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Research Article

## Pharmacognostical studies on leaf and stem of *Abrus precatorius*

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### ABSTRACT

*Abrus precatorius* L. Fabaceae, also known as “licorice”, commonly found in tropical region of southeastern India. The stem and leaves of *Abrus precatorius* are used in traditional and contemporary herbal medicine but there are no meticulous anatomical explanations that can be developed in pharmacognosy or in comparative anatomical characterization. This study has analysed the stem and leaf anatomy with the intention of supply sufficient information to the medicinal plant identification. The epidermis of the lamina has a cylindrical cells. Secondary xylem has dense radial lines vessel elements and xylem fibers. Cyclocytic type of stomata, simple unbranched trichomes and prismatic calcium oxalate crystals are characteristic of the family Fabaceae and were confirmed by these anatomical studies. This present anatomical characterization of stem and leaf of *Abrus precatorius* makes a distinction between the other ones of this genus to make sure protection for possible pharmacological use, assuring guarantee for the standardization and authenticity of raw material.

**Keywords:** *Abrus precatorius*; epidermis; licorice; trichomes; stomata; xylem.

### INTRODUCTION

*Abrus precatorius* L. Fabaceae, also known as Crab's eye is a common climbing shrub usually found in the tropical region of Vellore District, Tamil Nadu, India. Leaves are compound, alternate of 6 to 9 cm long (Fig. 1.0). Decoction of leaves is taken orally for coughs and flu (Desai, 1986). Hot water extract of dried leaves and roots are used for the treatment of eye disease (Panthong, 1986). Leaves crushed with oil are used as a poultice as an anti-inflammatory (Anam, 2001). Ethanol extract of fresh root administered intraperitoneally to mice produces significant CNS depressant activity (Adesena, 1982). The leaves and stem part of this plant has been commonly used by the traditional healers for treating various disease. Various bioactive compounds present in the leaf and stem parts are responsible for the treatment of various ailments by traditional practitioners (Gnanavel et al, 2013). However, as detailed morphological characteristics have not been highlighted for leaves and stem of *Abrus precatorius*, this study has analysed the stem and leaf anatomy of this plant, aiming to provide extensive information for the medicinal plant classification and for the taxonomy of related species.

### MATERIALS AND METHODS

#### Collection

Fresh leaf and stem of *Abrus precatorius* L. Fabaceae, was gather round the region of Vellore, Tamil Nadu, India (12°56'0"N, 79°8'0"E) in November 2011 and identifications for the collected plant materials were done by a botanist, Prof. P.Jayaraman, PARC, Tamil Nadu, India (S.No.PARC/2011/1008).

#### Sectioning

The collected plant materials were dried in shadow and powdered and conserved in FAE (Farmalin-5ml + 70% ethyl alcohol-5ml + acetic acid-5ml). The preserved plant materials were dehydrated by using tert-butanol as per the method discussed in Sass,1940. The specimen sectioning and microscopic analysis studies were done by the method as discussed by Johansen, 1940.

### RESULTS AND DISCUSSION

#### Leaf Anatomy

The leaf let is smooth on both sides with fairly prominent plano-convx midrib having even adaxial side and semi circular abaxial side of 170 µm thickness (Fig.1.1). Adaxial region of the midrib consists of cylindrical, slightly thick walled epidermal cells and the lower part of the midrib consists of slightly papillate, large, epidermal cells. The cuticle is prominent on both adaxial and abaxial sides. The palisade zone extends on either side of the adaxial part of the vascular bundle. The abaxial part of the midrib has 2 or 3 compact parenchyma cells. These are broadly conical with narrow part lying

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Figure 1: *Abrus precatorius* L.

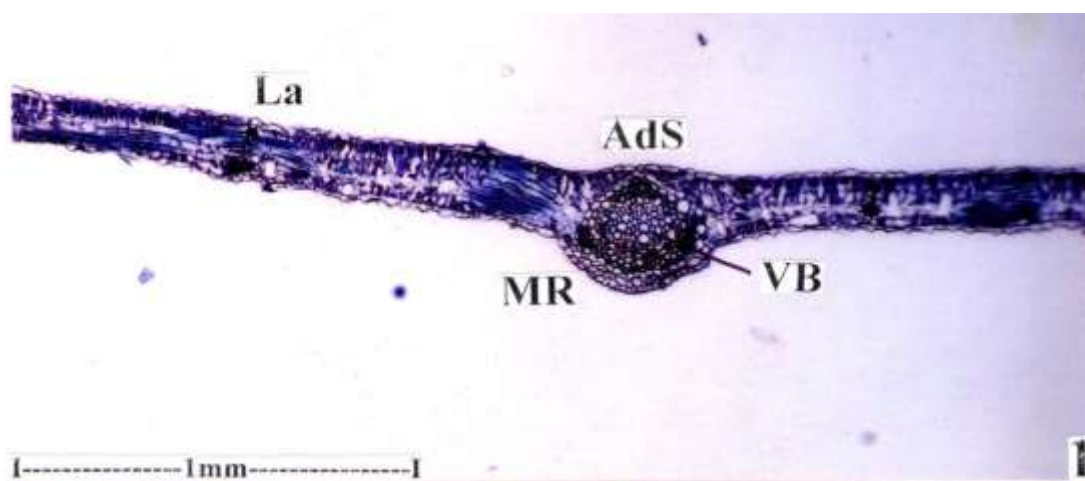


Figure 1.1: T.S of leaflet through midrib and lamina.

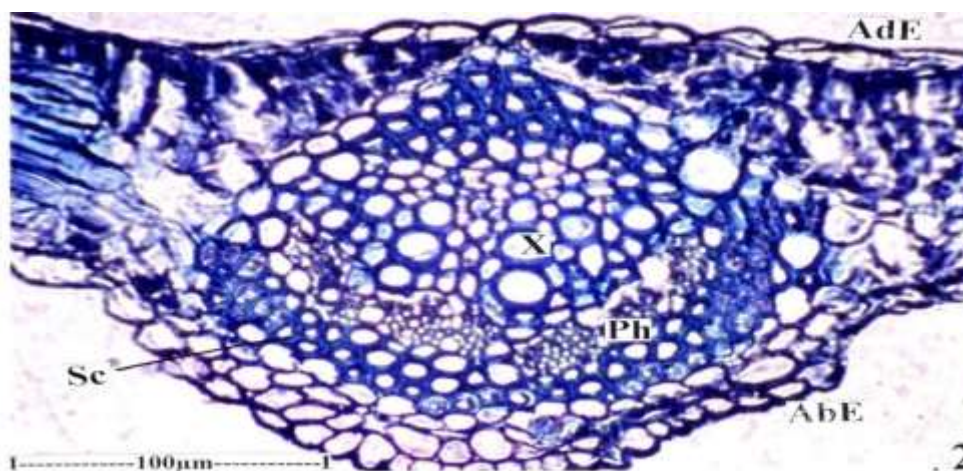


Figure 1.2: T.S of midrib- Enlarged.

towards the adaxial side (Fig. 1.2). The midrib consists of 4 or 5 short, parallel lines of thick walled circular vessel elements. The complete vascular strand is surrounded by thick sclerenchyma sheath which is 3 layers of thickness in the abaxial part, 4 or 5 layers thick in the adaxial conical part outer to the sclerenchyma sheath occurs a single layer of elliptical thick walled parenchymatous sheath (Fig. 1.2).

#### Lamina

The lamina includes major and minor vein lets. The veins have collateral vascular bundles with parenchymatous bundle sheath which extend up to the adaxial epidermis (Fig. 2.1). The epidermis of the lamina has cylindrical cells. A mesophyll tissue has two horizontal bands cylindrical cells and vertically oblong and spherical spongy parenchyma tissue located on the abaxial part and the lamina is 90 μm thick.

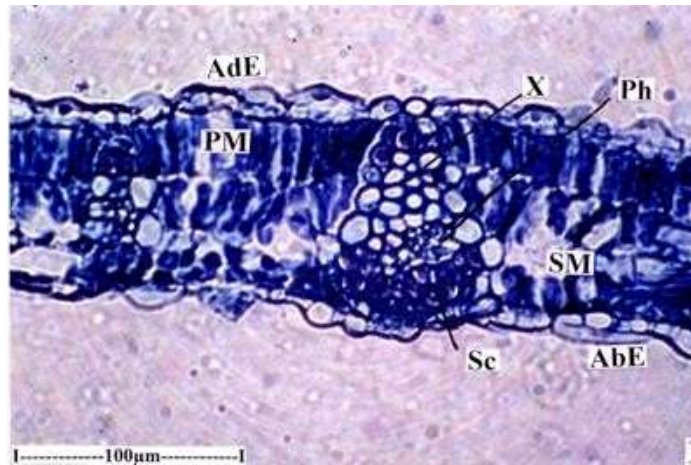


Figure 2.1: T.S. of lamina through lateral veins

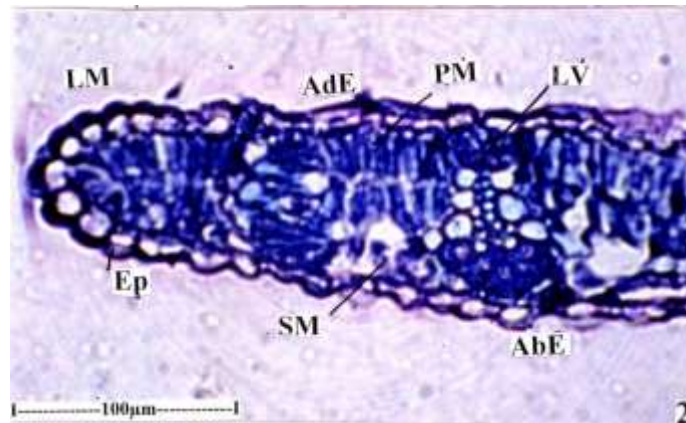


Figure 2.2: T.S. of Marginal part of the leaf let.



Figure 3: T.S of old stem - Entire view

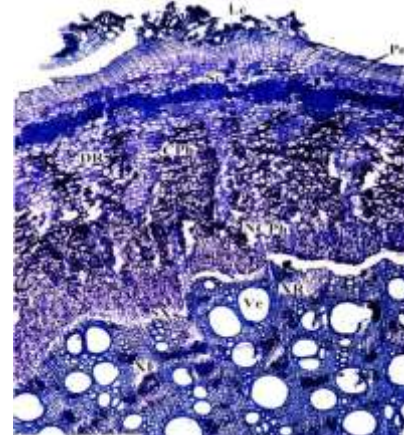


Figure 4: T.S. of old stem – A sector

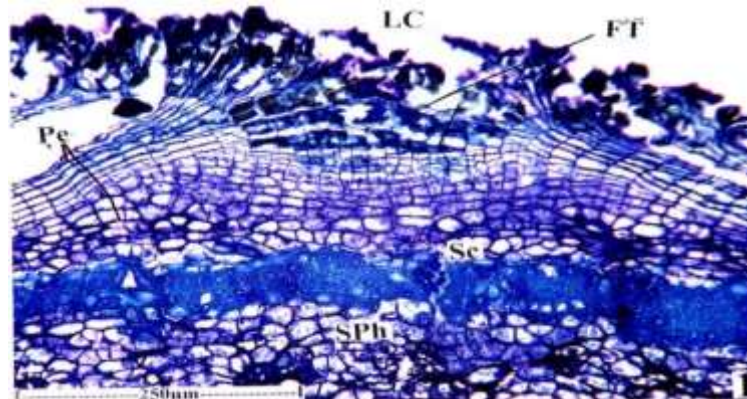


Figure 5.1 T.S. of stem showing lenticels, cortex and sclerenchyma cylinder

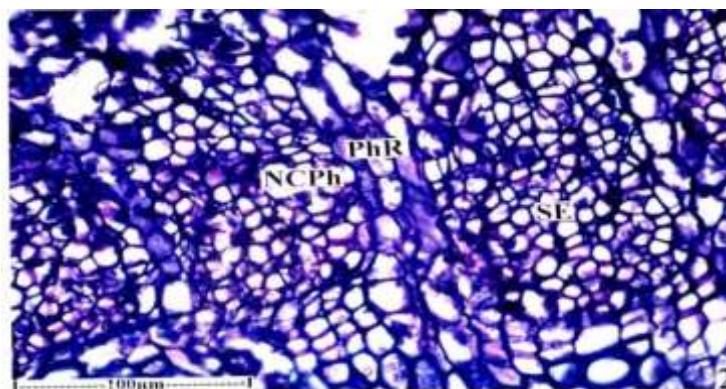


Figure 5.2 T.S. of stem showing intact non-collapsed phloem masses.

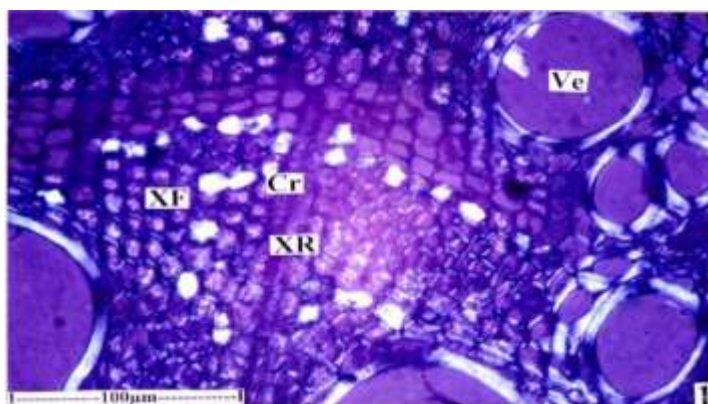


Figure 6.1: Prismatic crystals in the xylem parenchyma.

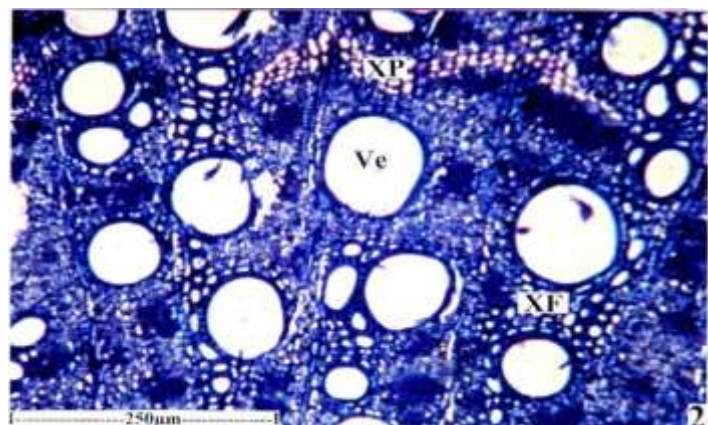


Figure 6.2: Secondary xylem showing the vessels and xylem parenchyma bands.

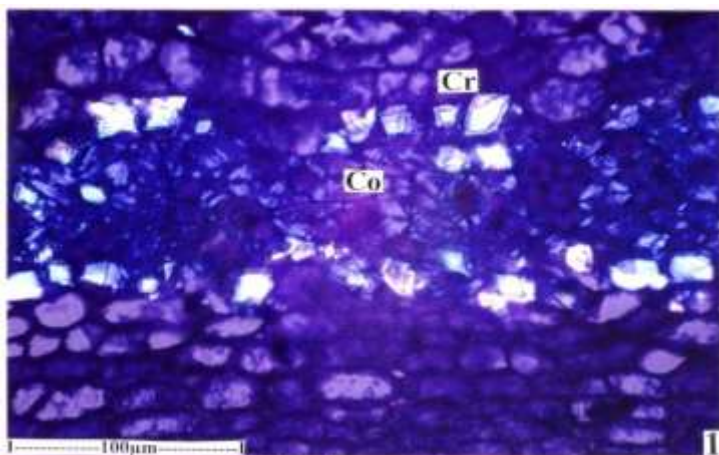


Figure 7.1: Presence of crystals in the cortical parenchyma.

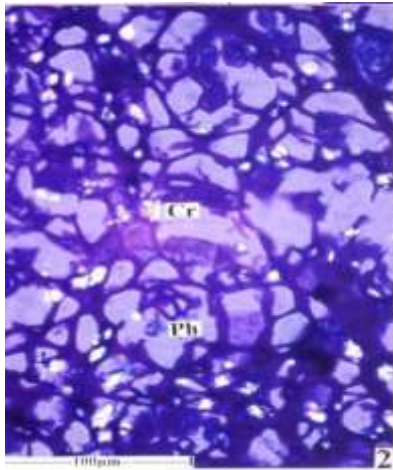


Figure 7.2: Crystals in the phloem parenchyma.

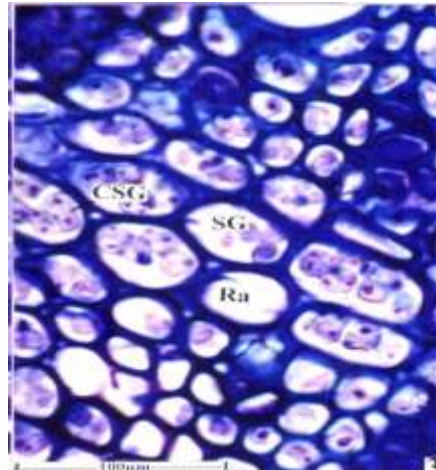


Figure 7.3: Starch grains in the xylem rays.

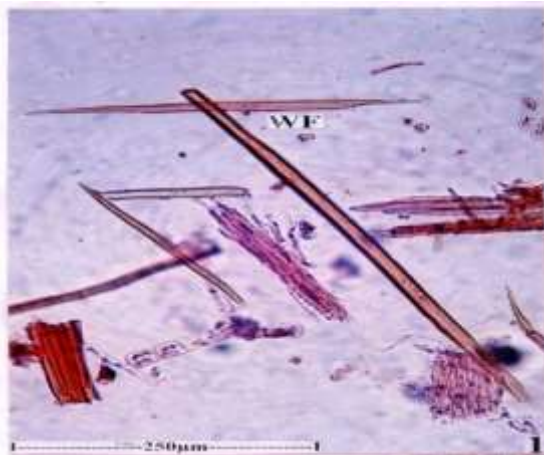


Figure 8.1: Wide fibers.

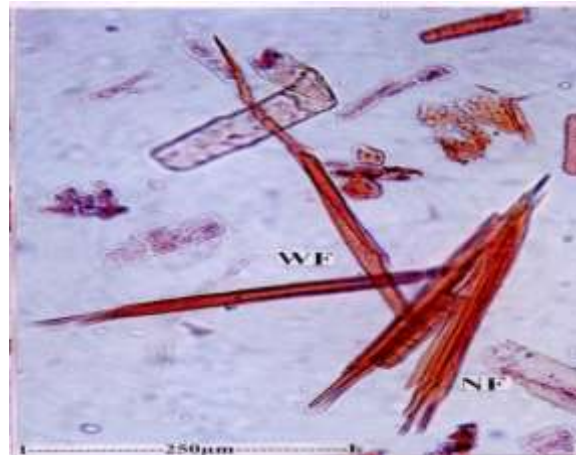


Figure 8.2: Wide fibres and Narrow fibers.

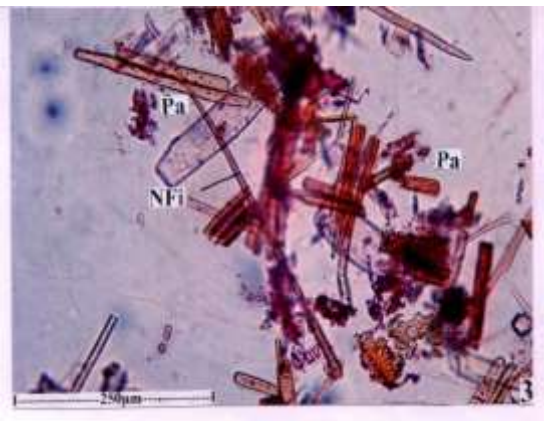


Figure 8.3: Parenchyma cells and fibers

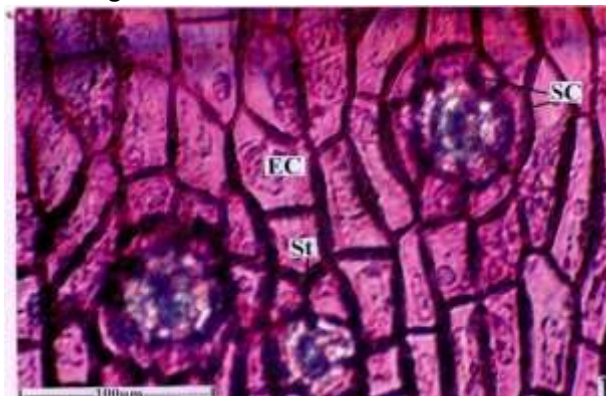


Figure 9.1: Epidermal peeling of the stem showing stomata.

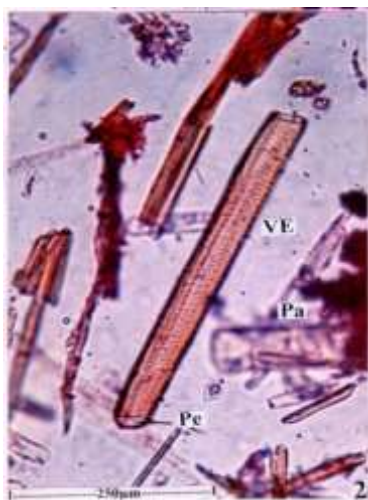
**Leaf Margin**

Leaf margin is straight and semi circular. The epidermal layer of the marginal part has semicircular thick cells and broad cuticle. The internal tissues do not change in the marginal part. The leaf margin is 60 µm thick (Fig. 2.2).

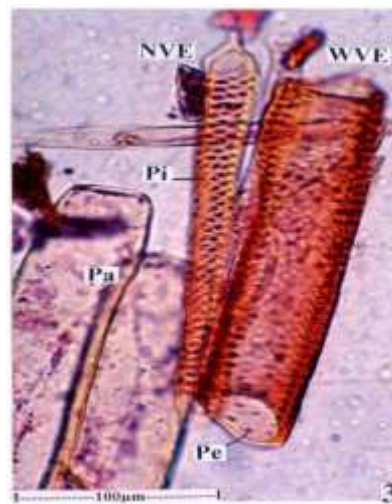
**Stem**

Thick stem with well developed secondary growth was studied. The stem consists of broad, superficial and continuous periderm tissue with frequent fissures

along the surface (Fig. 3 & 4). The periderm is 50 µm thick. It includes about ten layers of narrow, tabular, suberized phellem cells. Phelloderm is not evident. Lenticels are frequently seen which consists of outer broken, darkly stained cells and inner compact filling tissue parenchyma cells (Fig. 4 & 5.1). The cortex is narrow, comprising 3 or 4 layers of small, compact, parenchyma cells. Inner to the cortex occurs, continuous cylinder of sclerenchyma cells. The cylinder being unequal in thickness (Fig. 4 & 5.1). Secondary phloem is wide and includes outer wider zone of dilated rays and



**Figure 9.2: Long, Narrow Vessel Element**



**Figure 9.3: Vessel elements showing end wall perforation and lateral wall pits**

collapsed phloem elements. The collapsed region the sieve elements are crushed into several dark irregular masses. This portion of phloem includes dense, masses of sieve elements and parenchyma cells (Fig. 5.2).

The stem includes a wide, dense central core of compact thick walled cells with accumulation of darkly stained unknown substances. The secondary vascular cylinder consists of outer, wide phloem and small groups of phloem elements situated all along the inner boundary of the secondary xylem cylinder. The secondary xylem consists of dense radial lines of vessel elements and xylem fibers. The xylem vessel elements are mostly solitary, wide, elliptical or circular and thin walled. They are 30-100  $\mu\text{m}$  in diameter. Apart from the wide vessels there are also small, radial segments of narrow, thick walled vessels (Fig. 4 & 6.2). Xylem rays are thin and straight. Xylem parenchyma is fairly distinct and they occur in tangential segments and located away from the vessel. These xylem parenchyma segments are apotracheal banded parenchyma type (Fig. 6.2).

#### Crystal distribution

Calcium oxalate crystals are found in the cortical parenchyma cells in addition to secondary phloem parenchyma cells (Fig. 6.1 & 7.1). Crystals in the phloem parenchyma and xylem parenchyma are prismatic type. They are somewhat scattered in distribution and solitary in each cell (Fig. 6.1 & 7.1). Starch grains are densely accumulated in the circular either simple or compound. Circular grains are concentric with central hyla. The compound starch grains consist of 2 to 5 grains united to form a single mass.

#### Powder microscopy

The powder of the stem exhibits fibers, parenchyma cells and vessel elements.

#### Fibers

The fibers are abundant in the powder. Some of the fibers are wide, short and thin walled. They are 300  $\mu\text{m}$  long and 5  $\mu\text{m}$  thick (Fig. 8.1, 8.2 & 8.3).

#### Parenchyma cells

This walled, rectangular, wide parenchyma cells were present. These are small, circular simple pits on the lateral walls (Fig. 8.3). The parenchyma cells are 140-220  $\mu\text{m}$  long and 20-40  $\mu\text{m}$  wide.

#### Epidermal peeling of the stem

Thick walled, wide and vertically elongated epidermal cells are present. Cyclocytic type of stomata also seen in the epidermal of stem (Fig. 9.1). The stomata are cyclocytic type. The stoma is surrounded by 3-6 semi-circular subsidiary cells.

#### Vessel element

Vessel elements have wide simple perforation at the end walls (Fig. 9.2 & 9.3). The lateral walls have wide, elliptical, multiseriate bordered pits on the lateral walls (Fig. 9.3).

Fig. 2.2 (AbE-Abaxial Epidermis, AdE - Adaxial Epidermis, Ads-Adaxial side, La - Lamina, MR - Midrib, Ph - Phloem, Sc - Sclerenchyma, VB - Vascular Bundle, X-Xylem)

Fig. 3: T.S of old stem - Entire view. Co -cortex, Lc-Lenticels, Pe-Periderm, SPh-Secondary phloem, SX-Secondary Xylem, MPh-Medullary Phloem, Pi-Pith, TWC- Thick walled cell.

Fig. 4: T.S. of old stem - A sector, CPh-Collapsed Phloem, DR-Druses, Lc- Lenticels, NCPH- Non-Collapsed Phloem, Pe- Periderm, SX-Secondary Xylem, Ve-Vessel, XF-Xylem Fiber, XR-Xylem Ray.

Fig 5.2: NCPH- Non-Collapsed Phloem, Pe-Periderm, PhR-Phloem Ray, Sc- Sclerenchyma, SE- Sieve Element, SPh-Secondary phloem). Lc-Lenticels, FT- Filling Tissue.

Fig 9.3: EC-Epidermal Cell, NVE-Narrow Vessel Element, Pa- Parenchyma, Pe-Perforation, Pi-Pits, SC-Subsidiary Cell, St-Stomata, VE-Vessel Element, WVE-Wide Vessel Element.

## CONCLUSION

A presence of cyclocytic type of stomata, simple unbranched trichomes and prismatic calcium oxalate crystals are the diagnostic characteristic features of stem and leaves of *Abrus precatorius*. Pharmacognostical standards discussed here will be helpful for the future researchers to authenticate and validate the drug.

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