



# HISTOLOGICAL AND HISTOCHEMICAL STUDIES ON THE TRUNK BARK OF *LAGERSTROEMIA REGINAE* ROXB

(*Lagerstroemia-flos-reginae* Retz.) (LYTHRACEAE)

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## Abstract

*Lagerstroemia reginae* a popular ornamental tree grown in most of the tropical countries for its enchantic flowers. The timber of this tree is also commercially much valued. The bark anatomy of *Lagerstroemia speciosa* was studied in detail so as to use the bark anatomy to identify the different species, when the tree is in deciduous erudition. The bark of *Lagerstroemia reginae* has deep seated, very thick hetrocellular phellem, thin zone of phelloderm and a thick cylinder of sclereids in the cortical zone. Secondary phloem is distinctly differentiated into outer well defined **collapsed phloem** and inner intact **noncollapsed phloem**. The structure of the sieve elements and phloem rays are described as these tissues seen under transverse and vertical planes of sections.

**Keywords:** *Lagerstroemia reginae* Roxb; Lythraceae, Trunk - bark - Anatomical features - scope of the study.

## Introduction

*Lagerstroemia reginae* a popular cultivated garden tree for highly enchanting flowers. Further more, plant has some industrial utilities of the wood. The leaf and bark are said to be used for several human ailments. The above mentioned statements on the importance of the plant prompted us to take some anatomical studies of the tree. Since the bark of the tree has not been studied so far, the bark anatomy opted for the studies. Bark anatomy in parallel to wood anatomy and some time more relevant in systematic, pharamacological and taxonomic diagnosis, it was preferred for us present in vestigation.

## Materials and Methods for Anatomical Studies

### Collection of specimens

The bark specimens for the proposed study were collected from Tamil Nadu, India Care was taken select healthy plants and normal organs. The required samples of the bark were cut and removed from the plant and fixed in FAA (Farmalin-5ml+ Acetic acid-5ml + 70% Ethyl alcohol-90ml).After 24 hrs of fixing, the specimens were dehydrated with graded series of tertiary - Butyl alcohol as per the schedule given by Sass, 1940. Infiltration of the



specimens was carried by gradual addition of paraffin wax (melting point 58-60 C) until TBA solution attained super saturation. The specimens were cast into paraffin blocks.

### Sectioning

The paraffin embedded specimens were sectioned with the help of Rotary **Microtome**. The thickness of the sections was 10-12 urn. Dewaxing of the sections was by customary procedure (Johansen, 1940). The sections were stained with **Toluidine blue** as per the method published by O'Brien et al. (1964). Since **Toluidine blue** is a polychromatic stain, the staining results were remarkably good; and some **cytochemical** reactions were also obtained. The dye rendered pink colour to the **cellulose** walls, blue to the **lignified** cells, dark green to suberin, violet to the mucilage, blue to the **protein** bodies etc. Wherever necessary sections were also stained with **safranin** and **Fast-green** and IKI (for Starch)

### Photomicrographs

Microscopic descriptions of tissues are supplemented with micrographs wherever necessary. Photographs of different magnifications were taken with **Nikon lab photo 2** microscopic Unit. For normal observations **bright field** was used. For the study of **crystals, starch grains** and **lignified** cells, **polarized** light was employed. Since these structures have **birefringent property**, under polartzed light they appear bright against dark background. Magnifications of the figures are indicated by the scale-bars. Descriptive terms of the anatomical features are as given in the standard Anatomy books (Esau, 1964).

### Bark surface features

The trunk is smooth and shining. During period of exfoliation of the tree bark was fairly wide and think flakes of periderm is were separated from the trunk leaves, living surface. The tree in full bloom of purple flowers followed by leaf shading the periderm is an even in level with ups and down at certain places and smooth and even in other regions. (Fig.1.1, 2, 3)

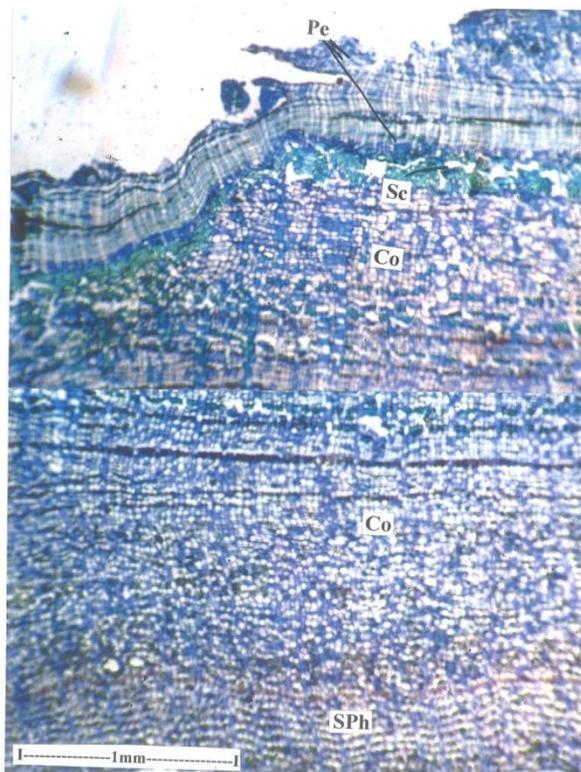


Fig. 1.1 *Lagerstoemia reginae* tree in flowering

Fig. 1.2 Trunk bark - surface feature

Fig. 1.3 T.S of bark entire view

(Co-Cortex ; Pe - Periderm; Sc - Sclerenchyma; SPh - Secondary Phloem)



### Observation

#### Bark of *Lagerstroemia reginae* Roxb.

The **Periderm** consists of a superficial a few layers small rectangular cells. Next periderm is deep in origins somewhere initiating in the deep cortical region. The second deep periderms and it is 300 μm thick. The periderm consists of three or four single layers of darkly stained **phelloid cells**. The remaining cells are phellem cells, which are rectangular and narrow; the cells are in long compact vertical lines and in horizontal layers (Fig 2.1, 2) The phellem cells are suberised while the **phelloid cells** are **lignified**.

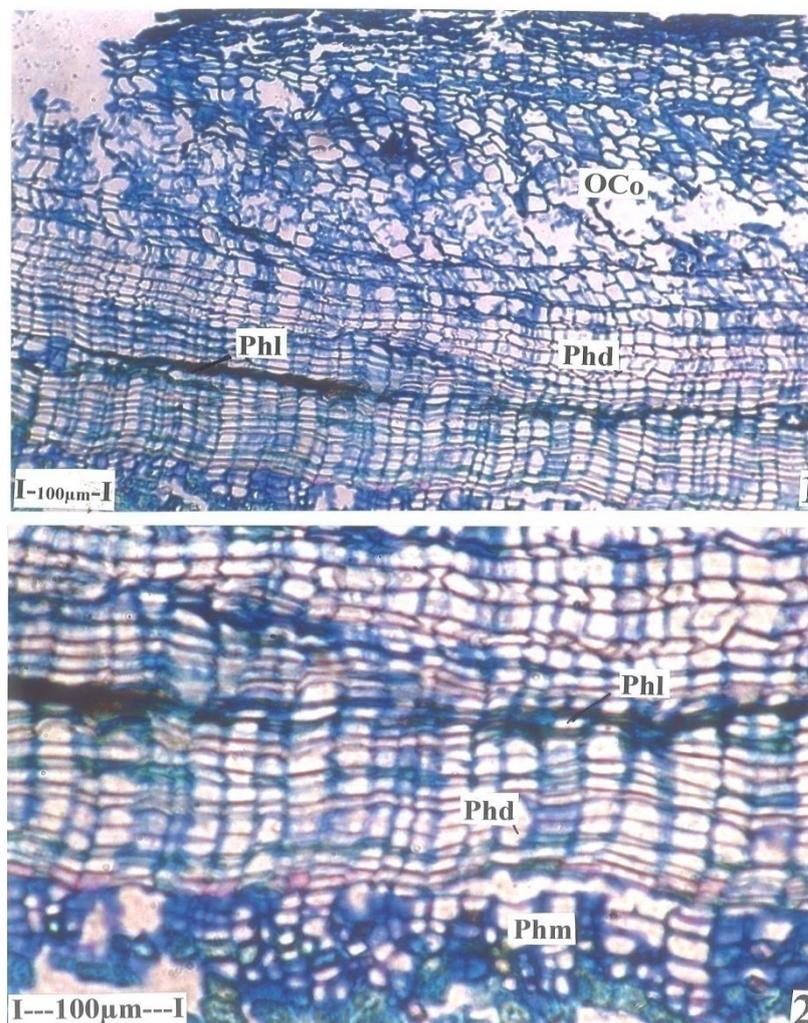


Fig. 2.1, 2

*Lagerstroemia reginae* T.S of bark showing hetero cellular phellem and Inner Phelloderm.

(Oco - Outer Cortex; Phl - Phellem; Phm - Phelloderm; Phd - Phelloid)

Inner both phellem zone is thick zone of six layers of phelloids cells. These cells are horizontally rectangular, thick walled, cells and walls have cellulose content (Fig. 2.2). Further inner part are four or five layers of **brachysclereids**. These **sclereids** are rectangular cells with very thick lignified walls narrow lumen and wide canal-like simple pits (fig. 3.1,2)



Cortical zone is inner to the sclereid layers. The cells of the cortex are parenchyma cells with thin walls.

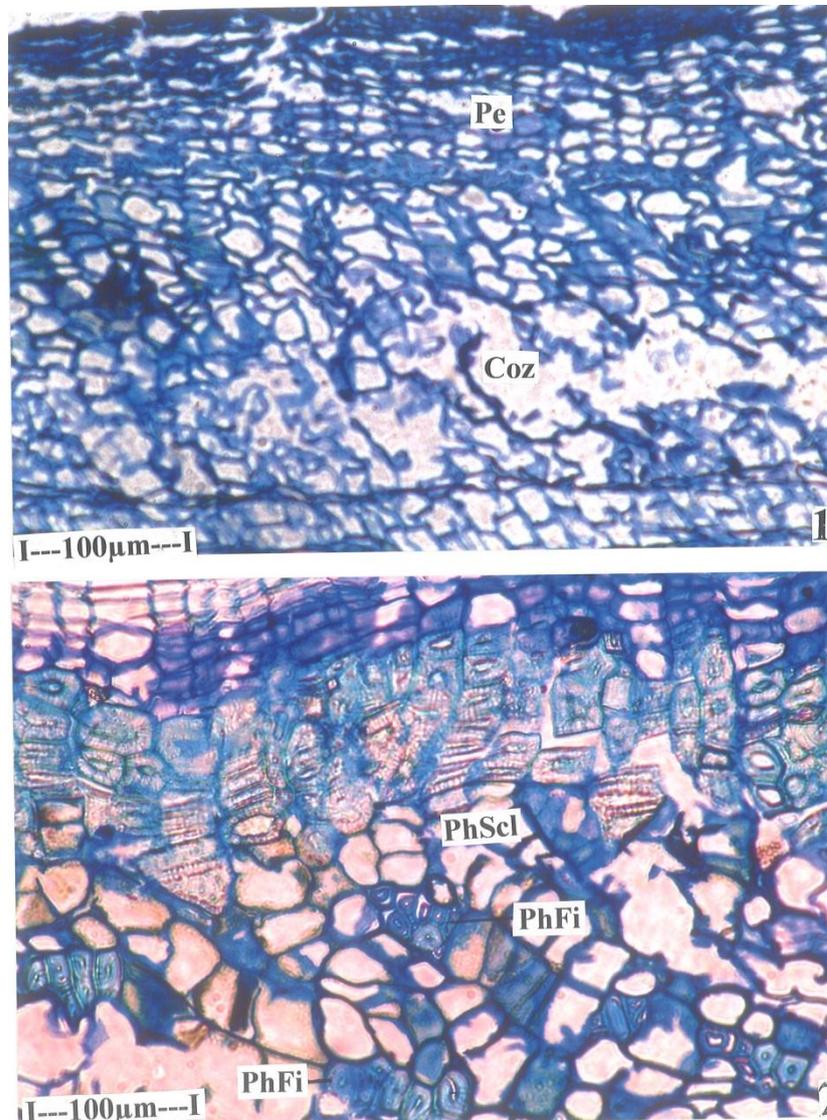


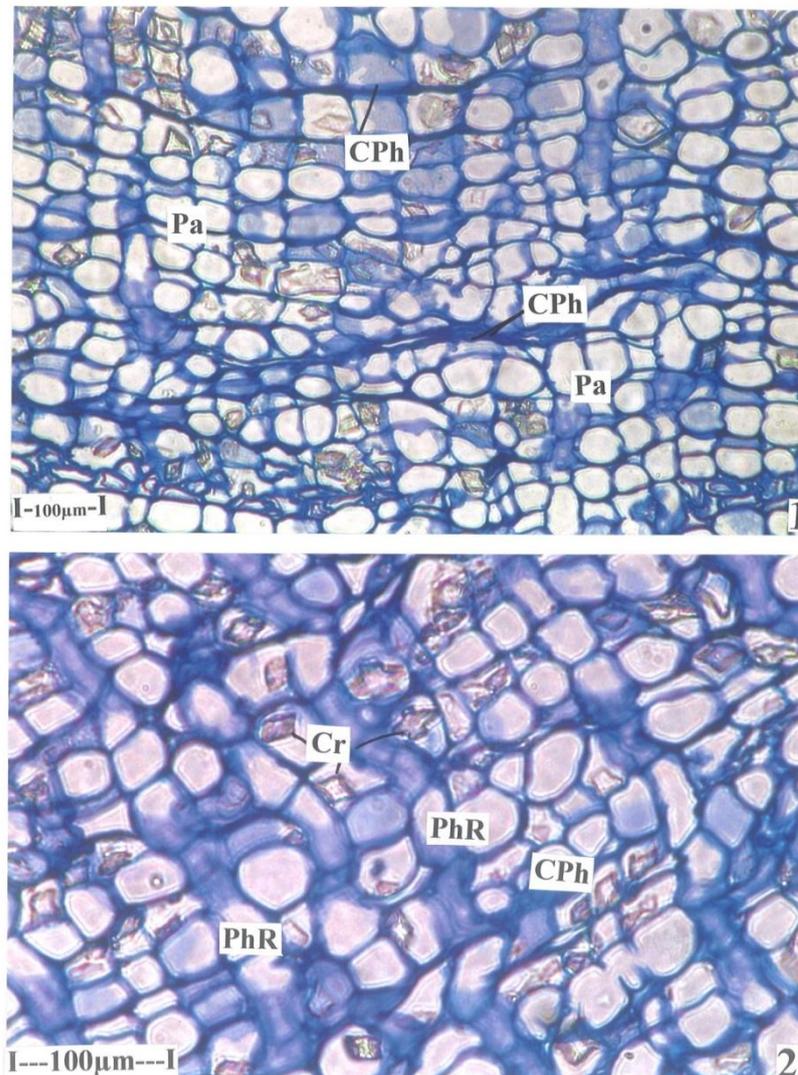
Fig. 3.1 *Lagerstoemia reginae* T.S of Bark - Cortical Zone

Fig. 3.2 T.S of Bark Cortical Zone with phloem sclereids

(Pe - Periderm; Coz-Cortical Zone; PhFi - Phloem Fibre; PhScl - Phloem Sclereids)

The inner part of the bark is the secondary xylem phloem zone which is the major part of the bark. It is differentiated into outer thicker **collapsed phloem** and inner narrow **noncollapsed phloem**.

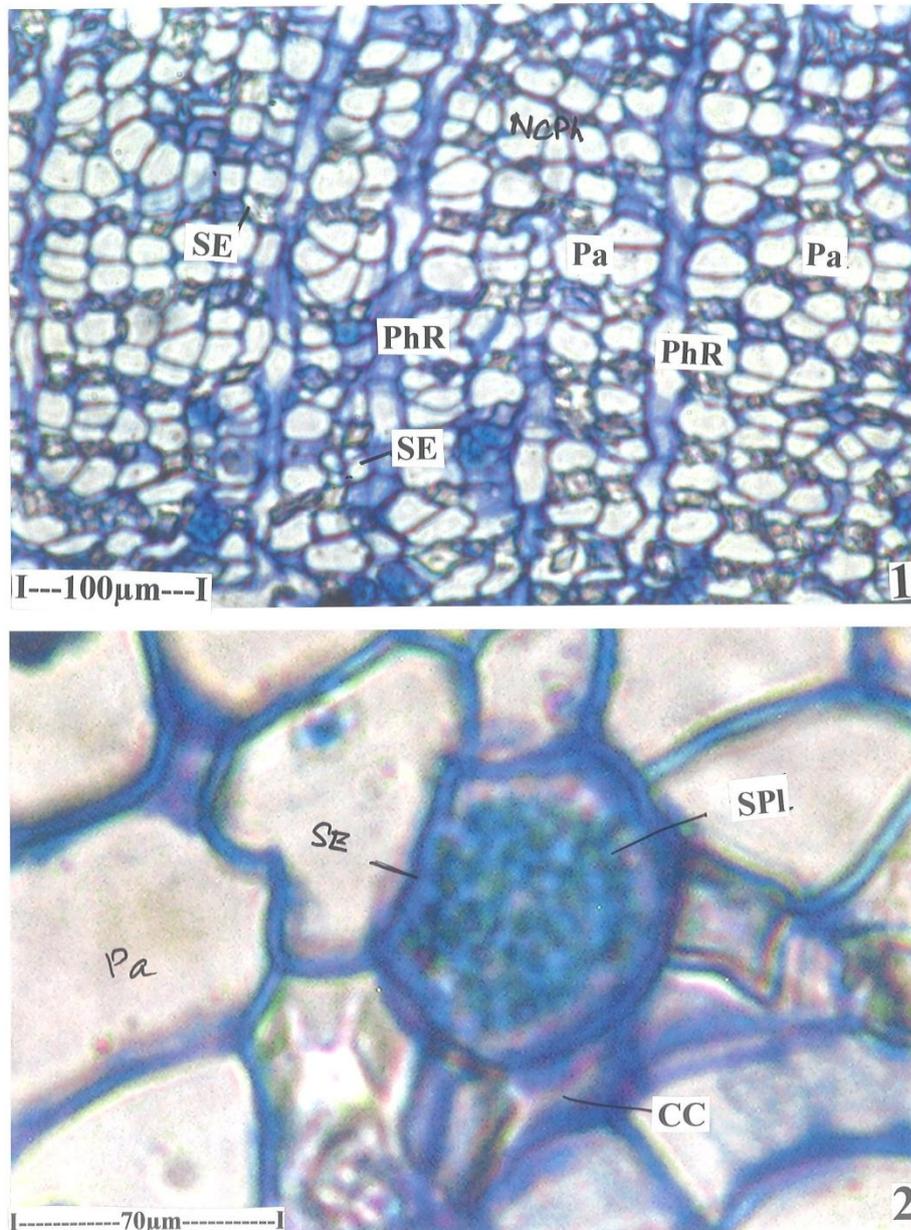
In the collapsed zone of phloem consists of tangential thin, dark lines which are collapsed and crushed sieve elements. The phloem parenchyma cells are dilated into wide circular and angular cells possessing **prismatic crystals** (Fig 4.1). The phloem rays are also dilated, the cells being larger and the rays become wider (Fig 4.2)



**Fig. 4.1** *Lagerstoemia reginae* T.S of Bark - Collapsed Phloem

**Fig. 4.2** Collapsed Phloem with Prismatic Crystal in the Phloem Parenchyma  
(CPh – Collapsed Phloem; Pa- Parenchyma; PhR – Phloem Ray; Cr-Crystals)

The **noncollapsed phloem** has intact angular compact **sieve-elements, companion cells**, narrow straight phloem rays and small compact parenchyma cells (Fig 5.1). The sieve elements have **sieve plates** at the end walls, which have small circular pores (Fig. 5.2). The sieve plate is 20 µm in diameter.



**Fig. 5.1** *Lagerstoemia reginae* T.S of Noncollapsed Phloem

**Fig. 5.2** A sieve element in cross section showing sieve plates.

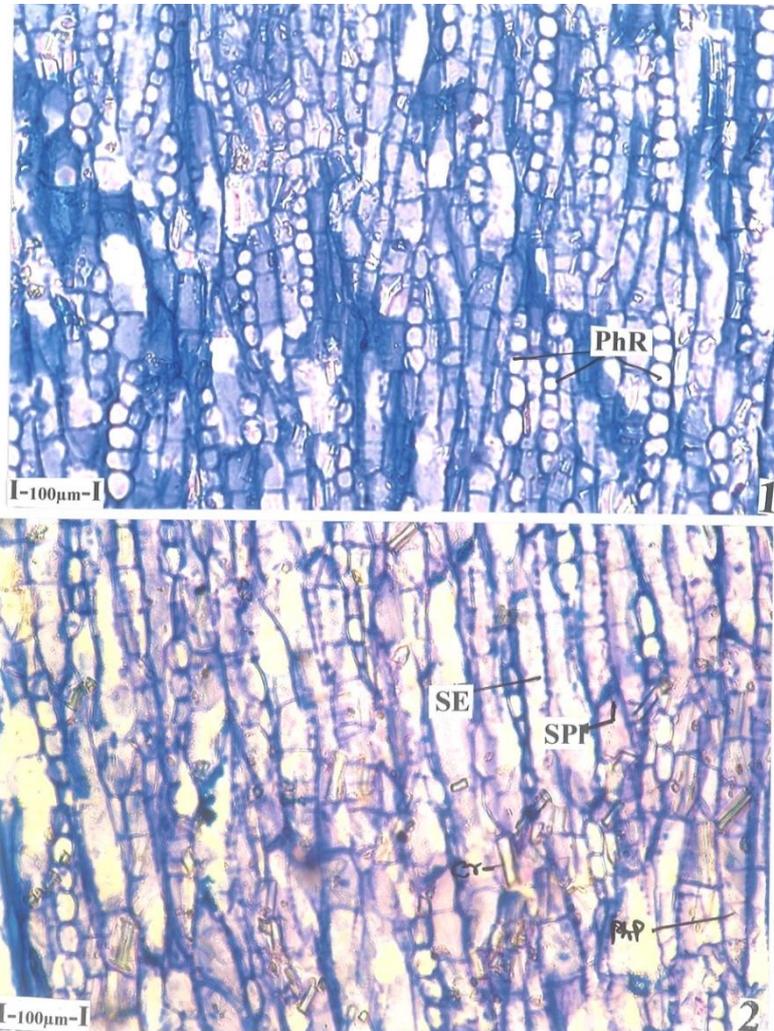
(PhR- Phloem Ray; NCPH- Noncollapsed phloem; SE-Sieve Elements; Pa-Parenchyma; CC-Companion Cells; SPL-Sieve plate;)

### Tangential longitudinal section of the Phloem (TLS)

In Tangential longitudinal sectional view, the phloem rays appear spindle shaped. They are mostly uniseriate comprising only one vertical row of cells; The rays are **non storied** and are hetrocellular comprising middle **Procumbent cells** and marginal **upright cells** (Fig 6.1,2) The cells of the ray are circular and thick walled. The rays are 50-153  $\mu\text{m}$  in height and 20  $\mu\text{m}$  thick.



The other components of phloem, namely, phloem parenchyma, Sieve-elements and companion cells are in vertical files parallel both rays (Fig. 6.2)

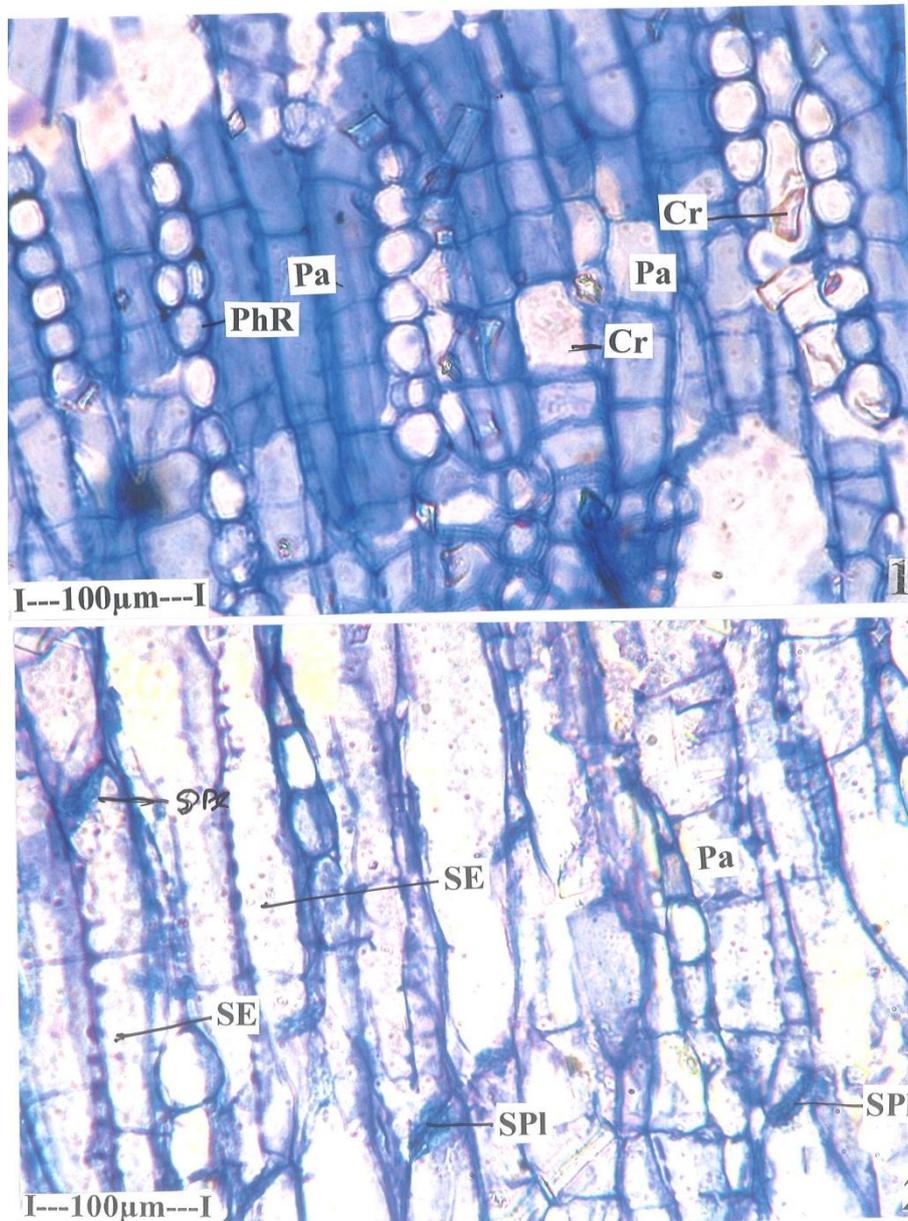


**Fig. 6.1** *Lagerstoemia reginae* TLS of Phloem showing uniseriate Phloem Ray

**Fig. 6.2** TLS of Phloem showing sieve element, sieve plate and Phloem Parenchyma.

(PhR-Phloem Ray; SE-Sieve Elements; SPI-Sieve plate; PhP-Phloem Parenchyma; Cr-Crystal;)

The sieve tube members are also in vertical rows. They are wide elongated cells with obliqua thick spindle shaped sieve plate (Fig 7.2)



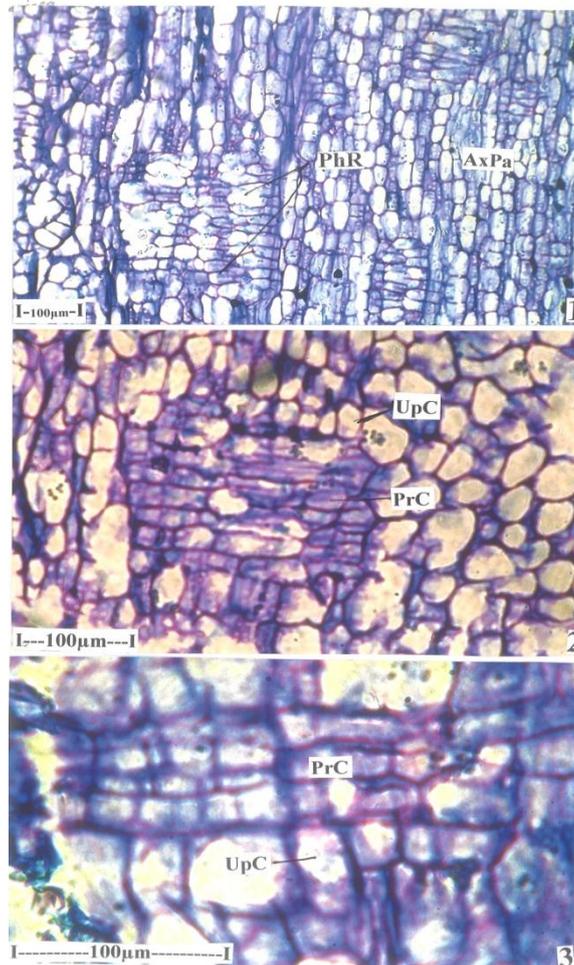
**Fig 7.1** *Lagerstoemia reginae* TLS of Phloem showing Phloem Parenchyma Phloem Ray and Crystal

**Fig 7.2** TLS of Phloem showing sieve element, sieve plates and parenchyma strand

(PhR – Phloem Ray; Cr- Crystal; Pa-parenchyma; SE- Sieve Elements SPI-Sieve plate; SPe- Sequent Periderm )

**Radial Longitudinal Section of phloem (RLS)**

In radial Longitudinal sectional view, the phloem rays are in horizontal ribbon shaped structure. The ray cells are rectangular in shape. The middle horizontally elongated cells are called procumbent cells and vertically enclosed marginal cells are called **upright cells** (Fig 8.1,2,3)

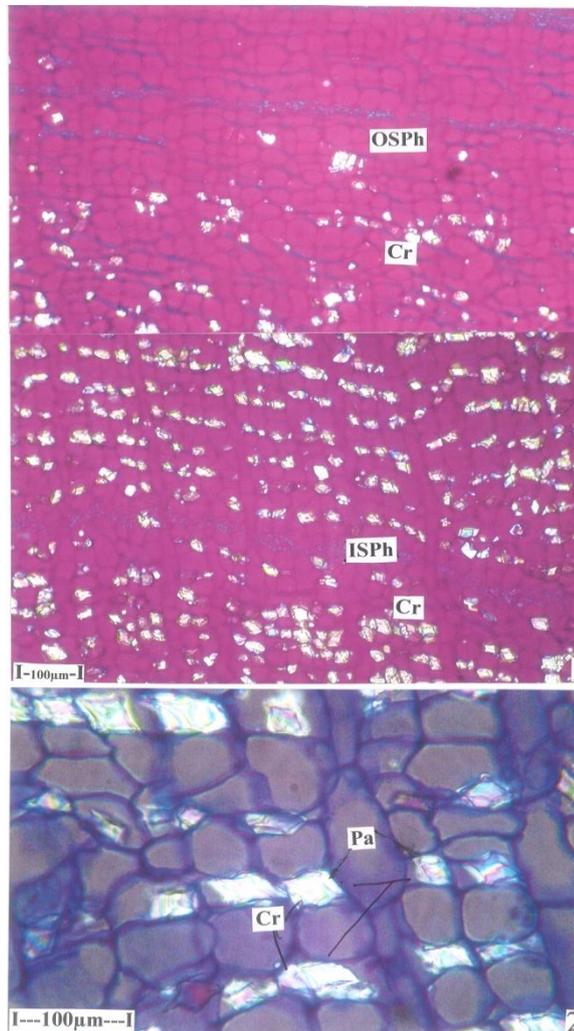


**Fig. 8.1** *Lagerstoemia reginae* RLS of Phloem showing horizontal ribbon shaped Rays and Vertical axile Parenchyma

**Fig. 8.2 , 3** RLS of Phloem showing upright cells and Procumbent cells  
(PhR-Phloem Ray; AxPa – Axial Parenchyma; UpC - Upright Cell ; PrC - Procumbent Cell )

### Crystal Distribution

Calcium oxalate crystals are abundant in the bark cells. Prismatic crystals of various shapes and sizes abundant in the phloem parenchyma cells (Fig 9.1,2). The crystals are triangular, cubical and rhomboid. The crystals are solitary and occupy the entire lumen of unmodified normal cells. In some of the phloem parenchyma these are elongated rectangular narrow crystals without ends (Fig. 6.1,2). The Prismatic crystals are 30 x 90 µm in size. The elongated scale with crystals are 40-50 µm long and 5µm thick.



**Fig. 9.1** *Lagerstoemia reginae* T.S of Phloem showing Prismatic calcium oxalate crystal in the Phloem Parenchyma.

**Fig 9.2** Crystal Enlarged

(Cr-crystal; ISph - Inner Secondary Phloem; OSph - Outer Secondary Phloem; Pa - Parenchyma)

## Discussion

*Lagerstoemia reginae* Roxb. of Lythraceae is one of intershowing components of ornamental tree. It is a deciduous tree with vare leaves and flowers during hot summer. When it is the blooms dense crown of leaves add to the charm of the tree. It is generally believed that bark of the tree have little studied for the microscope aspect. In the case of deciduous tree the anatomical aspect of the plant offers a helping hand to diagnose the species. Bark anatomy can be said to offer most essential important microscopic features that can be used to identify a tree species.

*Lagerstoemia reginae* has certain specific anatomical features of the bark. The mature bark studies. Its dead superficial periderm layers in inform of thin sheets leaving shining surface of the bark wide shining surface of the bark. The periderm is very thick comprising



thick phellem with thin lines of inner part of the phellegem includes narrow band of **brachy sclereids**. Secondary phloem has well defined outer collapsed sieve elements and inner intact noncollapsed phloem.

The thick cylinder of phellem and fairly thick layer of sclereids seem to offer protective measure for the inner secondary phloem against hot temperature outside of the tree. Presence of dense accumulation of calcium oxalate crystals in the phloem parenchyma is another protective measure or reserve source of Calcium, Ions during Ionic deficiency of calcium. A part from microscopic characters of botanical diagnosis of the Tree physiological adaptations are also seen in the bark, which are lighted in the version.

### Conclusion

Practical applications of bark microscopic features have been highly highlighted by several early plant anatomists like Solereder(1908), Easu(1979); Metcalfe (1979) and many others. The views of these eminent author on the relevance of anatomy of plant in various field of studies are endorsed in the present study of personal observation of bark anatomy. Taxonomic identity of species, Phylogenetic aspects of plants, industrial, pharmacological application are various disciplines. Where bark anatomy seen to play significant roles. These are vast areas of study of bark anatomy. Which are worthy's of investigation.

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