Pharmacognosy of a local market sample of parpataka *Polycarpaea corymbosa* (L.) Lam.

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SUMMARY

Polycarpaea corymbosa (L.) Lam. is used in Ayurvedic drugs for the treatment of jaundice, urinary calculi, boils inflammatory swelling and ulcers. The botanical, macro-, microscopic characters, macerate, histochemical studies, powder microscopy and physico-chemical studies have been presented in the paper.

Key words : Macro, Microscopical, Macerate, Histochemical, Physico chemical studies

In Ayurveda parpataka is one of the important drug used in fevers particularly. The drug is diuretic, antehelmintic and bitter (Nadkarni, 1996). It is used in the treatment of haemorrhage, thirst and burning sensation (Lakshmipati, 1973). In spite of its manifold uses the drug remains controversial because several plants are used and sold under the name parpataka in different parts of the country and in local markets. The accepted source of the drug is *Fumaria indica* (Hassk.) Pug. (Anonymous, 1978). Whole plant posess medicinal propreties (Sharma, 1983 and Nesamony,1985). Some of the plants used as parpataka are *Polycarpaea corymbosa* (L) Lam., *Glinus oppositifolius* (L) A.DC., *Mollugo nudicaulis* Lam. and its allied species, *Hedyotis corymbosa* (L) Lam. and it allied species, *Glossocardia bosvallea* (L. f) DC. and *Rungia repens* (L). Nees. (Chunekas, 1999; and Bapalal Vaidya, 1982).

Polycarpaea corymbosa (L.) Lam. is widely distributed in tropics of both East and West hemispheres. Common in fields, waste places and forests, in most districts. The leaves are used in jaundice, also applied as poultice, over boils and inflammatory swellings. (Yoganarasimhan, 1996; and Kirtikar and Basu, 2003). Its uses are similar to *Hedyotis corymbosa* (L.) Lam. in Ayurveda (Yoganarasimhan, 2000). Decoction of the herb is used for curing gastritis and vomiting along with honey.

A perusal of the literature revealed that no pharmacognostical work has been carried out on this taxon (Gurudeva and Yoganarasimhan, 2009). It is differed from the accepted source. Hence, the present study was initiated to identify the local market sample and analyse its botanical macro-, microscopic and physico-chemical details which helps to differentiate this drug from the accepted sources.

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Taxonomy : (Plate 1):

Polycarpaea corymbosa (L.) Lam. Tabl. Encycl. 2: 129. 1792; FBI 1: 245. 1874; Gamble 1: 65 (46). 1915. *Achyranthes corymbosa* L. Sp.Pl. 205. 1753.

Annual erect much branched herbs, up to 30 cm tall, branchlets densely villous or glabresent. Leaves decussate or in false whorls, linear to subulate. Flowers in axillary/ terminal cymes. Flowers 4 mm across, light pink, at length white in colour, calyx campanulate, sepals 5, lanceolate, scarious. Petals 5, ovate – suborbicular, Stamens 5, Ovary globose, 1-celled, ovules a, free central placentation, capsule oblong. embryo curved, rarely straight.

Herbarium specimen examined: DR 1919. (S.V.U):

The specimen was collected on 23rd November 2006, Japalitheertham of Tirumala Hills, Tirumala, Chittoor District of Andhra Pradesh and it is authenticated with Rangacharyulu (1991) deposited at the Herbarium of S.V.University, Tirupati

MATERIALS AND METHODS

The herbarium specimen was processed and followed by standard methods (Jain and Rao, 1977) and deposited in the Herbarium, Department of Botany, S.V.University, Tirupati. Macro and microscopical studies were carried out (Johansen, 1940 and Wallis, 1985) during the year 2005.

Physical constants were carried out by standard methods (Kokoski *et al.*, 1958; Chase and Pratt, 1949;

Plate 1 : *Polycarpaea corymbosa* (L.) Lam. (Caryophyllaceae)

Krebs *et al.*, 1969) and fluorescence studies followed by standard procedures (Khandelwal *et al.*, 1996).

RESULTS AND DISCUSSION

The results obtained from the present investigation have been discussed below:

Macro and microscopical characters of root:

Macroscopical Characters: Elongated, slender, with a few lateral roots, slightly bitter.

Microscopical characters:

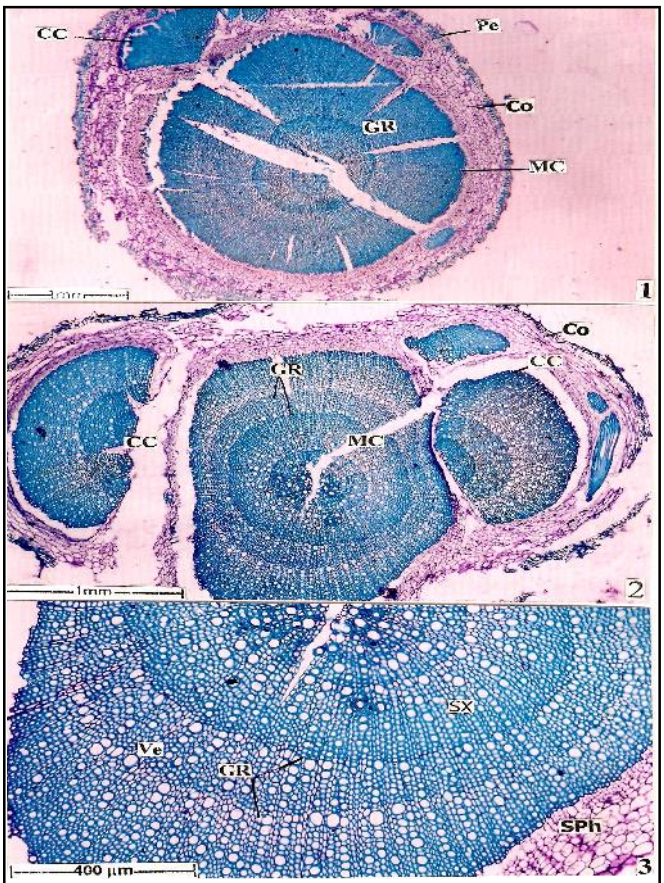
Transverse section of the root is circular in out line and shows periderm, cortex and vascular cylinders. Periderm is thin and it is followed by 6 to 7 layers of thin walled narrow parenchymatous cortex. Vascular tissues occur in anomalous position. There is a wide, circular central cylinder, surrounded by vascular cylinders in the cortex. Cortical strands may be circular, semicircular or fan shaped. Central rings are diffuse porous, vessels are narrow, thick walled, mostly solitary or in radial multiples. Xylem rays and xylem parenchyma are distinct. Xylem fibres are thick walled (Fig. 1).

Root-diagnostic characters:

– Periderm thin and followed by narrow parenchymatous cortex.

– Vascular tissues occur in anomalous position.

– Central large vascular cylinder is surrounded by smaller vascular cylinders.



Polycarpaea corymbosa

Fig. 1 : Microscopical Characters of Root

1. **T.S of Root – Entire view – showing central xylem cylinder and some cortical xylem bundles**
2. **Root showing central cylinder and cortical cylinders of xylem**
3. **Central cylinder showing growth rings**

– Presence of thick walled xylem fibres.

Macro and microscopical characters of stem:
Macroscopical characters:

Erect, branched, elongated internodes 0.2 cm width, internodes densely white tomentose, no specific taste and odour.

Microscopical characters:

Transverse section of the stem is circular in out line and shows epidermis, cortex and well developed stelar zone. It is circular, even and smooth. Epidermis is outermost layer and consists of single layer of barrel shaped cells and stomata. Cortex is made up of 3 to 4 layers of chlorenchyma cells and followed by endodermis made up of a single layer of large barrel shaped cells. Pericycle is made up of a single layer of sclerenchyma. Vascular zone is wide and continuous. Secondary phloem is narrow and thin walled and it is broken away from the secondary xylem because of the thin walled cells. Secondary xylem is a dense cylinder with even and smooth outline. It is 200 mm thick and consists of radial multiples and radial chains of circular, narrow thick walled vessels and libriform fibres. Pith is wide, circular and made up of thin walled compactly arranged cells (Fig. 2).

Stem-ciagnostic characters:

– Epidermis made up of wide, barrel shaped cells with occasional stomata.

– Cortex made up of 3 to 4 layers of chlorenchyma cells.

– Pericycle made up of sclerenchyma.

– Vascular cylinder wide, hollow and continuous.

– Pith is made up of thin walled, compactly arranged parenchyma.

– Presence of thick walled fibres with narrow lumen.

Macro and microscopical characters of leaf:

Macroscopical Characters: The leaves are narrow and fairly thick with enrolled margins, hairy, entire, acute, subsessile, stipules much fimbriate, 1-2 x 1.1-0.2 cm, no specific taste and odour.

Microscopical characters:

It is 2 mm in horizontal plane and 400 mm thick in vertical plane. The leaf shows 'Kranz anatomy' (Fig. 3). Epidermal layers are made up of dilated spindle shaped, thin walled cells. Both epidermal layers are stomatiferous (Fig. 3).

Transverse section of the leaf is slightly ridged and furrowed, the ridges are due to the presence of vascular bundles and thin furrows are in between the vascular bundles. On the adaxial part of the lamina palisade parenchyma occurs only above the vascular bundles; palisade parenchyma cells are broad and arranged compactly in single row. Along the furrows, vertical rows of dilated hyaline large parenchyma cells are present. Towards the lower epidermis single layer of spongy parendyma cells are present. Vascular bundles are six in number occur in a horizontal row in the middle part of mesophyll tissue. There is no distinction of vascular bundles in the midrib and lateral vein. However, some of the bundles are smaller than the others. Vascular bundles are conjoint, collateral with a few thin groups of xylem and phloem surrounded by radially oblong, dilated, chlorophyllous bundle sheath. This type of arrangement of cells is called 'Kranz anatomy'. Inner to the bundle sheath and just beneath the phloem strand, a small patch

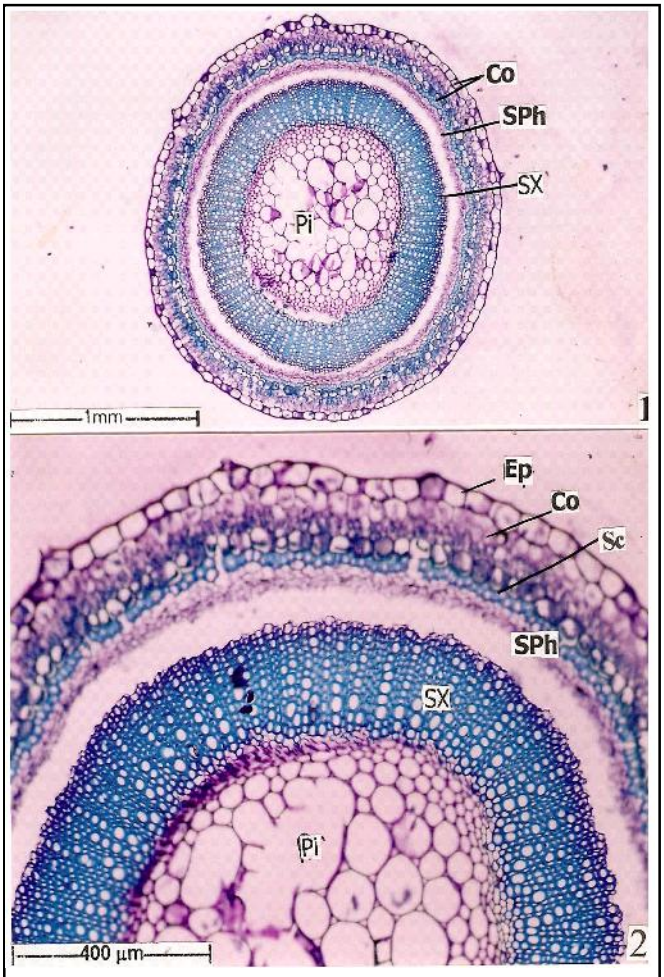


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Fig. 2 : Microscopical characters of stem
1. T.S. of stem - Entire view
2. T.S. of stem - A sector-enlarged

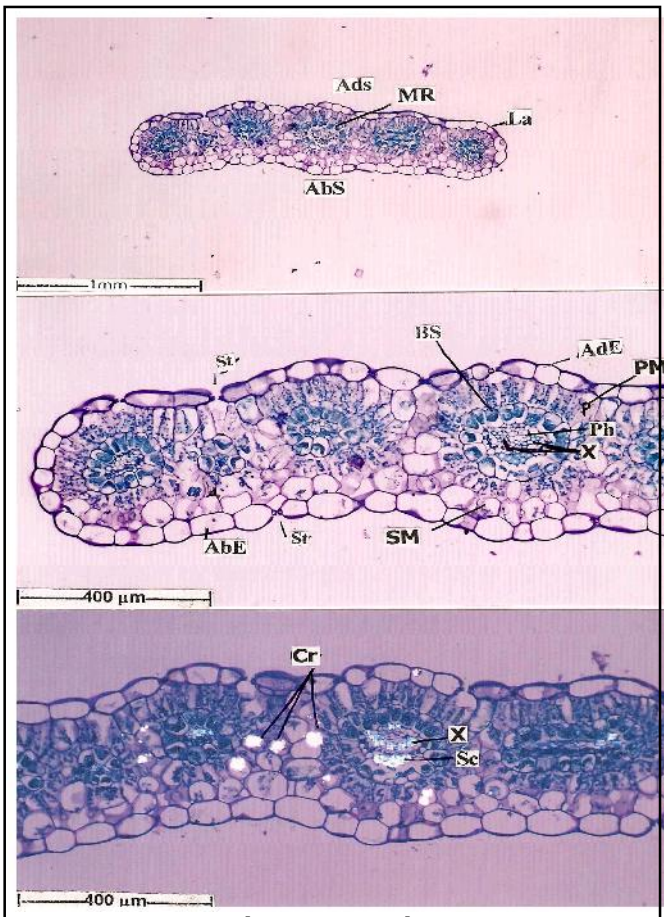

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Fig. 3 : Microscopical characters of leaf
1. T.S. of leaf - Entire view
2. T.S. of leaf - A sector enlarged
3. Crystals under polarized light microscope

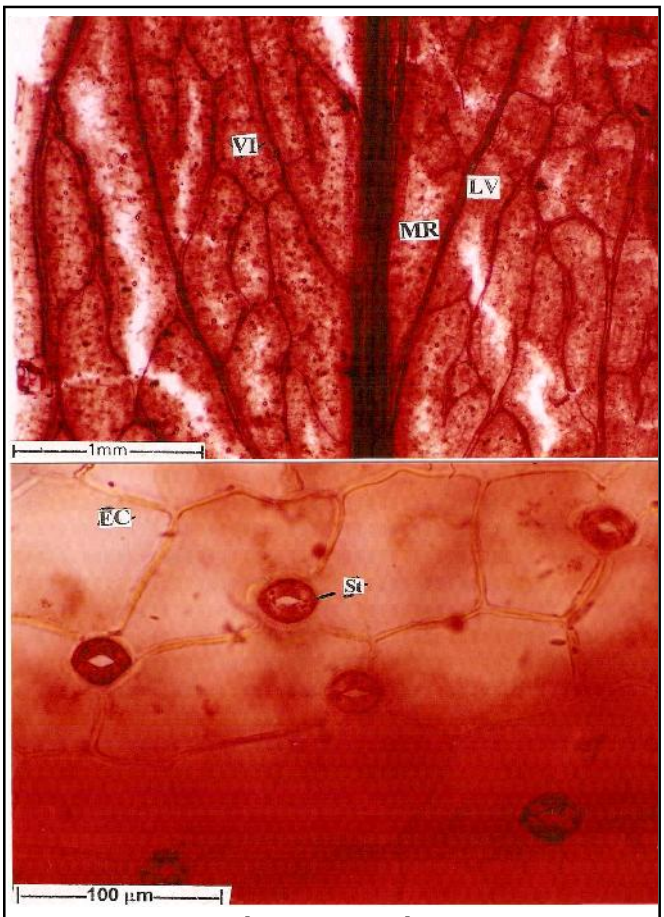

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Fig. 4 : Venation pattern and stomatal morphology
1. Leaf showing vein-islets and vein-termination
2. Abaxial epidermis with stomata

of sclerenchyma is present (Fig.3). When viewed under polarized light large druses of calcium oxalate crystals are observed in the spongy mesophyll (Fig. 3).

Venation of the leaf (Fig. 4). Lateral veins are thick forming fairly distinct vein-islets. Vein-islets are oblong and elongated parallel to the midrib, though the vein-islets are distinct, no vein-terminations are evident.

Stomata (4.2). Stomata are more or less circular, anomocytic without distinct subsidiary cells. Epidermal cells are either squarish or oblong, thick walled and anticlinal walls are straight and smooth.

Leaf-diagnostic characters:

– Leaf shows 'Kranz type' of anatomy.

– Epidermal layers are made up of thin walled spindle shaped cells.

– Mesophyll is well differentiated into palisade and spongy parenchyma.

– Vascular bundles are conjoint, collateral with a few groups of xylem and phloem surrounded by bundle sheath.

– Druses of calcium oxalate crystals are present in spongy parenchyma.

– Stomata are anomocytic, without distinct subsidiary cells occur on lower side of leaf only.

Whole plant - macerate:

Maceration of the whole plant shows the following elements.

Sclereids (Fig. 5):

Long, thick, fibre like sclereids are present in the powder, 100 mm long and 25 mm thick, walls thick, lumen narrow.

Fibres (Fig. 5):

Mostly narrow fibres with thick walls and narrow lumen, pits well developed, slit like and occur in vertical row, (Fig. 5), 550 mm long and 15 mm wide.

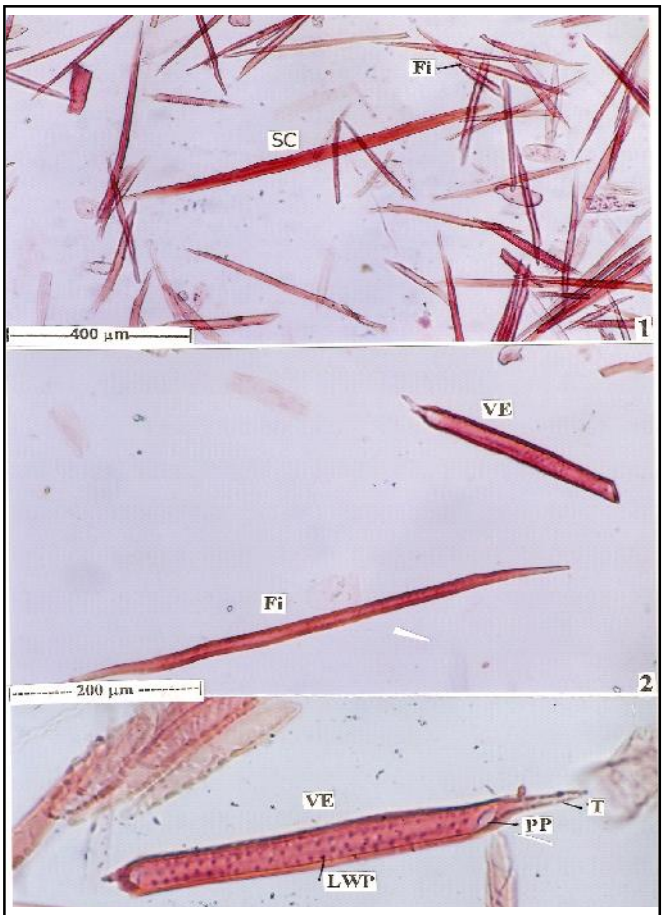

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Fig. 5 : 1-3 Whole plant – macerate
SC – Sclereids; Fi – Fibres; VE – Vessel element; LWP – Lateral wall pits; PP – Perforation plate; T - Tail

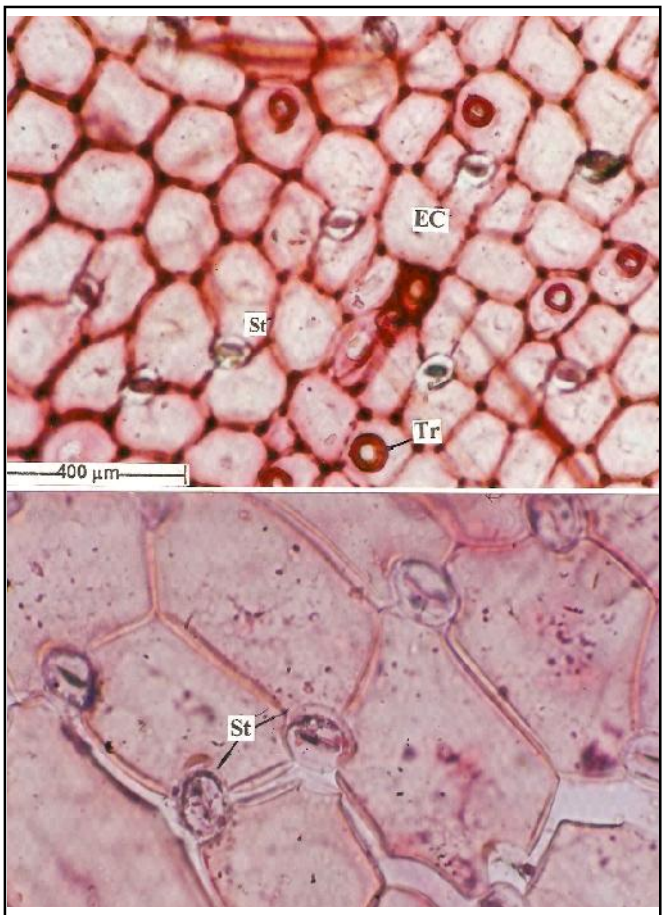

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Fig. 6 : 1-2 Whole plant macerate
EC – Epidermal Cells; St – Stomata; Tr - Trichomes

Vessel elements (Fig. 5):

Long, narrow, cylindrical, thick walled, mostly tailed at one end or both ends. Perforation plate simple, oblique. Lateral wall pits elliptical, alternate in vertical rows. Length 220 – 400 mm, 20 – 30 mm wide.

Epidermis and stomata (Fig. 6):

Epidermal cells regularly hexagonal and honeycomb like, walls thick and straight. Circular, thick walled markings of epidermal trichomes are frequently seen, stomata anomocytic occur at the junction of epidermal cell walls. Diameter of the basal part of the trichome 70 mm, stomata 50 mm wide.

Powder microscopy (Fig. 7):

The powder shows seeds, crystals and perianth fragments. Seeds are black, elliptical or oblong, smooth and shining. Crystals are sphaerocrystals or druses, visible under polarized light. Fragments of perianth are thin, membranous and consists of parallel rows of oblong cells.

Table 1: Histochemical tests

Drug	Reagents	Test for	Reaction	Results
Section	Iodine solution	Starch	Blue colour	+
Section	Ferric chloride solution	Tannin	Black	+
Section	Sudan III solution	Oil globules	No effervescence	-
Section	Phloroglucinol + dil. HCl + Alcohol	Lignin	Magenta	+
Section	Conc. HCl	Crystals	No effervescence	-

+ = Present; - = Absent.

Table 2 : Physical constants	
Ash values (%)	
Total ash%	8.5
Water soluble ash%	2.3
Alkanity of water soluble ash%	1.0
Acid in soluble ash (%)	1.5
Extractive values (%)	
a) Alcohol soluble extract	2.2
b) Water soluble extract	6.9
c) Hexane soluble extract	7.4
d) Chloroform soluble extract	7.6

Histochemical tests:

The sections were treated with different reagents and the observations are provided in Table 1.

Physico-chemical constants:

Physical constants:

The physical constants determined by standard methods are given in Table 2.

Fluorescence analysis:

Fluorescence analysis was carried out by standard procedures. The results are given in Table 3.

Conclusion :

Polycarpaea corymbosa is one of the substitute source of the drug parpataka. It is used in the treatment of jaundice, boils, inflammatory swelling and ulcers.

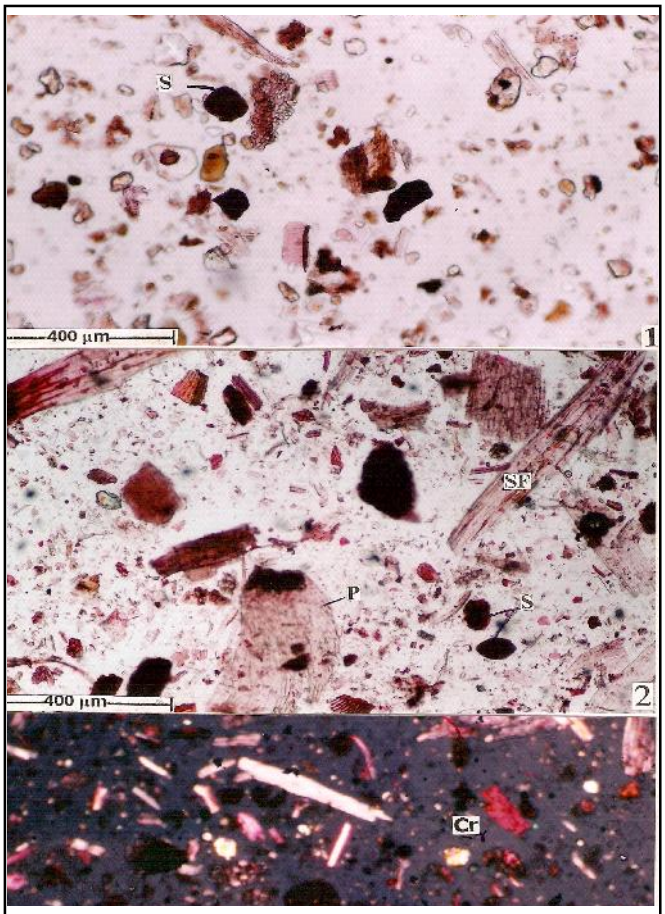

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Fig. 7 : 1-3 Powder microscopy
S – Seed; P – Perianth Fragment; Cr – Crystals; SF – Stem Fragment

Table 3 : Fluorescence analysis			
Experiments	Visible / day light	UV Light	
		254 nm	365 nm
Drug powder	Yellow	Pale green	Dark brown
Drug powder + 1 N NaOH (aq.)	Yellow	Fluorescent yellow	Light yellow
Drug powder + 1 N NaOH (alc.)	Orange	Fluorescent yellow	Light yellow
Drug powder + 1 N HCl	Yellow	Fluorescent green	Pale green
Drug powder + 50% H_2SO_4	Dark brown	Fluorescent green	Pale green
Drug powder + 50% HNO_3	Orange	Green	Green
Drug powder + Picric acid	Yellow	Fluorescent yellow	Yellow
Drug powder + Acetic acid	Plae brown	Pale green	Black
Drug powder + Ferric chloride	Brown	Green	Black
Drug powder + HNO_3 + NH_3	Reddish orange precipitate	Green	Green

Hence, this paper covers the morphology, macro and microscopical studies of the root, stem, leaf, whole plant macerate, histochemical tests and powder microscopy.

REFERENCES

Anonymous (1978). *The Ayurvedic Formulary of India*. Pt-I Controller of Publications, New Delhi.

Bapalal Vaidya (1982). *Some controversial drugs in Indian Medicine*, Chowkambha, Varanasi, pp. 207-211.

Chase, C.R. and Pratt, R.J. (1949). Fluorescence of powdered vegetable drugs with particular resource to development of a system of identification. *J. Am. Pharm. Asso.*, **38** : 324-333.

Chunekar, K.C. (1999). *Plants of Bhavaprakasa*, National Academy of Ayurveda, Ministry of Health and Family Welfare, New Delhi, p. 73.

Gurudeva, M.R. and Yoganarasimhan, S.N. (2009). *Bibliography of medicinal plants of India*. Divyachandra prakashana publishers, Bangalore.

Jain, S.K. and Rao, R.R. (1977). *Field and Herberiam methods*. Today and Tomorrow publishers, New Delhi.

Johansen, D.A. (1940). *Plant microtechnique*. McGrow Hill New York, 183-203.

Khandelwal, K.R., Pawar, A.P., Kokate, C.K. and Gokhale, S.B. (1996). *Practical Pharmacognosy techniques and experiments*, Nirali Prakasam, 3rd Ed., 140-141.

Kirtikar, K.R. and Basu, D. (2003). *Indian medicinal plants with illustrations*, Dehradun, Uttaranchal.

Kokoski, C.J., Kokoski, R.J. and Salma, F.J. (1958). Fluorescence of powdered vegetable drugs under ultra-violet radiation. *J. Am. Pharm. Asson.*, **47** : 715.

Krebs, K.G., Heunsen, D. and Wimmer, H.W. (1969). IN (editor E. Stahl), *Thin layer chromatography – A Laboratory handbook* (Second Ed.) London, 204-255, 855-909.

Lakshmipati, A. (1973). *One hundred useful drugs*, Arogya Ashrama Samithi, Madras, Vol. III, 89.

Nadkarni, A.K. (1996). *Indian materia medica*, Bombay, Vol. I, 108.

Nesamony, S. (1985). *Oushadha sasyanyal*. Trivandrum (In Malayalam), 339.

Rangacharyulu, D. (1991). Floristic studies of Chittoor district, Ph.D. Thesis, S.V.University, Tirupati.

Sharma, PV. (1983). *Dravyaguna Vijnana*, Varanasi (in Hindi), 321.

Wallis, T.E. (1985). *Text book of pharmacognosy* (15th edition), T.A. Churchill, London, 571-582.

Yoganarasimham, S.N. (1996). *Medicinal plants of India*, Karnataka, Inter line publishing private limited, Bangalore.

Yoganarasimham, S.N. (2000). *Medicinal plants of India*, Tamil Nadu, Inter line publishing private limited, Bangalore V.2.

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