteris confusa*	T
			14. *Pteris vittata*	T
11	Salviniaceae	12. *Salvinia*	15. *Salvinia molesta*	A
12	Selaginellaceae	13. *Selaginella*	16. *Selaginella delicatula*	T
13	Thelypteridaceae	14. *Christella*	17. *Christella dentata*	T
		15. *Cyclosorus*	18. *Cyclosorus interruptus*	T

Table 1. Pteridophytes observed from Pananchery Panchayath

Out of the 18 species, 13 spp. are terrestrial (T), 4 spp. are aquatic (A) and 1spp. is epiphytic (E) (Figure 1). Due to the overall favorable climatic conditions and the most suitable habitats available for growth, the mentioned pteridophytes are widely distributed in this area in varying habitats and some ferns have become locally abundant and conspicuous.

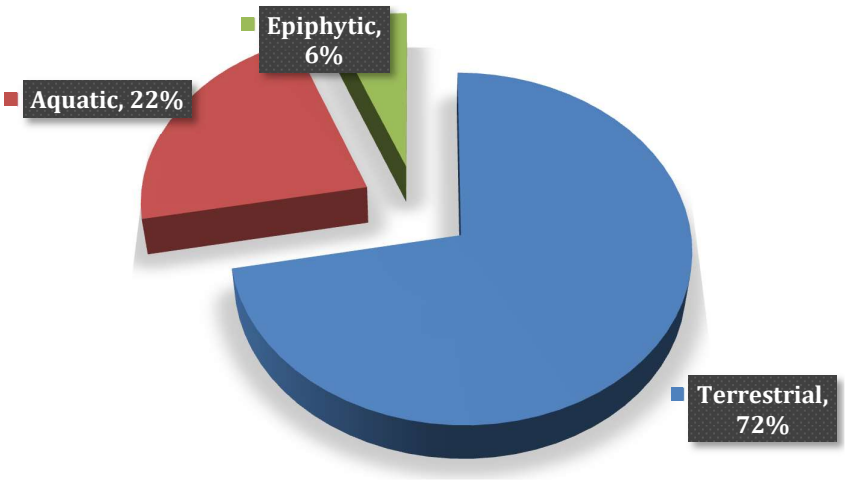


Figure 1. Habitat of observed pteridophytes.

Most of the collected species are economically important (Table 2). Among them, 9 spp. (50%) have medicinal importance, 4 spp. (22.22%) are used as food, 4 spp. (22.22%) as ornamentals, 2 spp. (11.11%) as fodder and 2 spp. (11.11%) as biofertilizer or manure. 2 spp. (11.11%) are used in waste treatment and 1 species (5.55%) used for phytoremediation. 2 spp. (11.11%) are observed as weeds, and 1 species (5.55%) used in paper industry (Figure 2).

Name of the species	Uses
Adiantum lunulatum	Medicinal
Azolla pinnata	Biofertilizer, edible, fodder and biofilter
Ceratopteris thalictroides	Edible, medicinal and manure
Dicranopteris linearis	Medicinal
Drynaria quercifolia	Medicinal
Lygodium flexuosum	Edible, medicinal
Marsilea minuta	Edible, medicinal and weed
Nephrolepis exaltata	Ornamental
Parahemionitis cordata	Medicinal
Pityrogramma calomelanos	Medicinal, ornamental
Pteris vittata	Medicinal, ornamental and phytoremediation
Salvinia molesta	Ornamental, fodder, weed, raw material of paper and in sewage treatment

Table 2. Potential uses of Pteridophytes

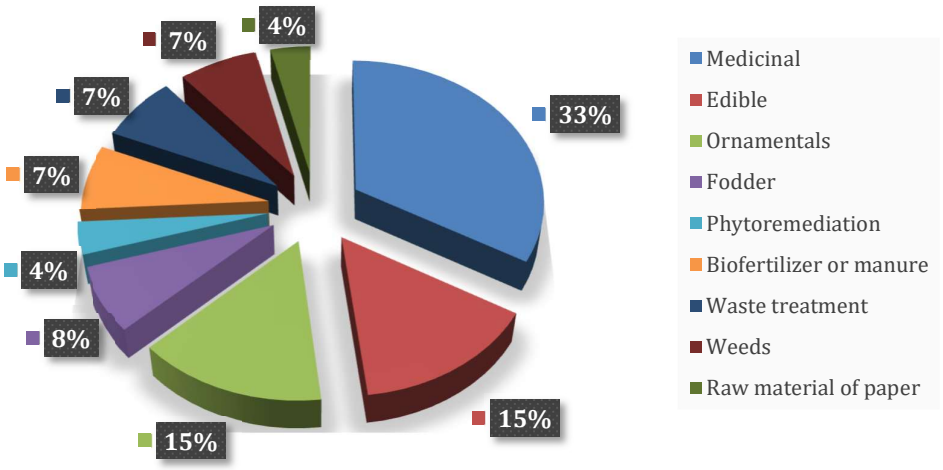
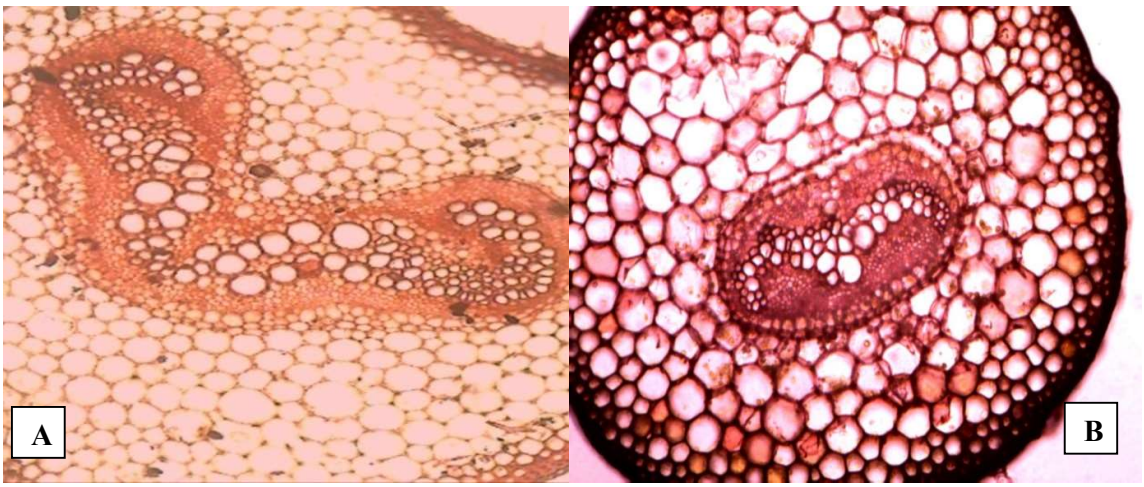


Figure 2. Potential uses of observed Pteridophytes.

Anatomical studies

Anatomy is one of the objectives of the present study because it too has an important role in the identification of pteridophytes. Out of the 18 species, in 10 species *viz. Adiantum latifolium, Adiantum lunulatum, Christella dentata, Cyclosorus interruptus, Dicranopteris linearis, Drynaria quercifolia, Lygodium flexuosum, Nephrolepis multiflora, Nephrolepis exaltata, Parahemionitis cordata, Pteris confusa, and Pteris vittata,* the ground tissue is differentiated into outer sclerenchymatous and inner parenchymatous regions. In *Ceratopteris thalictroides* the ground tissue is formed of many layered parenchyma cells. This may be due to the adaptation of the species to survive in the aquatic habitat. In *Marsilea*, sclerenchymatous middle cortex is present in contrary to others. Collenchymatous outer region and parenchymatous inner cortex is seen in *Pityrogramma calomelanos.* The stem of *Salvinia molesta* shows outer aerenchymatous and inner parenchymatous cortex. In *Azolla pinnata,* cortex is made up of many layered parenchymatous cells. Trabeculae are present in two species, *Selaginella delicatula* and *Marsilea minuta.*

The vascular tissue shows a variety of arrangements (Plate 1). The xylem is arranged in hippo-campus shaped manner in *Christella dentata, Cyclosorus interruptus and Pityrogramma calomelanos.* In *Marsilea minuta, Pteris vittata, Parahemionitis cordata, Ceratopteris thalictroides and Adiantum lunulatum* xylem is arranged in V- shaped manner. In case of *Dicranopteris linearis,* xylem is C shaped and in *Lygodium flexuosum* it is T-shaped. In *Adiantum latifolium* xylem is arranged like the skull of a bison, whereas in *Pteris confusa* it is arranged in Ω- shaped manner. *Parahemionitis cordata* receives 4-12 vascular strands from the rhizome. *Selaginella delicatula* shows tristelic, protostelic condition and *Salvinia molesta* shows solenostele condition. The protostelic type is considered to be phylogenetically the most primitive. The present study also justifies the systematic position of *Selaginella* with primitive protostele and *Salvinia* with phylogenetically advanced solenostele.



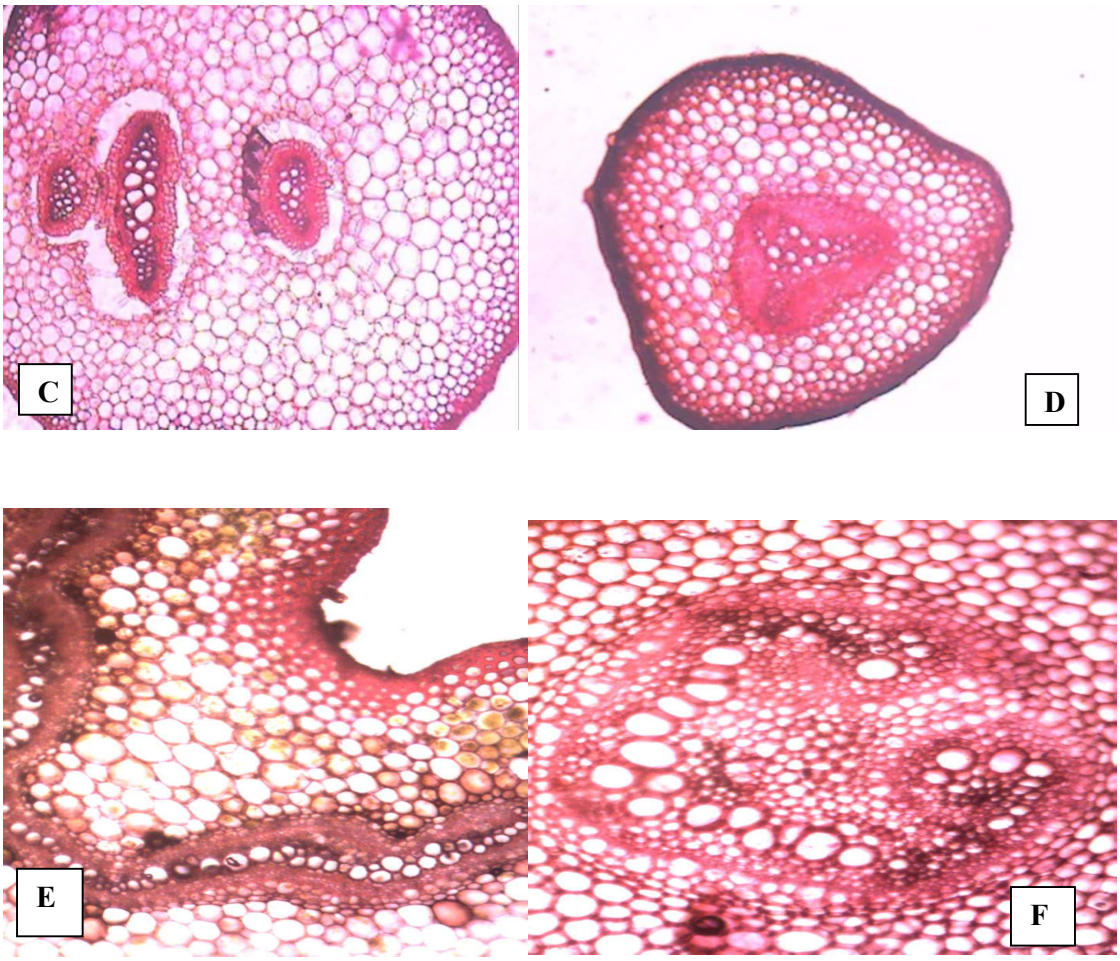


Plate 1: **A**. *Christella dentata* (hippo-campus shaped xylem). **B**. *Adiantum lunulatum* (V-shaped xylem). **C**. *Selaginella delicatula* (tristelic, protostelic condition). **D**. *Adiantum latifolium* (xylem is arranged like the skull of a bison) **E**. *Pteris confusa* (**Ω**- shaped xylem.).**F**. *Dicranopteris linearis* (xylem is C shaped).

Summary and Conclusion

The study area is enriched with excellent pteridophyte diversity. This study was an attempt to study the taxonomic and anatomical details of Pteridophytes of Pananchery Panchayath of Thrissur district. Through this study, 18 species of pteridophytes belonging to 15 genera comes under 13 families were collected in which one species belongs to the class Lycopsida and the remaining 17 species represent Filicopsida. Most of them have got much economical and ecological importance. The anatomical features show varied characters in the distribution of ground tissue and vascular elements and thus show the importance of vascular anatomy in identifying the systematic position of pteridophytes. A floristic documentation of panchayath level is significant for the preparation of panchayath level biodiversity registers. The results of brought out through the present study will also be useful in the preparation

of a flora of Pteridophytes of Kerala in future.

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