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Morpho-Anatomical Comparison of *Pyrrosia lanceolata* (L.) Farwell Accessions From Kerala, South India

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Abstract

Pyrrosia is a member of the Polypodiaceae family and is distinguished by its simple leaves and stellate hairs on the fronds. However, there is a lack of comprehensive research on the morphological and anatomical aspects of *Pyrrosia* species accessions. The present study aims on the morpho-anatomical comparison of *Pyrrosia lanceolata* (L.) Farwell accessions from Kerala. Observations of the epidermis, including stomata and stellate hairs, as well as morphological alterations were conducted after the samples were collected and thoroughly analyzed. The internal structure of the rhizome, stipe, and leaf was examined and photographed using light microscope.

Keywords: Dictyostele, Felt ferns, Morpho-anatomical studies, *Pyrrosia*, Scales, Stipe

INTRODUCTION

Pteridophytes consisting of ferns and fern allies are non-flowering tracheophytes that reproduce by the production of spores. They are spore-bearing, seedless vascular cryptogams characterized by the self-regulating heteromorphic alternation of generation. Pteridophytes constitute a prominent part of the present-day vegetation on the planet.

There are about 12,000 species of ferns in the world flora of which 41% are endangered due to the changing global climatic conditions. India has varying climatic conditions and pteridophytes contribute greatly to its rich floral diversity. Their distinctive ecological distributional pattern, make pteridophytes an interesting and conspicuous part of the national flora. Ferns are originated in ancient tropical habitats and have undergone a major evolution to colonize different types of environments (Kessler *et al.*, 2010). They are regarded as the most primitive group of vascular plants that appeared in the middle of the Paleozoic, about 438 million years ago during the Silurian period. Since water is essential for fertilization, they were first diversified in humid areas, especially in tropical regions, and spread to other parts of the world (Skog, 2001). By the process of evolution, quite a large number of taxa in this plant group have become extinct, but most of the species gradually evolved into the modern pteridophytes.

Pyrrosia is a terrestrial fern genus located in the tropical and temperate regions of the world. The genus *Pyrrosia* was originally established by Mirbel (1803) with *P. chinensis* as the only species. They are commonly known as "felt ferns" due to the presence of wool-like stellate hairs covered

over the entire surface of the lamina. *Pyrrosia* is an almost exclusively paleotropical genus distributed mainly in Asia and a few species in Australia, New Zealand, and Africa. Most of its species are epiphytes on exposed trees in lowlands or mountain forests or terrestrial regions. The *Pyrrosia* members have thick, fleshy fronds with dense stellate tomentum, the stoma is completely encircled by the epidermal cell and has an anastomosing venation pattern. The genus *Pyrrosia* was monographed by Hovenkamp (1986) and recognized 51 species.

Pyrrosia lanceolata (L.) Farwell is mostly epiphytic, lithophyte, and rarely terrestrial in habitat. They are usually distributed above the sea level to low altitudes, sometimes to 1000- 1500m. The species is widely distributed in India, China, Taiwan, Bhutan, Sri Lanka, Malesia, Sumatra to New Guinea. *Pyrrosia lanceolata* (L.) Farwell shows considerable variation, particularly with respect to the size and shape of the fronds and the nature of the midrib. Many authors (Nayar and Chandra, 1965; Satija *et al.*, 1983) have distinguished several species such as *Pyrrosia adnascens* (Sw.) Ching, *Pyrrosia nuda* (Giesenh.). However, Hovenkamp (1986) reduced all the species under the *Pyrrosia lanceolata* group. Nampy and Madhusoodhanan, (1998), recorded four *Pyrrosia* species from South India, namely *P. heterophylla* (L.) Price, *P. lanceolata* (L.) Farwell, *P. ceylanica* (Giesenh.) Sledge and *P. porosa* (Presl.). The ecological, morphological, and anatomical diversity of *P. lanceolata* (L.) Farwell accessions from Kerala, South India, are not well documented. The aim of this study is to characterize the morphology, anatomy, and host plant variations of *P. lanceolata* (L.) Farwell populations in Kerala, South India.

MATERIALS AND METHODS

Collection of Samples

The samples of *P. lanceolata* with both sterile and fertile fronds were collected and examined from different accessions of Kerala, South India. The voucher specimen was then deposited at the Herbarium of the Department of Botany, University College, Thiruvananthapuram.

Morphological analysis

The morphometric analysis of vegetative and reproductive features from different accessions was carried out. Fifteen qualitative and seven quantitative traits were considered for the analysis (Table 1 & 2).

Table 1
Qualitative morphological characters observed

Sl. No	Character states	Character attributes
1	Nature of rhizome	Erect /creeping
2	Colour of rhizome	Brown / dark brown / pale brown
3	Type of scales	Clathrate /non-clathrate
4	Scale attachment	Baxifixed / peltate/ pseudopeltate
5	Scale colour	Brown /transparent
6	Nature of stellate hair	Acuminate / lanceolate / ribbon like/ glandular
7	Frond Type	Monomorphic/ hemidimorphic/ holodimorphic/ dimorphic
8	Colour of lamina	Dark green/ light green
9	Nature of the lamina	Succulent / coriaceous
10	Colour of spore	Dark brown / light brown
11	Shape of sori	Triangular / globose
12	Type of Sori	Ceonosori / orbicular
13	Sori position	Entire / submarginal
14	Type of spore	Monolete / trilete
15	Nature of exine sculpture	Conical/triangular spines / globular spines

Table 2
Quantitative morphological characters observed

Character	Method of observation
1. Rhizome Characters	
a) Thickness	Three places of rhizome were selected from each sample and thickness measured using a vernier caliper
b) Length of internode	From each sample, the length of internode is measured using a scale

2. Sterile Frond	
a) Length, width, and thickness	From each sample, length, width and thickness were measured using a vernier caliper
b) Length of stipe	From each sample, the length of the stipe is measured using a scale
3. Fertile frond	
a) Length and width	The length and width of fertile fronds were measured in the same way as sterile fronds.
b) Length of stipe	From each sample, the length of the internode is measured using a scale
c) Length up to sori present	The length up to which the sori is present in fertile frond is measured using a scale.

Anatomy of rhizome, stipe, and frond

Some mature and fresh parts of the rhizome and frond of *P. lanceolata* were collected. With the help of a razor blade, transverse sections of stem and root were obtained by cutting along the radial plane of a cylindrical portion of the stem and root. Frond was dissected with the help of papaya pith. All the fine dissections were kept in watch glass along with water. Safranin was used to stain the sections. The obtained sections were mounted temporarily using glycerin, photographed using Carl Zeiss photomicroscope and the characters were noted.

RESULTS AND DISCUSSION

Morphological variations in *P. lanceolata* accessions

Rhizome characters

P. lanceolata has a long, creeping, slender, dark-brown rhizome (Figure 1A) (Nayar, 1959). The surface of rhizome is covered with brown-coloured clathrate scales which are peltately attached (Figure 1B). The scale's shape varied, ranging from linear to lanceolate and having ciliate-dentate margins (Satija *et al.*, 1983; Hovenkamp 1986; Vasques *et al.*, 2017).



Figure 1A. Rhizome of *P. lanceolata*

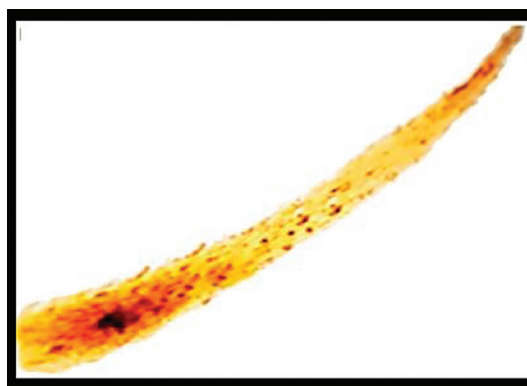


Figure 1B. Scales in *P. lanceolata* rhizome

Frond characters

P. lanceolata has simple, coriaceous, and monomorphic fronds (Figure 2A). Light green, linear-lanceolate, frond laminae are broadest below, attenuate to connate at base, rounded at apex, and have entire margins. Midrib elevated from below, creating a groove on the upper surface. On the bottom surface of the leaf, there are more lanceolate-shaped stellate hairs than on the upper surface (Figure 2B). Sori are organized in five to six layers on either side of the midrib, deeply sunken and spherical or orbicular at the conspicuous pit (Hovenkamp, 1986). The monoete spores are light brown in colour, oval to elliptical, tuberculated with irregular exine (Satija *et al.*, 1983) (Figure 2C & 2D). The quantitative morphological traits seen in *P. lanceolata* are shown in Table 3.



Figure 2A. Fronds of *P. lanceolata*



Figure 2B. Stellate Hairs

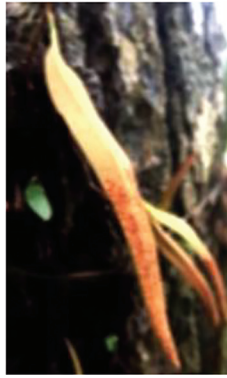


Figure 2C. Spore arrangement

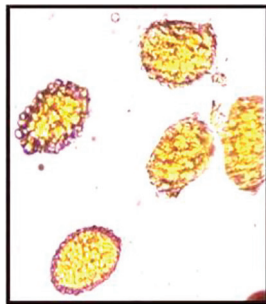


Figure 2D. Spore of *P. lanceolata*

Table 3
Quantitative morphological characters
observed in *P. lanceolata*

Attributes	Range
Rhizome thickness	0.1-0.4 cm
Internode length	1.2-2.5 cm
Sterile frond thickness	0.2-0.35 cm
Sterile frond length	6.4-8.5 cm
Sterile frond width	1-1.3 cm
Sterile frond stipe length	0.84-1.15 cm
Fertile frond length	9.2-13.5 cm
Fertile frond width	0.45-1.2 cm
Fertile frond stipe length	1- 3.5 cm

Anatomical observations of *P. lanceolata*

Rhizome

The transverse section of rhizome of *P. lanceolata* is almost circular in outline. Epidermis is polygonal, 2-4 layered, outer layer composed of compactly packed cells and inner layer consisted of various cell size. Ground tissue is composed of an inner parenchymatous layer and 3-5 sclerenchymatous outer layers. The inner parenchymatous layer contains centrally distributed sclerenchymatous strands. Stellar type is dictyostelic with 6

meristeleles in PL 04 (Figure 3A), 5 meristeleles in PL02, PL03, PL05, PL06, PL07 (Figure 3B) and 4 meristeleles in PL01 (Figure 3C) which are almost oval-shaped and each meristele is covered by endodermis. According to Sofiyanti *et al.*, (2021) and Hovenkamp (1986), the *P. lanceolata* rhizome has 4 vascular strands and 5 vascular strands respectively. The vascular bundle is concentric and amphicribal, with the xylem compact in the centre and larger than the phloem. The cortex is distinctly differentiated into parenchymatous and sclerenchymatous layers and sclerenchymatous strand is found in the central parenchymatous tissue.

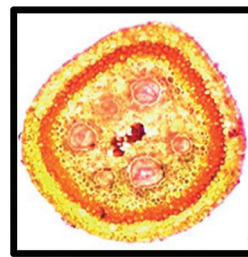


Figure 3A. T.S of rhizome

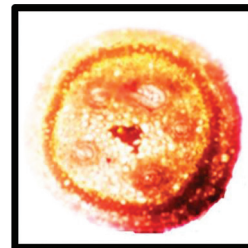


Figure 3B. T.S of rhizome with 6 meristeleles with 5 meristeleles

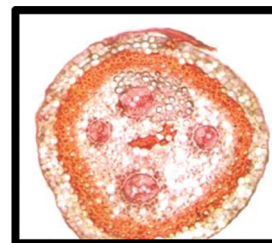


Figure 3C T.S of rhizome with 4 meristeleles

Stipe

The transverse section of *P. lanceolata* stipe is almost heart-shaped in outline. Epidermis is irregular-shaped with sinuous anticlinal cell walls. The ground tissue is made up of two layers, an inner parenchymatous layer and outer 3-4 layered sclerenchymatous layer. Figure 4A depicts a dictyostele of the stellar type with 4 meristeleles in PL01 and PL04, 3 meristeleles in PL02, PL05, and PL06 (Figure 4B), and 2 meristeleles in PL07 (Figure

4C). Vascular bundle is concentric, amphicribal, oval shaped, and xylem cells are bigger than phloem. In the transverse section of the *P.lanceolata* stipe, Hovenkamp, 1986, noted three central and one lateral meristeles, and Sofiyanti et al., 2021, observed five meristeles.

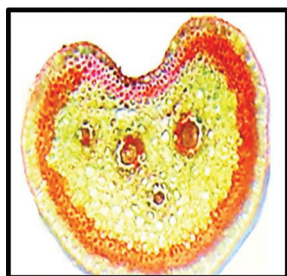


Figure 4A.T.S of stipe with 4 meristeles

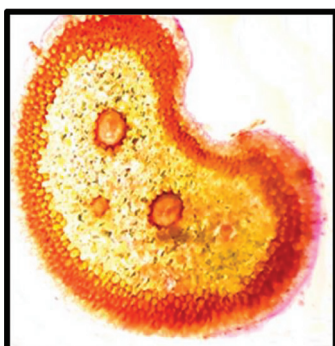


Figure 4B T.S of stipe with 3 meristeles

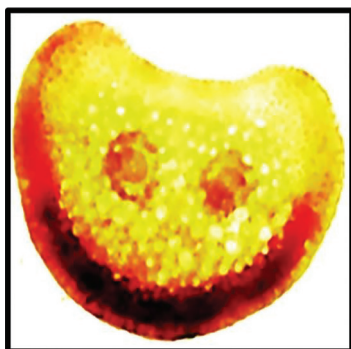


Figure 4C.T.S of stipe with 2 meristeles

Lamina

The transverse section of the lamina of *P. lanceolata* shows a winged appearance. There is a distinct upper and lower epidermis covered with cuticle. The mesophyll tissue is differentiated into upper palisade parenchyma with elongated cells and the lower storage parenchyma cells. In the pith region, vascular bundles are present. In the lower epidermis below the vascular bundle, a distinct layer of sclerenchyma is present in all accessions (Nayar, 1959) (Figure 5).



Figure 5. Lamina of *P. lanceolata*

Habitat of *P. lanceolata* (L.) Farwell

Variation in host plants of *P. lanceolata* were noted and shown in Table 4. Host plants range from some ornamental shrubs to tall trees over 20 m height such as *Mangifera indica*, *Artocarpus heterophylla*. and *Azadirachta indica*. It grows on both monocots and dicots and can grow on tree trunks with smooth or rough bark.

Table 4
Variation in host plant of *P. lanceolata* (L.) Farwell.

Host plants	Common name	Habit of host plant
<i>Codiaeum verigatum</i>	Croton	Shrub
<i>Mangifera indica</i>	Mango	Tree
<i>Artocarpus heterophylla</i>	Jack fruit	Tree
<i>Cocos nucifera</i>	Coconut	Tree
<i>Areca catechu</i>	Areca nut	Tree
<i>Tectona grandis</i>	Teak	Tree
<i>Albizzia julibriussin</i>	Silk tree mimosa	Tree
<i>Caesalpinia pulcherrima</i>	Peacock flower plant	Shrub
<i>Hevea brasiliensis</i>	Rubber tree	Tree
<i>Cassia fistula</i>	Golden shower tree	Tree
<i>Azadirachta indica</i>	Neem	Tree

CONCLUSION

The *P. lanceolata* are long creeping epiphytic ferns in the family Polypodiaceae with dimorphic fronds and globose spores. While there were similarities in the morphometric traits of the accessions, there

were differences in the quantitative parameters that were examined. The number of layers in the sclerenchymatous sheath in the cortical region and the number of vascular bundles varied among accessions, although the transverse section of the lamina was consistent across all accessions, according to anatomical examinations of the rhizome and stipe. The morpho-anatomical observations reported earlier also revealed notable variations between the *P. lanceolata* (L.) Farwell accessions. The wide distribution ranges, varying climatic conditions, or ecological changes could all contribute to the variations between the various accessions used in the current study. The current investigation will enhance the data already available for identification purposes and is essential for further taxonomic study in the genus *Pyrrosia*.

REFERENCES

- Kessler, M., Mehlreter, K., Walker, L. R., Sharpe, J. M. (2010). Biogeography of ferns.
- Skog, J. E. (2001). Biogeography of Mesozoic leptosporangiate ferns related to extant ferns. *Brittonia*, 53. 236-269.
- Hovenkamp, P. (1986). *A Monograph of the Fern Genus Pyrrosia (Polypodiaceae)*. Leiden.
- Nampy, S., Madhusoodanan, P. V. (1998). Fern flora of South India: taxonomic revision of polypodioid ferns. Daya Publishing House, Delhi.
- Nayar, B.K. (1959). *Studies in Polypodiaceae*. VII. *Pyrrosia*. Bull. Nat. Bot. Gard. Lucknow.
- Nayar, B.K., Chandra. (1965). *Ferns of India*. 15 *Pyrrosia*. Bull. Nat. Bot. Gard. Lucknow 117.
- Satija Chander, K., Bir, S., Bhardwaj, A. K. (1983). Taxonomic revision of the Polypodiaceous genera of India *Pyrrosia mirbel*. *Nelumbo* 25:1-4, 62-89.
- Sofiyanti, N., Sari, A. K., Iriani, D., Mutrofin, R., Taufiq, I., Juliantari, E., Pranata, S. (2021). Morphological and anatomical study of four *Pyrrosia* (Polypodiaceae) species from Rumbai forest, Riau Province, Indonesia. *Biodiversitas Journal of Biological Diversity*. 22(11).
- Vasques, D. T., Ebihara, A., Ito, M. (2017). The felt fern genus *Pyrrosia mirbel* (Polypodiaceae): a new subgeneric classification with a molecular phylogenetic analysis based on three plastid markers. *Acta Phytotaxonomica et Geobotanica*, 68(2):65-82.

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