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Pharmacognostical Studies of *Bauhinia variegata* Linn root

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ABSTRACT

The present study deals with the macroscopical and microscopical studies of *Bauhinia variegata* Linn root. Some distinct and different characters were observed with sections of young, thick and very old and thick roots. The anatomy of the root was studied by taking transverse section. Secondary phloem and secondary xylem were seen distinctly. Secondary phloem had fairly wide rays, dense masses of phloem fibers and radial rows of phloem elements. Secondary xylem had much wider, thin-walled vessels which were either solitary or in radial multiples. The xylem fibers constituted gelatinous type and normal type. Calcium oxalate crystals were predominantly prismatic type. Powder microscopical examination showed presence of xylem parenchyma cells, xylem fibers and vessel elements. Physicochemical parameters and preliminary phytochemical studies of the root powder were also carried out. The present study on pharmacognostical investigation of *B. variegata* L. root might be useful to supplement information in regard to its identification parameters assumed significantly in the way of acceptability of herbal drugs in present scenario lacking regulatory laws to control quality of herbal drugs.

Key words: *Bauhinia variegata*, root

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INTRODUCTION

About 600 species of *Bauhinia* grow in the tropical regions of the world.[1] The genus includes trees, vines, and shrubs that are frequently planted for their showy flowers and ornamental foliage. *Bauhinia variegata* is native to Southeastern Asia and grows throughout India and China. It is most commonly cultivated in India and is a reliable greenhouse species.[2,3] *Bauhinia variegata* Linn (Caesalpiniaceae) grows as a medium-sized, deciduous tree and is called *Kanchanara* in Sanskrit.[4] It is traditionally used in bronchitis, leprosy, piles, dysentery, tumors and ulcer.[5] No report is available on micro-morphological work of this drug, hence the present study was undertaken to explore pharmacognostical investigation of *B. variegata* root.

MATERIALS AND METHODS

Plant material

The plant specimens for the study were collected from botanical garden of Sapthagiri Group of College campus, periyanahalli, Dharmapuri District, Tamilnadu, India. It was identified and authenticated by Dr. P. Jayraman, Chennai (India). Care was taken to select healthy fully grown plant and normal organs. The samples of different organs were cut suitably and removed from the plant and thoroughly washed with water to remove the adherent impurities and dried in sunlight. Selected samples of the dried root were stored in a solution containing formalin (5 ml), acetic acid (5 ml) and 70% v/v ethyl alcohol (FAA)

(90 ml). After 24 hours of fixing, the specimens were dehydrated with graded series of tertiary-Butyl alcohol as per the method.[6] Infiltration of the specimens was carried by gradual addition of paraffin wax (50–60 °C m.p.) until tertiary-Butyl alcohol solution attained supersaturation. The specimens were casted into paraffin blocks.

Sectioning

The paraffin-embedded specimens were sectioned with the help of Senior Rotary Microtome, RMT-30 (Radical Instruments, India). The thickness of the sections was kept between 10 and 12 μm. The dewaxing of the sections was carried out as per the procedure.[7] The section was stained with toluidine blue as per the method.[8] Since toluidine blue is a polychromatic stain, the staining results were remarkably good. The dye rendered pink colour to cellulose walls, blue to the lignified cells, dark green to suberin, violet to the mucilage, and blue to the protein bodies. The sections were also stained with saffranin, fast-green, and iodine potassium iodide reagents (for starch).

Photomicrograph

Microscopic descriptions of selected tissues were supplemented with micrographs. Photographs of different magnifications were taken with Nikon Lab Photo 2 Microscopic unit. For normal observations, bright field was used. For the study of crystal, starch grains and lignified cells, polarized light was employed. Since these structures have birefringent property under polarized light they appear bright against dark background. A magnification of the figures is indicated by scale bars.[9]

Physicochemical Parameters

Physicochemical parameters of *B. variegata* root powder were determined[10] and reported as total ash, water-soluble ash, acid-insoluble ash, alcohol-soluble extractive, water-soluble extractive and moisture content.

Preliminary Phytochemical studies

Preliminary phytochemical test of *B. variegata* root powder was performed and the chemical constituents were detected.[11,12]

RESULTS

Macroscopy

The root was cylindrical or slightly curved, about 10–30 cm in length and 4–6 mm in thickness. The root was externally earthy brown in colour, its surface was fissured and the fractures were fibrous [Figure 1]. It had no specific odour and taste.

Microscopy study

Young Root: The thin young root, of about 1.6 mm diameter, was studied. The root was circular, smooth and even surfaced [Figure 2.1]. It consisted of the following tissue zones:

Periderm: It was quite broad and deeper in origin. It consisted of outer wider zone of phellum, comprising of several compact and compressed tubular cells of phellum, narrow densely tannin filled and regular radial rows of phelloderm cells [Figure 2.2]. The phellum zone was 150 μm wide, while the phelloderm was 100 μm wide.

Secondary Phloem: It was broad and continuous cylinder of randomly arranged sieve elements and phloem parenchyma cells.

Secondary Xylem: It was circular and solid consisting of thin-walled xylem fibers and four radial masses of thin-walled, wide circular vessels. The primary xylem was distinctly visible as four prominent exarch masses around fairly wide sclerenchymatic pith [Figure 2.2]. The widest vessels were 100 μm and narrow vessel was 50 μm in diameter.

Thick Root: The thick root having thickness of about 3.5 mm was studied. It had rough fissured surface [Figure 3.1]. Fairly thick root had smooth surface. The thick root had broad and distinct phellum. Phelloderm was not evident. The root with inner boundary of the periderm had thick irregular cylinder of sclerenchyma elements. The secondary phloem had fairly wide rays, dense masses

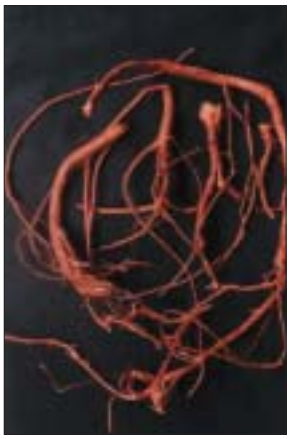

Figure 1: External morphology of root of *Bauhinia variegata* L.

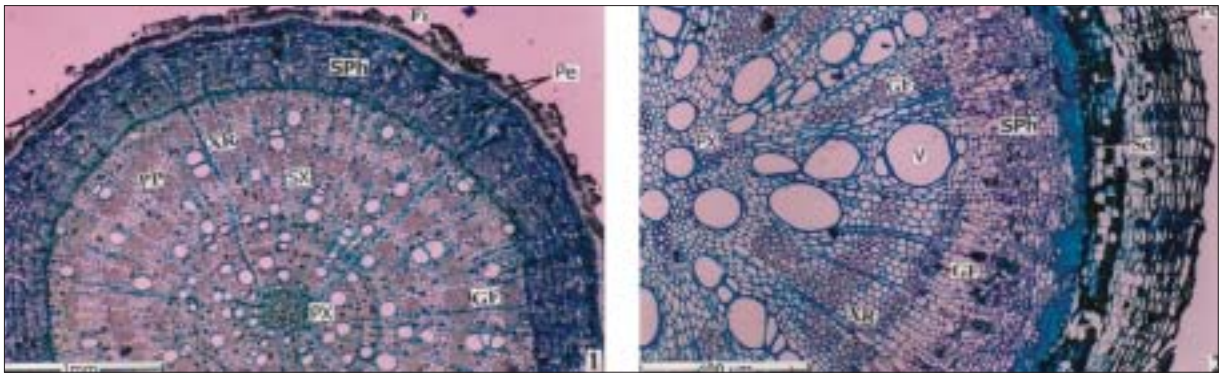

Figure 2: Microscopical view of *Bauhinia variegata* L. thick root.
3.1 T.S. of root, half portion enlarged. ; 3.2 T.S. of median sized root a sector enlarged.; Fi : Fissures; GF: Gelatinous fibers; Pe : Periderm; PP : Paratracheal parenchyma; PX : Primary xylem; Scl : Sclerenchyma; SPh : Secondary phloem; SX : Secondary xylem; V : Vessel; XR : Xylem ray.

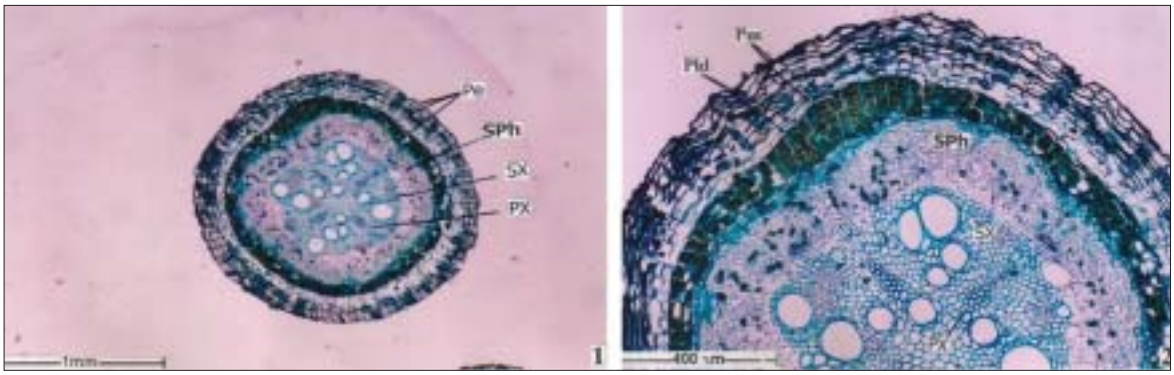

Figure 3: Microscopical views of *Bauhinia variegata* L. root.
2.1 T.S. of thin root measuring about 1.6 mm. thick. ; 2.2 T.S. of thin root, a sector enlarged.
Pe : Periderm; Pld : Phelloderm; Pm : Phellum; Px : Primary xylem; SPh : Secondary phloem; SX : Secondary xylem

of phloem fibers and radial rows of phloem elements. The secondary xylem had much wider, thin-walled vessels which were either solitary or in radial multiples. The xylem fibers constituted gelatinous type and normal type. The gelatinous type, were either tangential bands or radial blocks [Figure 3.2].

Very old and Thick Root: The old root had uneven periderm with broken and fissured phellum tissue. Cortex was not evident. The secondary phloem was 350 µm wide. It consisted of fairly dilated rays at certain places and narrow rays at the outer regions. Phloem fibers were scattered in large masses. The sieve elements were randomly distributed.

The xylem cylinder was found to be solid and dense with circular outline. The central part of the xylem cylinder had tetrarch or pentarch primary xylem strands around a narrow pith. The secondary xylem had no growth rings. The vessels were diffused evenly. They were wide, circular, and thick walled. They were solitary or short radial multiples of two or more cells. Xylem parenchyma was abundant and occurred in broad continuous paratracheal bands.

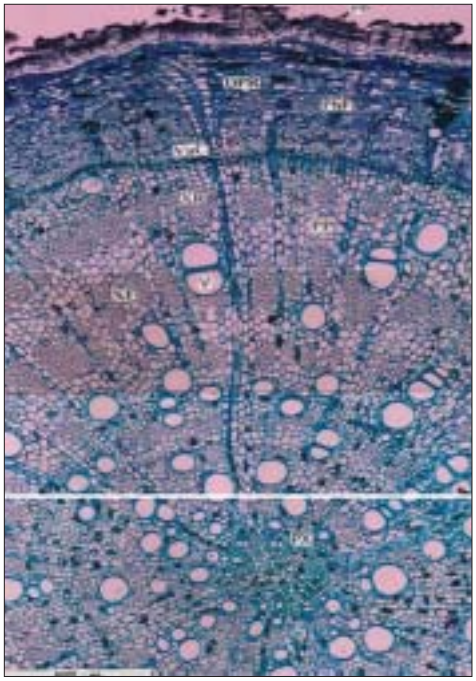

Figure 4: Anatomy of the very old and thick root of *Bauhinia variegata* L. DPR: Dilated phloem; Pe: Periderm; PhF: Phloem fibers; PP: Paratracheal parenchyma; Px: Primary xylem; V: Vessel; Vac : Vascular bundles; XF : Xylem fibers; XR: Xylem ray.

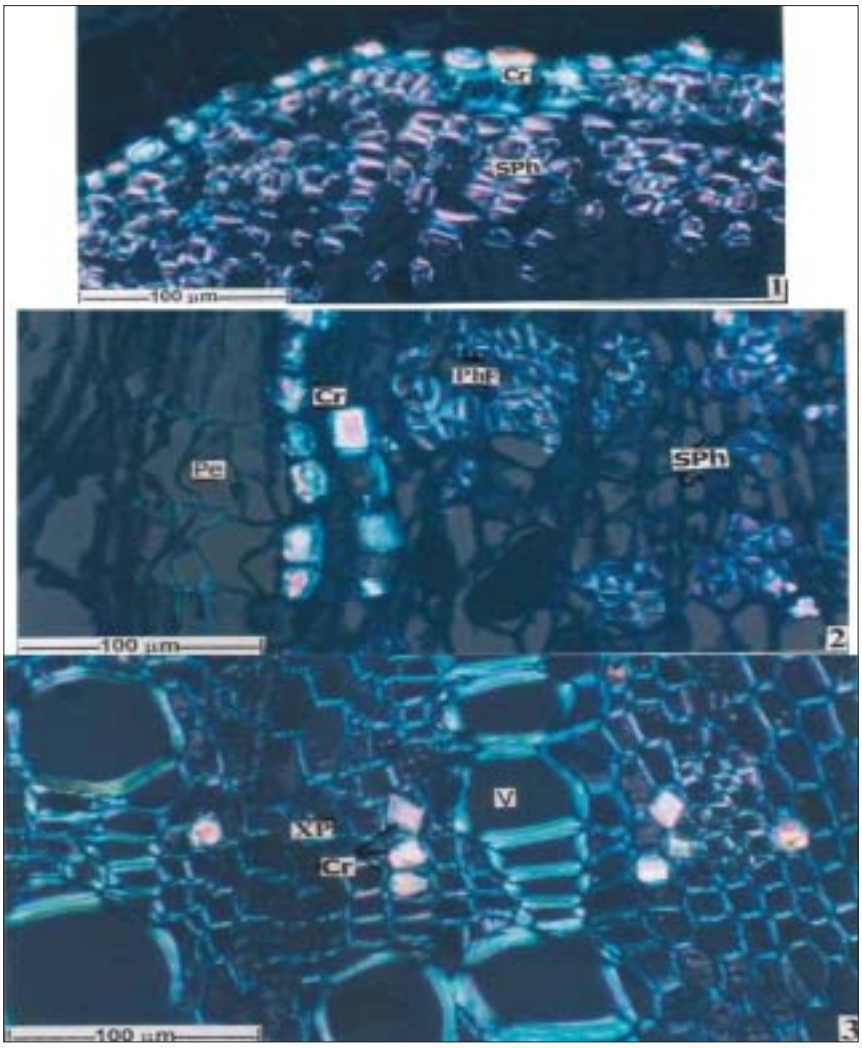

Figure 5: Crystal distribution in the root of *Bauhinia variegata* L.
5.1 Crystals along periphery of the Secondary phloem. ; 5.2 Crystals beneath the Periderm.; 5.3 Crystals in the Xylem parenchyma. ; Cr : Crystals; Pe : Periderm; PhF : Phloem fibers; SPh : Secondary phloem; V : Vessel; XP : Xylem parenchyma

The xylem fibers were predominantly gelatinous type, these fibers occurred in wide cylinders alternating with the parenchyma cylinders. The diameter of the vessels ranged from 50–95 µm. The xylem rays were fairly distributed. They ran as thin radial lines and got dilated to limited extent in the phloem zone [Figure 4].

Crystal Distribution

Calcium oxalate crystals were abundant in different parts of the root. The crystals were predominantly prismatic type. The crystals occured with outer boundary of the secondary phloem, inner to the periderm [Figure 5.1-2]. They were also frequently seen with xylem parenchyma cells. The crystals were mostly rhomboidal type and were 15 x 20 µm in size [Figure 5.3].

Powder Microscopy

Powder of the root exhibited three types of elements [Figure 6.1-2-3].

Xylem Parenchyma: The parenchyma cells were abundant. They were thin walled, wide. They occurred in small groups. The shape of the cells varied from rectangular to squarish. They had no pits.

Xylem Fibers: The xylem fibers were mostly gelatinous type; the fiber had lignified outer wall which stained blue and cellulose inner wall which stained violet or purple. The fibers were long narrow, thin-walled cells [Figure 6.1-2]. The fibers ranged in length from 300–600 µm.

Vessel Elements: These were cylindrical cells with wide,

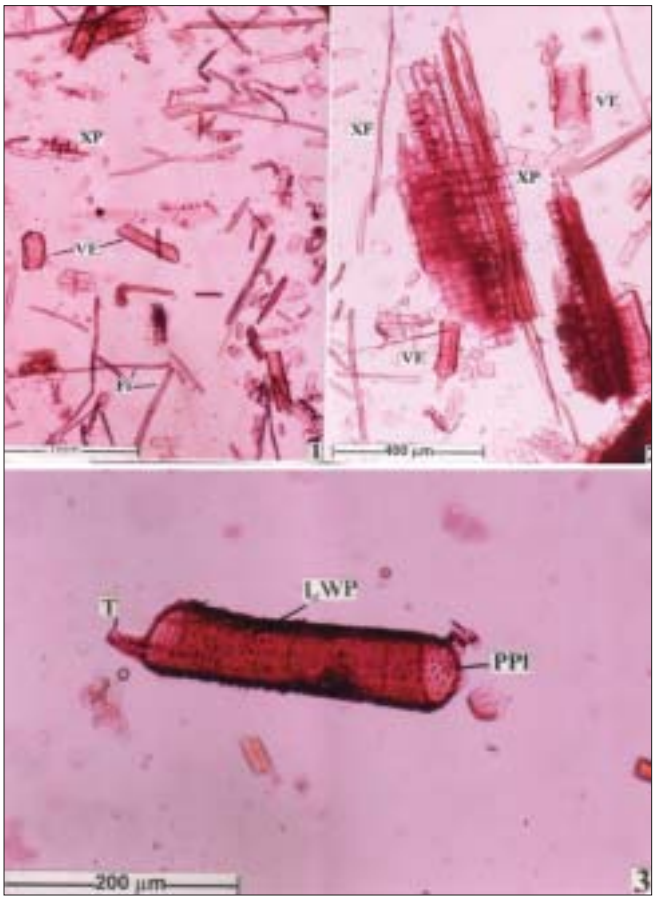

Figure 6: Powder microscopy of *Bauhinia variegata* L. root.
6.1 and 6.2 Vessel elements, fibers and parenchyma; 6.3 Vessel element enlarged.
Fi : Fibers; LWP : Lateral wall pits; PPl : Perforation plate; T : Tail; VE : Vessel elements; XF: Xylem fibers; XP: Xylem parenchyma.

simple perforated plates at the ends [Figure 6.3]. The perforations were slightly oblique or horizontal; lateral wall pits were abundant. The vessel element had a small tail. The vessel elements were 250–500 µm in length.

Physicochemical Parameters

B. variegata root powder showed the presence of total ash – 8.28% w/w, water-soluble ash – 2.85% w/w, acid-insoluble ash – 2.56% w/w, alcohol-soluble extractive – 1.63% w/w, water-soluble extractive - 3.95% w/w and moisture content – 8.68%.

Preliminary Phytochemical studies

The qualitative chemical test of *B. variegata* root powder showed the presence of carbohydrates, glycosides, furanoids, flavonoids, tannins, phenolic compounds, proteins, gums and mucilages.

DISCUSSION

The macroscopic study of root bark indicated that it contained fissures on the outer surface [Figure 1]. It may be an important characteristic feature for identifying the plant. The anatomy of the root was studied by taking transverse section. Transverse section of the root showed, quite broad and deeper periderm in the origin. Secondary phloem had fairly wide rays, dense masses of phloem fibers, and radial rows of phloem elements [Figure 2–4]. Secondary xylem had much wider, thin-walled vessels which were solitary or in radial multiples. The xylem fibers constituted gelatinous type and normal type. Fibers of gelatinous type were either tangential bands or radial blocks. Xylem vessels were wide, thick walled and solitary.

Calcium oxalate crystals were predominantly prismatic type. They occurred with outer boundary of secondary phloem, inner to periderm. They were also frequently seen with xylem parenchyma cells, where the crystals are rhomboidal type [Figure 5].

Powder microscopical examination showed presence of xylem parenchyma cells which were rectangular to squarish in shape; they had no pits [Figure 6]. Xylem fibers were long narrow, thin-walled cells, lignified with outer wall and cellulose in inner wall. Vessel elements were cylindrical cells wide with simple perforation at the end.

Physicochemical parameters and preliminary phytochemical studies will be useful tool along with macroscopical and microscopical characteristics of *B. variegata* L. root.

CONCLUSION

The present pharmacognostical studies of *B. variegata* L. root might be useful to supplement information in regard to its identification parameters assumed significantly in the way of acceptability of herbal drugs in present scenario that lacks regulatory laws to control quality of herbal drugs

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