

## Stem anatomical characteristic of rhizophoraceae species in Kerala

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### Abstract

A study was conducted on the stem anatomical characteristics of six selected Kerala mangrove species, which are representative of three genera in Rhizophoraceae. These anatomical features can be very useful in revealing the relationship between the plant species and its environment, and the results showed that some anatomical adaptations had occurred in response to extreme climate and exposed environment. These adaptations such as the presence of aerenchyma cells, cutinized epidermal cells and variations in the presence of parenchyma cells which occurred fairly uniformly among all the species studied.

**Keywords:** mangroves, anatomy, diffuse porous wood, sclereids.

### Introduction

Mangroves are a specialized group of trees and shrubs that reside in the intertidal areas on the edge of the land and sea. Mangrove forests are regarded as the most productive and biodiverse wetlands on earth, as an important natural reserve of biological diversity. The mangrove ecosystem constitutes a bridge between terrestrial and marine ecosystem. This ecosystem serve as excellent reservoirs of nutrients and feeding and nursery grounds for a wide variety of organisms such as crabs, oysters, prawns and fishes. The mangrove vegetation stabilizes the shoreline by checking the erosion of land by the sea. This characteristic anchoring of aerial network of stilt roots and pneumatophores trap sediments and help in building up of land, thus mangroves act as land markers <sup>[1]</sup>.

Traditionally it has been included in the Myrtales, however, more recent critical evaluation has tended to emphasize its isolation, and it is now frequently placed in a separate order, Rhizophorales, albeit still related to the Myrtales <sup>[2]</sup>. Within the family, a number of tribes are recognized. The more important tribe is Rhizophoreae, which includes the well-known mangrove trees *Rhizophora*, *Bruguiera Ceriops* and *Kandelia*. Therefore, it is convenient to refer to the tribe as the 'mangrove Rhizophoraceae'.<sup>[3, 4]</sup> The mangrove plants are characterized by stilt roots in *Rhizophora* species and knee pneumatophore roots in *Bruguiera* species <sup>[5-9]</sup>.

Researchers on wood anatomy of the mangroves can date back to the beginning of this century. Representative work include investigation on the wood structure of mangrove species in Philippines <sup>[10]</sup>, wood structure of some mangrove species of Rhizophoraceae <sup>[11, 12]</sup> and studied vessel characteristics of some Javan mangrove species <sup>[13]</sup>. In addition, other reports were also published on wood structure of selected mangrove species <sup>[13-18]</sup>.

### Materials and methods

The study was conducted for characterizing anatomical features of 6 mangrove species seen in Kerala. The species are *Bruguiera cylindrica*, *Bruguiera gymnorrhiza*, *Bruguiera*

*Sexangula*, *Kandelia candela*, *Rhizophora apiculata*, *Rhizophora mucronata*. Stem samples were collected from the selected species which are distributed in the mangroves of intertidal zones of Kerala. The plants were identified by Botanical Survey of India, Coimbatore. One of the healthy plants was selected and the mature stem (T.S, T.L.S, R. L.S.) were taken for anatomical studies. Stained with Toluidine blue 0 and mounted in 50% glycerin. The slides analysed by trilocular compound microscope model number 10093409 and imaged by using the camera Olympus E-PL3.

### Result and discussion

#### *Bruguiera cylindrica*

Epidermis covered with thick cuticle. Cortex was thick, multilayered and parenchymatous. Large number of tannin cells occur in both cortex and pith. Sclereids also present in the cortex, phloem and pith. Stem shows secondary growth. Growth rings were indistinct. It is diffuse porous wood. Vessels are small distinct moderately numerous, evenly distributed, in short radial multiples of 2 to 3 and with inconspicuous vessel line. Vessel cylindrical in outline with scalariform perforation plate. Rays were biseriate and homogeneous. Pith was large and parenchymatous. (Plate A)

#### *Bruguiera gymnorrhiza*

Growth rings were indistinct. It is a diffuse porous wood vessels moderately numerous, evenly distributed, solitary and in short radial multiples of 2 to 3, vessel line inconspicuous. Vessel cylindrical in outline with scalariform perforation plate. Long tails or ligules like structures at the end walls of vessel elements occur. Rays are moderately broad, widely spaced and multiseriate. Numerous crystalliferous cells seen in cortex, phloem, xylem and pith. (Plate B)

#### *Bruguiera sexangula*

Epidermis consist of thick cuticle and multilayered cortex present. Outer cortex collenchymatous and inner cortex consists of numerous air cavities. Growth rings were indistinct. It is a diffuse porous wood. Vessels are small, distinct, moderately numerous to evenly distributed, solitary

and in short radial multiples of 2 to 3, vessel line inconspicuous. Vessel cylindrical in outline with scalariform perforation plate. Rays are moderately broad, widely spaced, biseriate to multiseriate. Sclereids associated with phloem. Numerous crystalliferous cells seen in cortex, phloem, xylem and pith. (Plate C)

**Kandelia candel**

Epidermis single layered, wavy and highly cutinized. Growth rings are indistinct. It was diffuse porous wood. Vessels are small to very small, moderately numerous to numerous, evenly distributed, solitary and in short radial multiples of 2 to 5, open, and vessel lines inconspicuous. Vessel cylindrical in outline with scalariform perforation plate. Long tails or ligules like structures at the end walls of vessel elements occur. Rays are multiseriate (2 to 3 cell width) and homogenous. (Plate D)

**Rhizophora apiculata**

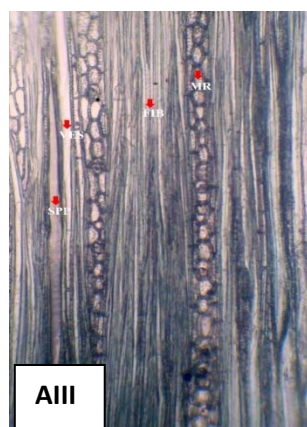
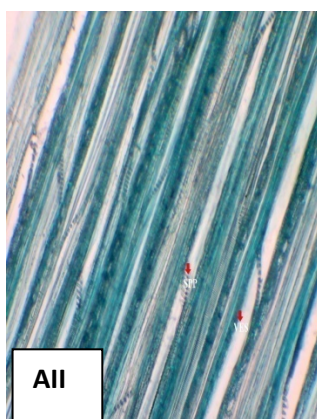
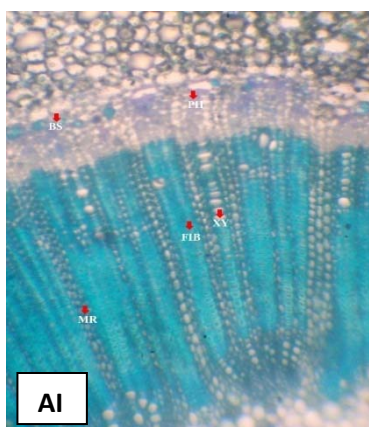
Stem with highly cutinized epidermis in the outer region. Cortex was thick, multilayered and parenchymatous and contains numerous air cavities. Growth rings are indistinct. It is a diffuse porous wood. Vessels are large; moderately numerous, evenly distributed, solitary and in short radial multiples of 2 to 3, round in outline, vessel line inconspicuous. Vessel cylindrical in outline with scalariform perforation plate. Rays are multiseriate (2 to 3 cells width).

Sclerieds associated with phloem. Crystalliferous cells present in the pith. (Plate E)

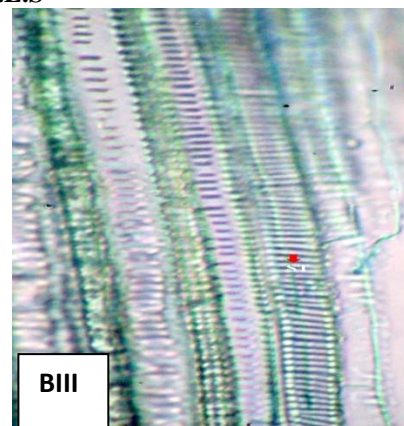
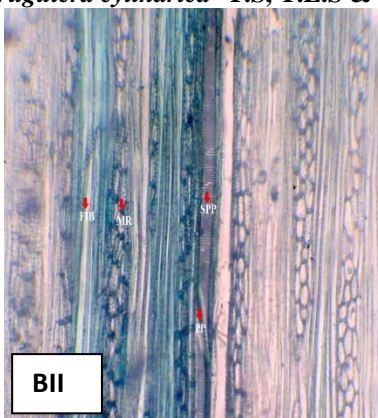
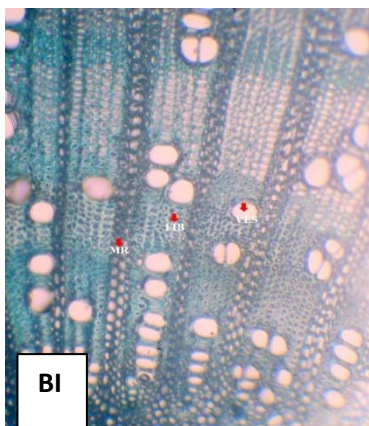
**Rhizophora mucronata**

Stem with multilayered cork in the outer region. Cortex was thick, multilayered and parenchymatous and contains numerous air cavities. Growth rings were indistinct. It is a diffuse porous wood. Vessels are large; moderately numerous to evenly distributed, solitary and in short radial multiples of 2 to 3, round in outline, vessel line inconspicuous. Vessel cylindrical in outline with scalariform perforation plate. Rays were multiseriate (2 to 3 cells width), very few uniseriate. (Plate F).

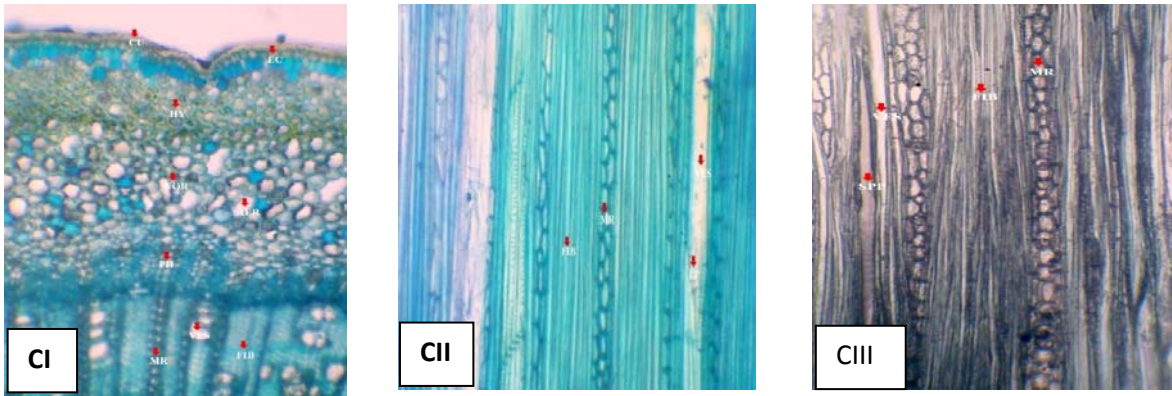
Members of Rhizophoraceae possess scalariform perforation plate. The vessels having few or no bars on the perforation plates indicate more favorable adaption to dry environmental conditions than perforation plates with numerous and closely spaced bars. The scalariform perforation plates as functionally disadvantageous as compared to simple perforation plates, because of resistance to water flow [19]. *Kandelia candel* possesses simple perforation plate. Scalariform perforation plates distinguish Rhizophoraceae from their terrestrial relatives. Length to width ratio of vessel elements also indicates the degree of specialization of vessel elements. A high ratio indicates primitiveness and low ratio, advancement [20].



*Bruguiera cylindrica*- T.S, T.L.S & R.L.S

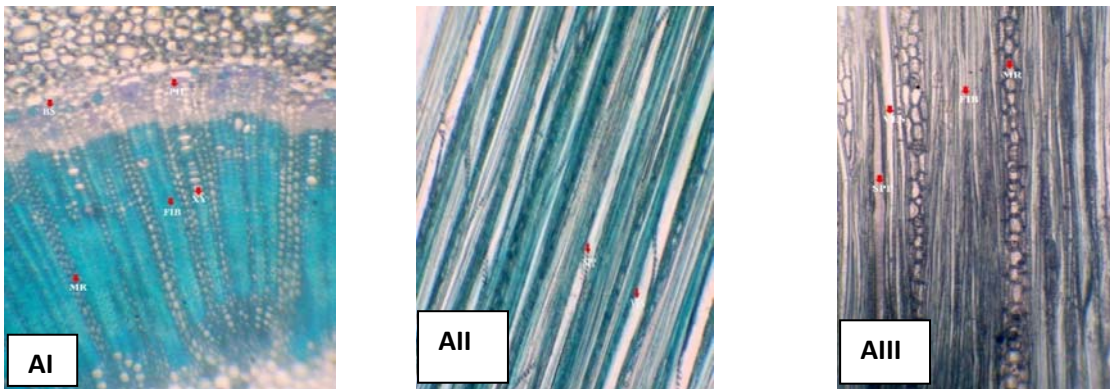


*Bruguiera gymnorhiza*- T.S, T.L.S & R.L.S

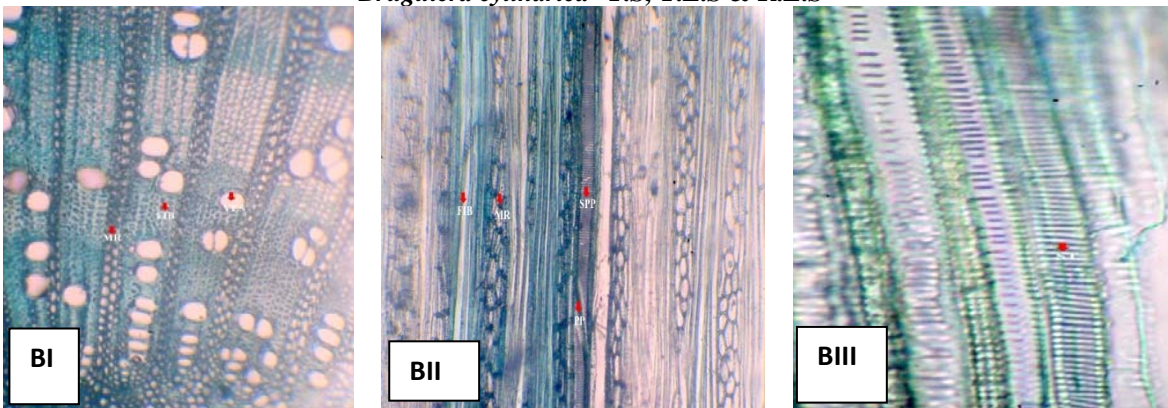


*Bruguiera sexangula*- T.S, T.L.S & R.L.S

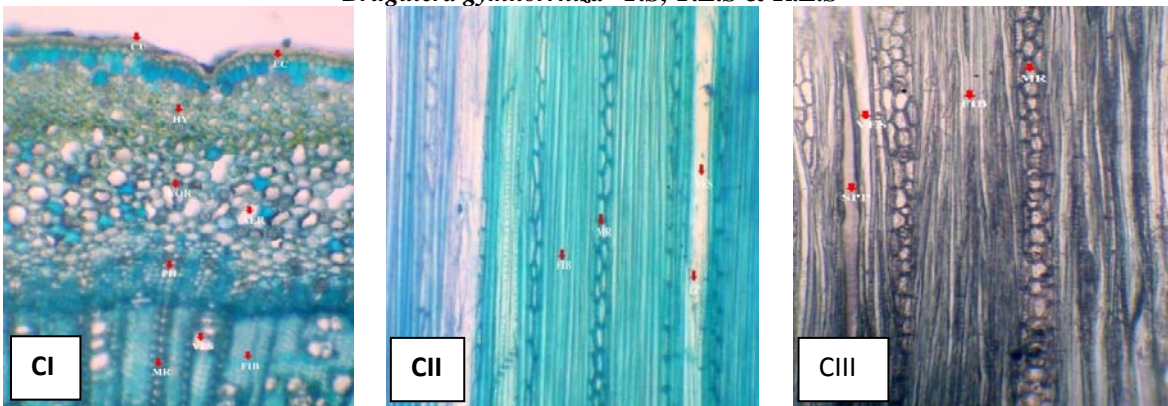
TAN- Tannin, FIB- Fiber, XY-Xylem, AT- Annular thickening, SP-Spiral thickening, MR- Medullary ray, SPP-, Simple perforation plate VES- Vessel, AP- Alternate pits, BS- Brachy sclereids, PH- Phloem. CK- Cork, AER- Aerenchyma, SCL-Sclerenchyma, ST- Spiral thickening.



*Bruguiera cylindrica*- T.S, T.L.S & R.L.S



*Bruguiera gymnorrhiza*- T.S, T.L.S & R.L.S



*Bruguiera sexangula*- T.S, T.L.S & R.L.S

CU- Cuticle, EC-Epidermal cells, HY- Hypodermis, COR- Cortex, SB- Sclerenchyma bands, PAR- Parenchyma, STK- -Spiral thickening, ATK- Annular thickening.

## Conclusion

Mangroves with stand unique environment, which different from normal terrestrial plants in plant parts like leaf, stem, root and reproductive structures. Plant group showing different modification in morphological, anatomical and physiological aspects to survive the stress environment. In this study anatomical structures with its functional modifications different from semi mangroves and back mangals. Presence of air cavities and sclereids in cortex, numerous vessels, perforation plates, inter- vessel pits helps to their existence.

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