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Anatomical Studies on Gajapipal Fruit: An Ayurvedic Herb

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Abstract: The detailed histological examination of crude drugs can be used to confirm the structural features of the crude drugs. Anatomical/histological practice playing a unique role in the more detailed examination of crude drugs and can be used to confirm the structural features of the crude drugs. Quantitative microscopy and linear measurements are the other important aspects of the histological method. The histological approach to study plants and plants parts is helpful in the searching of specific microscopical characters and even some times it is helpful in the differentiation between two species of same genus. The plant *Pothos officinalis* (Roxb.) (Gajapipal in Hindi) is also known as *Scindapsus officinalis* (Roxb.) Schott. Fruits of the plant are widely used in many parts of India for the treatment of various diseases and ailments. Since no complete anatomical data related to fruit is available so far, hence the present study aimed to establish anatomical profile of the fruit of *Pothus officinalis* (Roxb.).

Key words: Gajapipal · Anatomy · *Pothos officinalis* (Roxb.) · Araceae · Traditional medicine

INTRODUCTION

Pothos officinalis (Roxb.) also know as *Scindapsus* officinalis (Roxb.) Schott. is one of the plant used in Indian system of medicine which belongs to family Araceae. The plant of *Pothus officinalis* is a large, stout, epiphytic and perennial climber with adventitious aerial roots growing on trees and rocks (Figure 1) [1-3]. The plant is growing in tropical part of India. It is common in the Midnapore district of west Bengal and cultivated vegetatively for its fruit, which is cut into transverse pieces, dried and used medicinally [4-6]. Fruit (Figure 2) is very important part of the plant and accepted as raw drug of known properties in both Ayurvedic and Unani system of medicine. The fruit is reported to be useful as a diaphoretic, carminative stimulant, anthelmintic, aphrodisiac, galactagoguue, appetiser and also useful in the form of decoction in diarrhea, asthma and other affections supposed to be caused by *Kafa* [7-10].

Anatomical/histological practice playing a unique role in the more detailed examination of crude drugs and can be used to confirm the structural features of the crude drugs. Quantitative microscopy and linear measurements are the other important aspects of the histological method [11]. The histological approach to study plants and plants parts is helpful in the searching of specific microscopical characters and even some times it is helpful in the differentiation between two species of same genus. Based on this fact and Since no complete anatomical data related to fruit is available so far, the present study aimed to establish anatomical profile of the fruit of *Pothus officinalis* (Roxb.).

MATERIALS AND METHODS

Plant Material: The fruits specimens of the plant *Pothus officinalis* [Roxb.] Schott for the proposed study were collected from the market [K. Ramaswamy Chetty (KRC), Country Drugs dealer, whole sale and retail, Shop No. 117, Rasappa Chetty Street, Park Town, Chennai, India] during the month of August 2009 and authenticated by Dr. P. Jayaraman (Director, Plant Anatomy Research Centre, Chennai-6000445). A voucher specimen (No.-PARC/2009/363) has been deposited for further reference.

Anatomical Study [12-16]

Fixation of Specimen: The collected specimen was cut with the help of sharp knife and immediately immersed in fixative fluid FAA i.e. Formalin: Acetic acid: 70% ethyl alcohol in the ratio of 5:5:90.

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Fig. 1: Entire plant of *Scindapsus officinalis* (Roxb.) Schott

Dehydration of Specimen: After 24 hrs of fixing, the specimen were dehydrated Dehydration was carried out employing the graded series of ethyl alcohol and tertiary butyl alcohol as per the steps given by Sass (1940). The specimen is kept in each grade of the fluid for about 6 hrs. Every time the fluid is decanted and immediately the specimen were flooded with next grade of fluid.

Infiltration with Paraffin Wax: After dehydration the fine shavings of paraffin wax was added to the vial containing the plant material with pure TBA. The paraffin shavings are added every 30 minutes at about 40-45°C. After 4 or 5 times adding wax to the plant material, vials were filled with wax without damaging the tissues. The vial filled with the wax is kept open in the thermostat in order to evaporate all TBA, leaving the specimen in pure molten wax. The specimen was filed with wax are filled with pure molten wax for 2 -3 times by decanting the old wax every time. Improper infiltration may lead to collapse of tissues.

Casting to Mold: A boat made out of chart board, by folding the margin, is used to prepare a mold of wax containing specimens. The paraffin along with the specimen was poured into the sufficient quantity of molten boat. With the help of heated needles, the plant materials were arranged in parallel rows with enough space in between the specimens. The block was then immersed in chill water and allowed to cool for few hours.

Microtome Sectioning of Paraffin Embedded Materials: The paraffin embedded specimens were sectioned with the help of Rotary Microtome (Weswox Rotaory Microtome-Spencer Type). The thickness of section was 10-12 µm. The sections were first dewaxed which was done by customary procedure (Johansen, 1940). The sections were stained with toludine blue (0.25 % having a pH of 4.7) as per method suggested by O'Brien *et al*. 1964. Since Toludine blue is a polychromatic stain, the staining results were remarkably good and some cytochemical reaction was also obtained. The dye rendered pink colour to the cellulose walls, blue to the lignified cells, dark green 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: In order to supplement the descriptive part, the photomicrographs in different magnifications of all necessary cells and tissues were taken with NIKON Cool Pix 8400 digital camera and Nikon Labphoto 2 microscopic Unit. For normal observations

Fig. 2: Matured fruit of *Scindapsus officinalis* (Roxb.) Schott. with winged stalk

bright field were used. For the study of crystals, starch grains and lignified cells, polarized light was employed. Since these structures have birefringent property, under polarized light they appear bright against dark background. Magnifications of the figures are indicated by the scale-bars. Descriptive terms of the anatomical features are given as in the standard anatomy books.

RESULTS AND DISSCUSSION

Microscopic Features of Spadix and Fruit: The spadix has thick straight central axis or the peduncle with spirally arranged fruits. The fruits are covered entirely by fleshy perienth. In the mature inflorescence the fruits are fused into hard, cylindrical, brownish body (Figure 3) within the perienth. In L.S. view of the spadix the axis of the inflorescence bears the fused fruits on either side in vertical rows. The seeds are seen in each of the fruit with seed coat and endosperm. The spadix is 5 mm thick and spadix axis is 1.5 mm thick. The seeds are free from the pericarp and only the funicle is attached with basal part of the fruit (Fig. 3.1, 2).

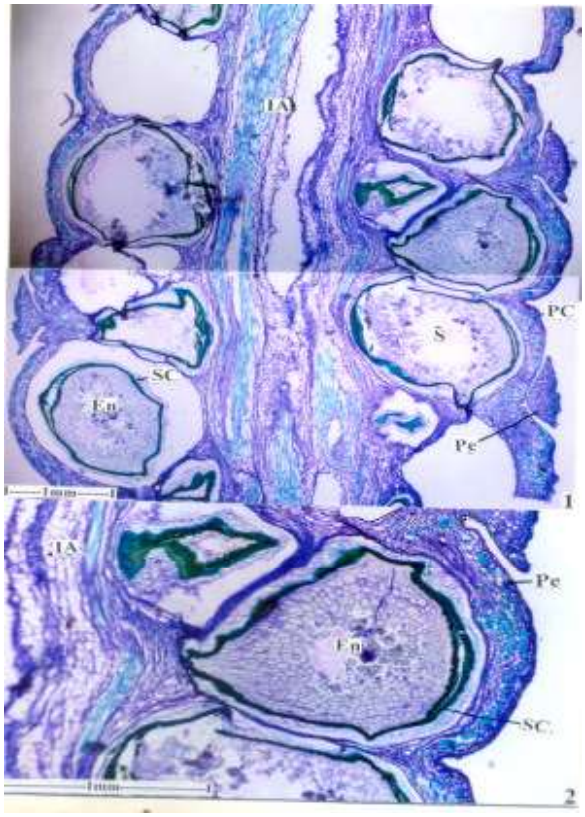

Fig. 3.1: Middle portion showing central axis and fruits on either side.

Fig. 3.2: An enlarged portion showing a single fruit

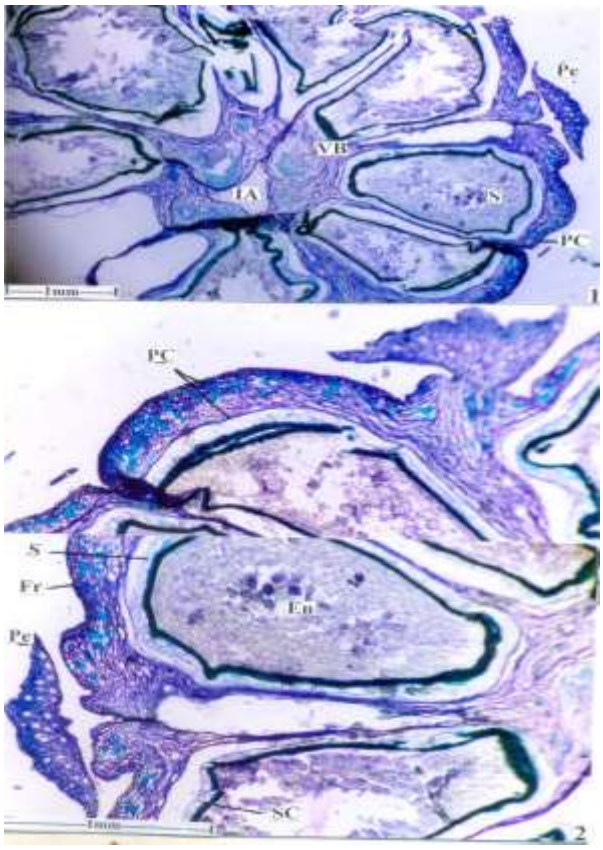

Fig. 4.1: T.S. of the spadix at 20X (IA-inflorescence axis of the spadix; Pe-perenth; PC-pericarp; S-seed; VB-vascular bundle)

Fig. 4.2: A section showing enlarged fruits at 40X (Fr-fruit pericarp; SC-seed coat)

In T.S. view of the spadix, there is a central lobed axis with hollow central core and lobed inflorescence axis. The axis bears radial circle of fruits which are separated from each other by thin radial septa. The fruits are fused with each other laterally. The central axis has well developed vascular system (Figure 4.1 and 5.1). There are three major vascular bundles with smaller accessory strands around each major bundle. The major vascular bundles are collateral and have wide rectangular block of phloem and a few parallel rows of angular thick walled xylem elements. The vascular bundle has a thick and wide sclerenchyma cap abutting the xylem elements. Outer with vascular bundle, there is a parenchymatous bundle sheath of one or two cells thick (Figure 5.1).

Pericarp (3,4 and 5.2): The pericarp is formed by a single integument of the ovary. It consists of thick walled tabular epidermal cells with thick cuticle and a subepidermal cell

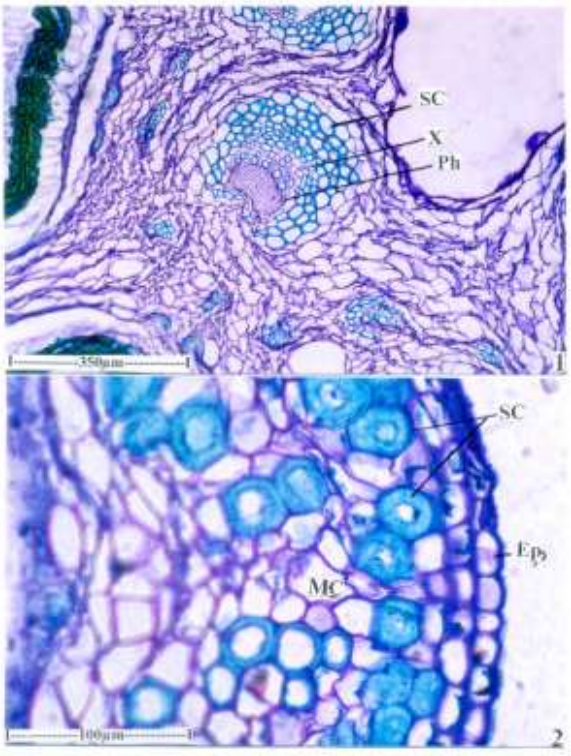

Fig. 5.1: Central Portion of spadix showing the vascular strands at 10X (Ph-phloem;SC-sclerenchyma cells; X-xylem)

Fig. 5.2: An enlarge section of pericap at 40X (Ep-epidermis or epicarp; MC-mesocarp; SC-sclerenchyma cells)

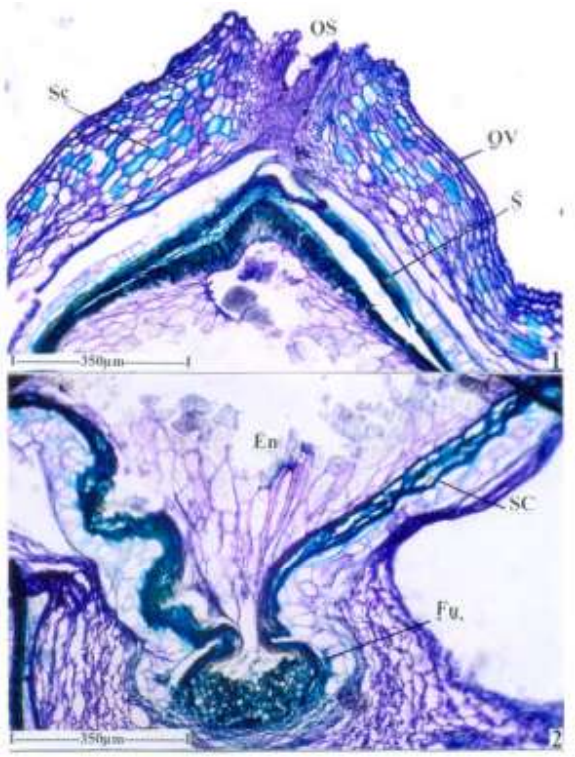

Fig. 6: Vertical section (VS) of the fruit and the seed-entire view at 10X [En- Endosperm (cellular type); Fu-funicle (stalk of the ovule); OS- ostiole (passage of the ovule); OV-ovary (seed); S-seed; SC-seed coat]

layer of similar cells with thick walls. The ground tissue consists of a mixture of thin walled parenchyma cells and thick walled sclereids (Figure 5.2). The sclereids are of brachy-sclareid type i.e. the cells isodiametric or circular with heavily lignified thick walls and wide lumen. The sclereids are either solitary or in groups of two or three. They are random in orientation and are about 20-25 µm in diameter.

Seed: The seed develops from straight ovule which is attached to the ovary wall with the basal funicle. The seeds are obovate with the basal part and wider outer part (Figure 4.1, 2). It contains dense endosperm and thick testa or seed coat.

Seed-coat (Figure 6 and 7.1): The seed coat is 100-130 µm thick and consists of outer zone of sarcotesta where the cells are wide, angular and parenchymatous with thin walls. The cells are random in orientation. The outer sarcotesta is 20 µm wide.

Inner with parenchyamtous sarcotesta is athin dark region of sclerotesta forming the inner seed-coat. It is three layered, comprising of outer and inner wide sclerotic cells and middle thin layer of parenchymatous cells. The two sclerotic layers are darkly stained so that they are less distinct. The sclerotic inner seed coat is about 150 µm thick (Figure 7.1).

Endosperm: The seed is filled with copious amount of endosperm (Figure 6). The endosperm is cellular type which are elongated polyhedrally with thin walls and dense starch grains (Figure 7.1,2). In sections of the seed the central core of the seed has free cells while the outer zone has wide, compact polyhedral cells. When viewed under the polarized light microscope, the endosperm cells exhibit dense accumulation of starch grains (Figure 7.2).

Perienth (Figure 4.1,2): In sectional view the perienth appears triangular with long wings. The central portion is 200 µm thick and the marginal portion is 50 µm thick.

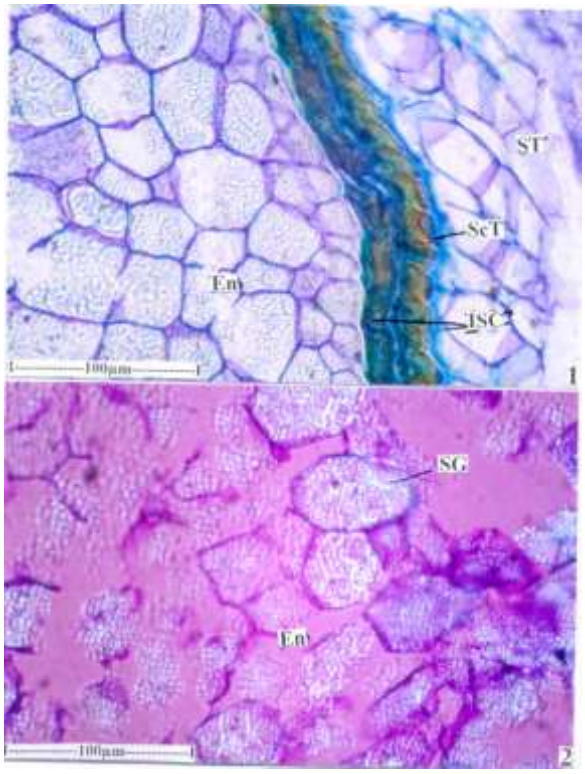

Fig. 7.1: An enlarge section of the seed coat at 40X [En-endosperm; ISC-inner seed coat; ScT-sclerenchyma tissue; ST-sarcotesta (outer seed coat].

Fig. 7.2: Endosperm cells as seen under polarized microscope at 40X (En- endosperm; SG- starch grains).

The perienth has darkly staining compact parenchyma cells and wide hyaline cells dispersed in the parenchyma tissue.

CONCLUSION

Pothus officinalis (Roxb.) or *Scindapsus officinalis* (Roxb.) Schott. fruit is known for its various medicinal properties. Since no complete anatomical data related to fruit is available so far, hence the present study may be useful to supplement information in respect to its identification, authentication and standardization of fruits.

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