

## PHARMACOGNOSTICAL STUDIES ON SEEDS OF ARTOCARPUS HIRSUTUS

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### ABSTRACT

The genus *Artocarpus* belongs to the family Moraceae which comprises of about 60 genera and over 1000 species. *Artocarpus* species are known for its edible fruit with high nutritive values. *Artocarpus hirsutus* Lam. is one among the five available varieties of jackfruits. The aim of the present study is to evaluate preliminary pharmacognostic investigation of seeds of *Artocarpus hirsutus*. Studies were carried for analyzing the organoleptic parameters followed by evaluation based on morphological, microscopical and powder characteristics. In pharmacognostical studies the macroscopy, microscopy, and phytochemical studies were carried out. The

morphological characters of *Artocarpus hirsutus* were observed. The seeds are pearl white, smooth and shining and elliptical in shape. The hilum is prominent, the raphae are dark brown. TS passing through the centre of the seed is circular, shows thin layer of Arillus encircling the narrow brown coloured testa and centrally located unequal sized horizontally placed cotyledon. The crystals are prisamate type. Starch grains are abundant in the powder. The starch grains have centric hilum.

**KEYWORDS:** *Artocarpus hirsutus* fruits, morphology of *A.hirsutus* seeds, microscopy of *A.hirsutus* seeds.

### INTRODUCTION

Wild Jackfruit, also called Wild Jack is having the latin name *Artocarpus hirsutus* Lam. Belonging to the Moraceae family. It is common in Western Ghats from north Karnataka to

Malabar Coast and Travancore.<sup>[1]</sup> *Artocarpus hirsutus*, is a tropical evergreen tree species that is native to India, primarily in Kerala. It grows at an altitude ranging from sea level at an elevation of 1000 meters in places with an annual rainfall of 1500 mm or more.<sup>[2]</sup> *Artocarpus hirsutus* is an evergreen tree with a dense crown growing up to 50 metres tall. The straight, cylindrical bole can be 150cm or more in diameter. The heartwood is yellowish-brown; the sapwood white. The wood is moderately hard, durable, it lasts well in water and is not attacked by white ants. Fruits are edible, bright yellow, ovoid covered with spines, seeds ovoid and white. It required warm humid climate heavy rainfall and thrives well in any type of soil. Kerala's own fruit locally called 'Anjili Chakka' (*Artocarpus hirsutus*). Tree is propagated through seeds or by grafting, flowering season is from December to January and fruits get ripened in May and June.

### VERNACULAR NAMES OF *Artocarpus hirsutus*

English – Wild Jack

Kannada- *Hebbalasu, hebbe-lasu*

Malayalam- *Ayani, Anjili, Ayaniplavu, Annali, Annili, Aini, Ayari*

Marathi- *Pat-phanas, Ranphanas*

Tamil- *Kattuppala, Akkini, Anjili*

Telugu- *Pejuta*

### TAXONOMY AND ETHNOBOTANY

Taxonomically *Artocarpus hirsutus* Lam. Belongs to angiosperms and the details are as follows.

- Kingdom –Plantae
- Division-Angiosperms (unranked)
- Phylum-Eudicots (unranked)
- Class-Rosids (unranked)
- Order-Rosales
- Family-Moraceae
- Tribe- Artocarpeae
- Genus-*Artocarpus*
- Species-*hirsutus*
- Species authority- Lam



**Fig 1: Fruits of Artocarpus hirsutus.**

The plant *A. Hirsutus* is notable for its valuable medicinal properties. Bark has the properties to cure ulcers, diarrhea and pimples. Roasted seeds powder mixed with honey is used for the treatment of asthma. Oil from the fruits are used for the treatment of skin diseases. Grinded bark of *Artocarpus hirsutus lam* is a constituent of many herbal medicines for piles, and Grinded bark is smeared on the affected part to cure piles. Latex of *Artocarpus hirsutus* is used for asthma and seeds are use as appetizer. Burnt leaves ash is taken internally to treat abdominal problems. Dry leaves are useful in treating buboes and hydrocele. Fruits are rich source of carbohydrates,  $\beta$ -carotene and essential aminoacids. Unripe fruits are useful in vitiated conditions of *vata* and *pitta* and anorexia.

The ripe fruits posses sour, sweet, cooling, appetizing, constipating and aphrodisiac properties. It causes flatulence, colic, tridosas and rakta vitiations. Studies on pylorus ligated rats demonstrates that the *A. hirsutus* stem bark extract reduces the gastric secretory volume, acidity and ulceration.<sup>[3]</sup> An infusion of the bark is applied to cure small pimples and cracks on the skin, and the powdered bark is used to heal sores.<sup>[4]</sup> Bark ash mixed with coconut oil is used externally against 'dhobi's itch' and ringworm. Bark paste in coconut oil can be applied for snake bite.<sup>[5]</sup> Roots and bark decoctions are used to cure diarrhoea whereas leaves used along with white camphor and root of curcuma to treat venereal bubones and chronic haemorrhage. Juice of cooked fruits is potential for inducing appetite and applied to the anus to relieve the pains of haemorrhage. It's barks are used to cure diarrhea, pimples and ulcers.<sup>[6]</sup>

Grinded bark of *Artocarpus hirsutus* is a constituent of the medicine for piles, and Grinded bark is smeared on the affected part to cure piles.<sup>[7]</sup> The timber of the plant is used for house and boat building and furniture manufacture.

## MATERIALS AND METHODS

### Sample Collection

Fruits of *Artocarpus hirsutus* Lam. were collected from Mannarkkad area of Palakkad district, Kerala. Healthy plants with previous history of giving fruits were selected and identified. The required samples of different organs were cut and removed from the plant and fixed in FAA (Formalin-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.

The fruits and seeds were authenticated by Dr. Usman Arerath, Young Scientist(SERB-DST), Department of Botany, MES Kalladi College, Mannarkkad, Palakkad, Kerala. Botanical characters were also compared with various floras. Seeds were taken out from the fruit, washed properly and sun dried for further evaluation and studies.

### SECTIONING<sup>[8,9,10,11]</sup>

Sun dried samples of *Artocarpus hirsutus* Lam. seed were keenly observed under naked eyes to record the specific botanical characters and it was also recorded using Canon Ixus digital camera with size indicating rulers. The paraffin embedded specimens were sectioned with the help of Rotary Microtome. The thickness of the sections was 10-12 µm. Dewaxing of the sections was by customary procedure. The sections were stained with Toluidine blue. 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).

For studying the stomatal morphology, venation pattern and trichome distribution, paradermal sections (sections taken parallel to the surface of leaf) as well as clearing of leaf with 5% sodium hydroxide or epidermal peeling by partial maceration employing Jeffrey's

maceration fluid were prepared. Glycerine mounted temporary preparations were made for macerated/cleared materials. Powdered materials of different parts were cleared with NaOH and mounted in glycerine medium after staining. Different cell components were studied and measured.]

### **Photomicrographs<sup>[12]</sup>**

Microscopic descriptions of tissues are supplemented with micrographs wherever necessary. Photographs of different magnifications were taken with Nikon Labphoto 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 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 as given in the standard Anatomy books.

## **RESULTS AND DISCUSSION**

### **MACROSCOPY**

The seeds are pearl white, smooth and shining. It is elliptical in shape. It is 19mm long and 5mm thick. The hilum is prominent, circular at subterminal part of the seed. The raphe is dark brown and is 4mm long. A thick seed coat encloses the entire cotyledons. The upper surface is convex and the dorsal surface is concave. (Fig 1.1, 1.2 & 1.3)

### **MICROSCOPICAL STUDY**

TS passing through the centre of the seed is circular, shows thin layer of Arillus encircling the narrow brown coloured testa and centrally located unequal sized horizontally placed cotyledon occupying the major area of the section.

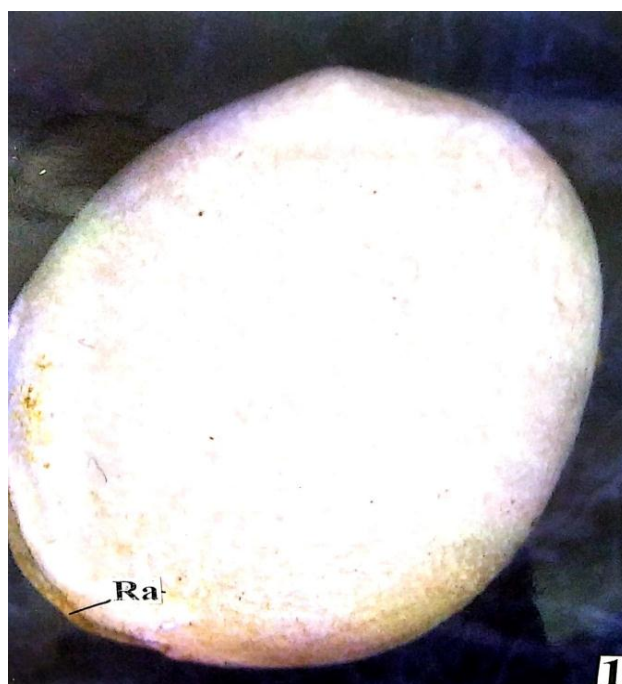
The seed consists of a thick seed coat or testa, which measures 200µm in thickness. The testa uniformly thick all around the seed. The seed coat is differentiated into outer parenchymatous known as sarcotesta which includes polygonal thin walled parenchyma cells in the outer part. The cells become gradually polygonal thick walled cells towards interior (Fig 3.1). There are small prominent and well developed vascular strands located in the sarcotesta region. The vascular strands include a few vertical rows of wide, angular and thickwalled xylem elements and thin layer of phloem elements. (Fig 3.2)

The sclerotesta includes a few layers of sclerides which are compactly arranged. The region is 50 $\mu$ m thick. The sclerides are polyhedral and more or less isodiametric. The sclerides are brachysclerid type. (Fig 3.1)

Along the border line of the sarcotesta and sclerotesta are seen a single horizontal row of calcium oxalate crystals. The crystals are prisamate type. (Fig 3.2) there is a thick inner pigmented seed coat which includes parenchymatous cells. There are two cotyledons enclosed by the seed coat. The cotyledonary cells are thin walled, polyhedral compact parenchymatous cells. The cotyledonary cells possess dense accumulation of starch grains and are concentric in shape. (Fig 4.1, 4.2)

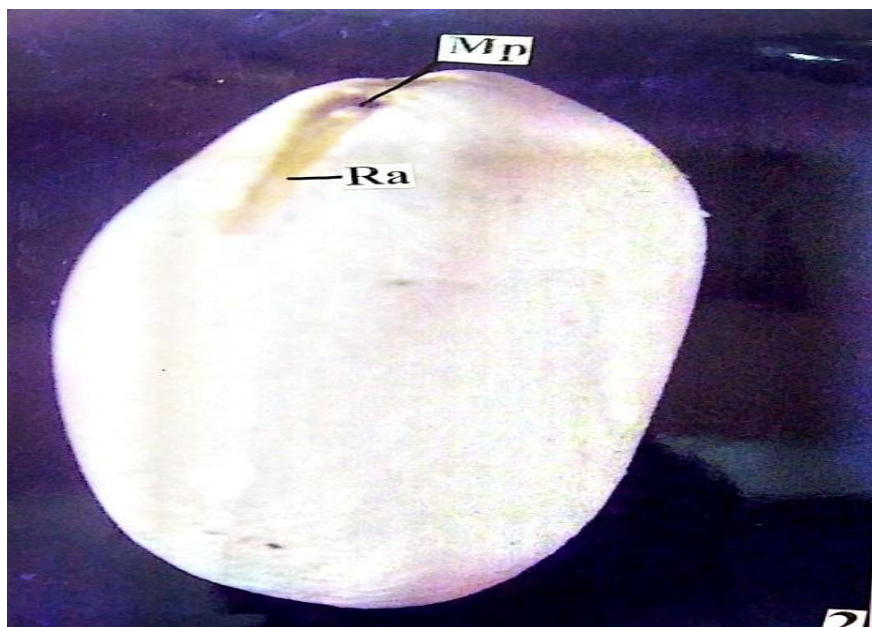
### POWDER MICROSCOPY

The seed powder when examined under the microscope, exhibits the following elements:- Starch grains are abundant in the powder when the grains were stained with iodine potassium iodide solution. They turn black (fig 4.1). They are spherical in shape with varying sizes. They are upto 12 $\mu$ m in diameter. When the starch grains were viewed under polarized light, they appear bright white under dark background. The starch grains have centric hilum and dark radial lines of palmaris are seen radiating from the hilum. (Fig 4.2) Broken small masses as well as individual sclerides are densely seen in the powder. (Fig 5.1, 5.2) The sclerides are brachysclerid type.

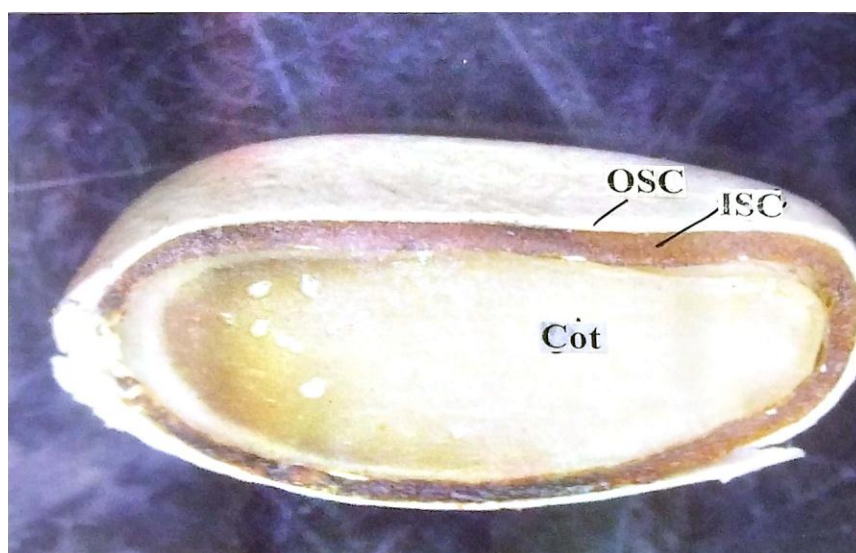


**Fig 1.1: External Appearance Of The Seed-Antiraphal Region.**

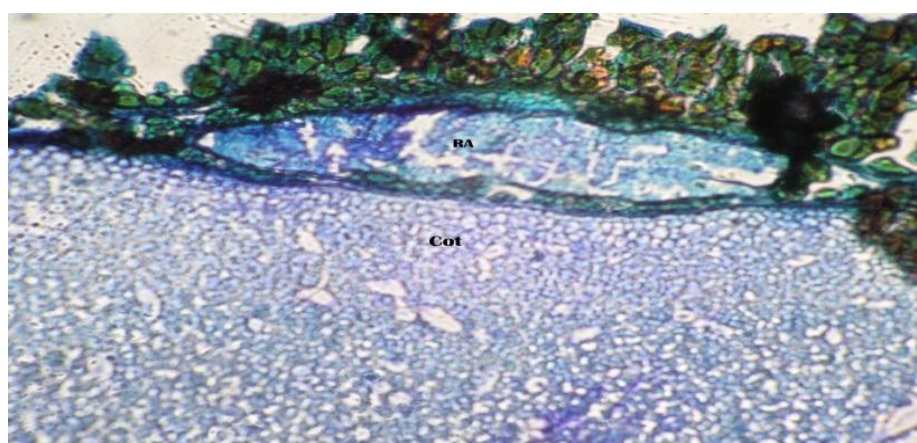


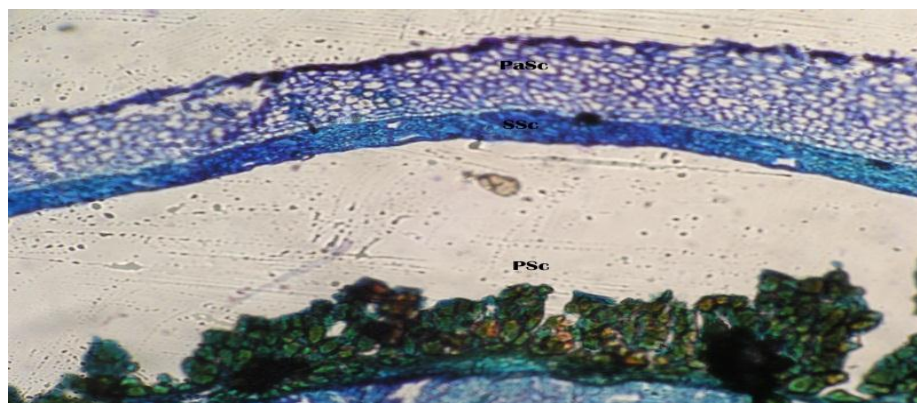


**Fig 1.2 Surface Appearance Of The Seed –Raphal Region.**

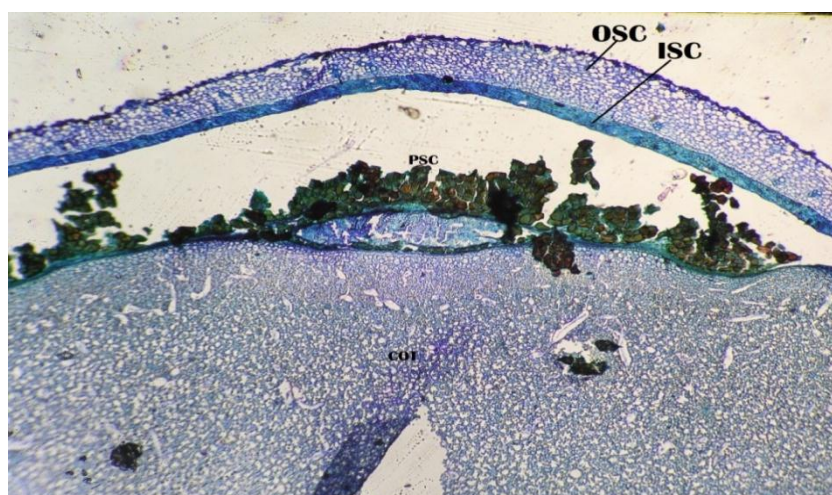


**Fig 1.3 Seed-Transverse Section Showing Seed Coat And Cotyledons.**

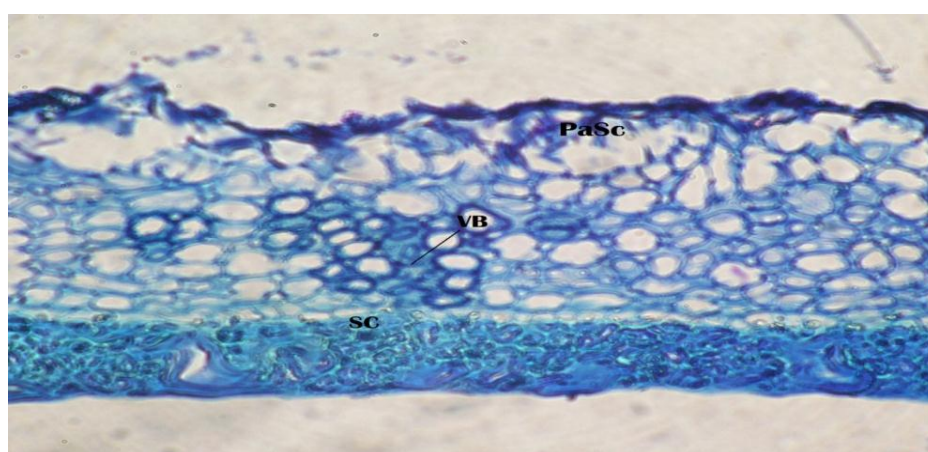




*Fig 2: T.S Of Artocarpus hirsutus Seed.*

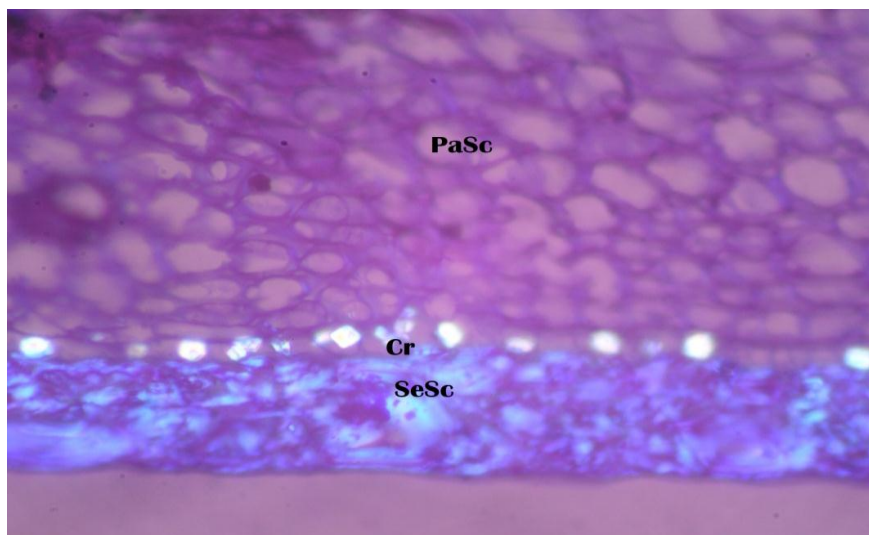


*Fig 2.2 T.S Of Seed Showing Outer Seed Coat And Inner Seed Coat With Pigments.*

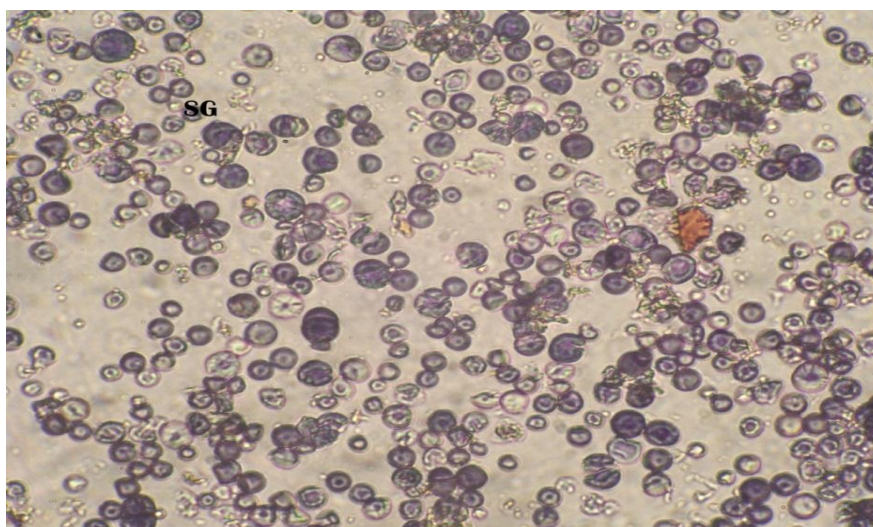


*Fig 3.1 Seed Coat Tissues Enlarged.*

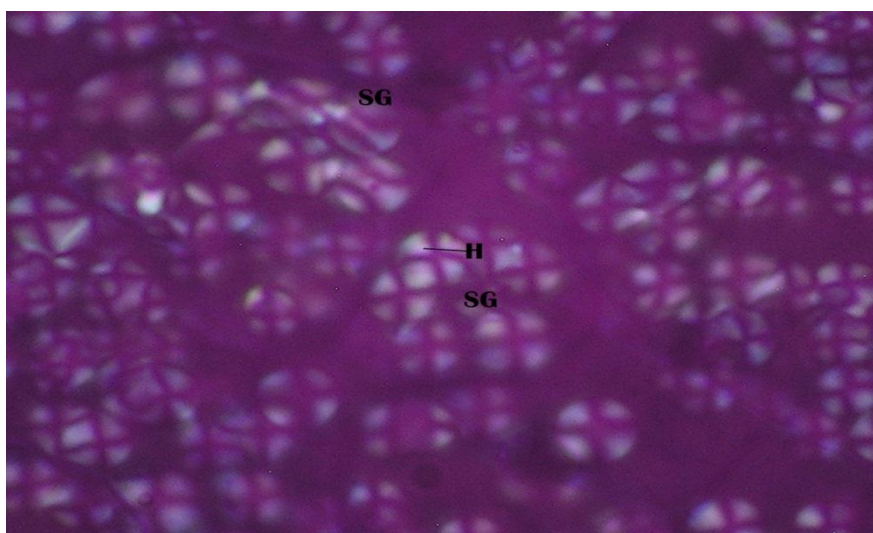




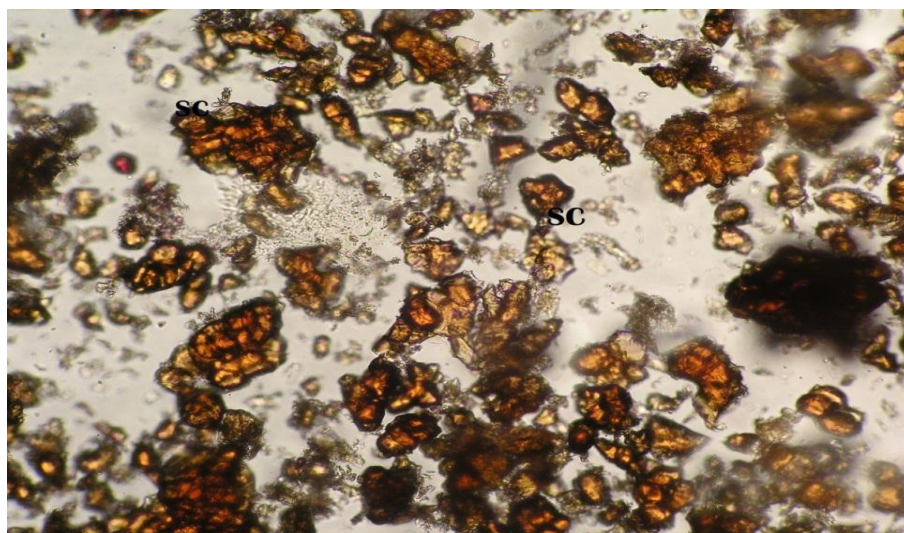
**Fig 3.2: Crystals In The Seed Coat.**



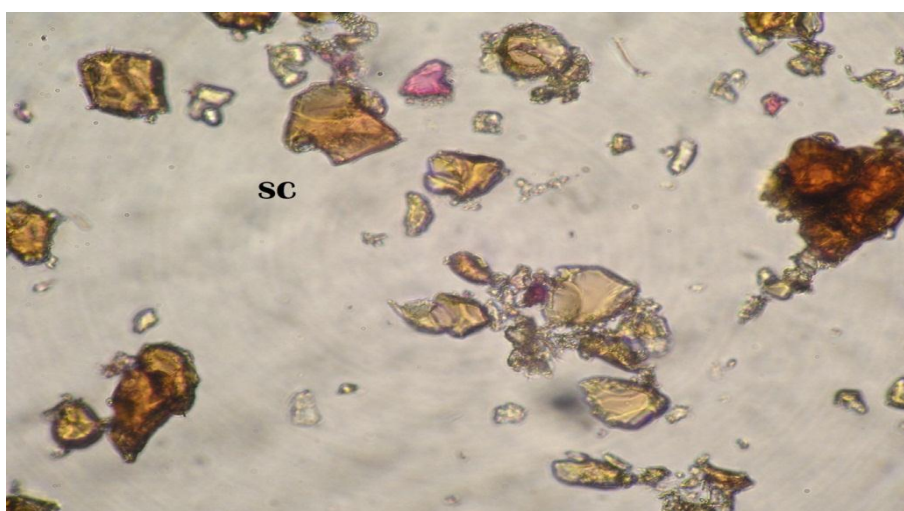
**Fig 4.1: Starch Grains Stained With Iki.**



**Fig 4.2: Starch Grains Seen Under Polarized Light.**



**Fig 5.1: Seed Coat Sclerides In The Powder.**



**Fig 5.2: Sclerides Enlarged.**

COT-COTYLEDON

ISC-INNER SEED COAT;

RA-RAPHAEE;

PSC- PIGMENTED SEED COAT;

PaSc- PARENCHYMATOUS SEED COAT;

SSc-SCLEROTIC SEED COAT;

OSC-OUTER SEEDCOAT;

Cr-CRYSTALS;

VB- VASCULAR BUNDLES;

H-HILUM;

SG- STARCH GRAINS;

Sc-SCLERIDES

## CONCLUSION

The literature revealed that only fragmentary information was available on this plant species regarding pharmacognostical study. In pharmacognostical studies the macroscopy, microscopy, and histochemical studies were carried out. Pharmacognostical standards obtained during the observation are valuable tools for the identification of the plant material. Morphological study had provided a characteristic identity of morphological characters of *Artocarpus hirsutus*. was observed and the seeds are pearl white, smooth and shining. It is elliptical in shape. It is 19mm long and 5mm thick. The hilum is prominent, circular at subterminal part of the seed. The raphae are dark brown and is 4mm long. a thick seed encloses the entire cotyledons. The upper surface is convex and the dorsal surface is concave.

The microscopical characters of *Artocarpus hirsutus* was observed and TS passing through the centre of the seed is circular, shows thin layer of Arillus encircling the narrow brown coloured testa and centrally located unequal sized horizontally placed cotyledon. The seed consists of a thick seed coat or testa. The seed coat is differentiated into outer parenchymatous known as sarcotesta. There are small prominent and well developed vascular strands located in the sarcotesta region. The sclerotesta is includes a few layers of sclerides which are compactly arranged. Along the border line of the sarcotesta and sclerotesta are seen a single horizontal row of calcium oxalate crystals. The crystals are prisamate type. Starch grains are abundant in the powder The starch grains have centric hilum.

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