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STANDARDIZATION OF PARPATAKA (*PERISTROPHE PANICULATA*) - AN AYURVEDIC DRUG

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ABSTRACT: The drug Parpataka is used particularly for the treatment of fevers, indigestion, biliousness, burning of the body, tired feeling, giddiness, urinary discharges, vomiting, thirst, enriches the blood and works good in leprosy. The present study is intended to authenticate and validate the species of *Peristrophe paniculata* (Forssk.) Brummitt, which is one of the sources of the Parpataka drug used in Ayurvedic and Siddha systems. The objective of the present work was to assess and established the various pharmacognostical properties like; macroscopical, micro-scopical (cell structure and their arrangement), physicochemical (including different ash values, loss on drying and extractive values), fluorescence and preliminary phytochemical profiles of the leaf, stem and roots of the plant. Qualitative tests for various functional groups were also carried out. The pharmacognostical screening of *Peristrophe paniculata* on different standardization parameters may prove to be very useful for the correct identification of the genuine drug and also to determine the quality and purity of the plant material to be used in different Ayurvedic formulations.

INTRODUCTION: Parpataka is mentioned in Ayurvedic classic literature like; Charaka Samhita [1], Sushruta Samhita [2] and Ashtanga Hridayam [3]. Subsequent Ayurvedic treatises like; Raja Nighantu [4], Madanapala Nighantu [5], Kaiyadeva Nighantu [6] and Bhavaprakasha Nighantu [7] also concur with the therapeutic efficacy mentioned in the classics.

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Like many drugs in Ayurveda, Parpataka is also considered as one of the controversial drug as more than one botanical source is used by the physicians in various parts of the country.

Botanical study of the drugs, and their morphological examination by the use of modern pharmacognostical tool, helps in the identification of the macro and microscopical characteristics of the desired plant drugs. Microscopical methods have been used successfully in cases of powdered crude drugs, wherein, the physicochemical methods could not be applied for the standardization. But still some drugs remain controversial as several plants are used under the same drug name.

In such cases, pharmacognostical studies help to identify the genuine plant material, which prevents adulteration of the drugs. Thus pharmacognosy, helps in laying down standardization and pharmacopoeial parameters. According to previous literature *Peristrophe paniculata* is one of the sources of the Parpataka drug [9].

Roots used in filariasis, skin disorders, worm infestation, wounds and indigestion. The whole plant is used for the treatment fevers and in lung diseases.

In this connection present study was intended to authenticate the Parpataka drug with the scope pharmacognostic studies.

MATERIALS AND METHODS: The plant specimens for the present study were collected from the Hill ranges of Tirumala, Chittoor District Andhra Pradesh state. It was examined with Herbarium specimen preserved in the Department of Botany, Sri Venkateswara University with field book number G.S. 1985. Care was taken in obtaining healthy plants, from which the different parts were separated for the study. Then the separated samples were fixed in FAA. The collected samples were allowed to dehydrate with a graded series of tertiary butyl alcohol only after 24 h of fixation [11]. Then infiltration of samples was brought out by the continuous addition of paraffin wax (m.p. 58-60 °C) until the TBA solution attained supersaturation. The specimens were permitted to make into paraffin blocks.

Sectioning: [9-12] The selected samples were embedded in the paraffin wax and sectioned with rotary microtome. The section with the thickness of 10-14 µm was de-waxed and stained with a polychromatic stain, Toluidine blue to obtain some cytochemical reactions. The lignified cells produced a blue color, cellulose wall displays pink color, suberin becomes a dark green, mucilage becomes violet, protein bodies generate a blue color, *etc*. The necessary sections were also stained with safranin, fast green and KI (for starch), wherever required. Photomicrographs (Microscopic pictures) of different tissues at multiple magnifications were taken with help of Nikon photomicroscopic unit. Polarized light was employed for the study of crystals, starch grains, lignified cells, and the bright field was used for normal observations. Scale bars in pictures indicated the microscopic magnification.

Physico-chemical studies: Loss on drying, total ash value, acid insoluble ash, water-insoluble ash, various extractive values, *etc*. were evaluated **Table 1-5** [12-15].

Fluorescence Studies: It is one of the fundamental studies for quality control of drugs and valuable in preparing the standards of the quality of the powdered drug. The fluorescence study of powdered drugs as a method of identification seems to possess distinct probabilities of practical application **Table 6** [9-12].

Preliminary Phytochemical Studies: The dried parts were pounded to make a coarse powder and stored in polythene containers for further analysis of **Table 7** [9-20].

RESULTS:

Macroscopic Characters of the Plant: It is a much-branched herb growing up to 75 cm tall. The leaves are elliptic to lanceolate, 4-6 × 2-3 cm; apex is gradually acute to acuminate inflorescence is a panicle. The flowers are pink. Trichotomously branched panicle, corolla is 2-lipped: upper lip is bifid and lower lip is three-lobed; stamens – two; ovary-oblong, two-celled, 2-ovules per cell. Capsule ellipsoid, seeds 4, rounded **Plate 1** and **2**.

Root Macroscopic Characteristics: It measures 0.8-0.9 cm in diameter and bitter to taste **Plate 1**.

Microscopic Characteristics: The root is old and it has undergone extensive secondary growth. It is 1.55mm thick. The root has a thin superficial layer of periderm which is unequal in thickness. It is often fissured and the surface cells are crushed into the dark crest. Cortex is narrow comprising about 6 layers of tangentially elongated compact parenchyma cells. Secondary phloem is narrow and continuous comprising uniformly distributed sieve elements and parenchyma cells. Secondary xylem is a dense, solid and excentric cylinder measuring 1.3mm in diameter. It includes more or less regular radial lines of vessels, either in radial multiples or in radial chains. The vessels are angular or circular thin-walled and range in diameter from 20-50 µm. Xylem fibers are libriform fibers with thin lignified walls and narrow lumen **Fig. 1 A, B, C**.

Root Diagnostic Characters:

1. Presence of narrow cortex.
2. Secondary xylem is dense and solid.
3. Lignified xylem fibers.

Stem Macroscopic Characteristics: Stem sharply 4-6-angled and branches hard woody.

Microscopic Characteristics: The young stem is hexagonal in cross-sectional outline; these are six, short, thick and blunt ridges alternating with flat sides. It is 2.3 mm thick. The stem consists of an epidermal layer cortex, vascular cylinder, and pith. The epidermis is thin, continuous and comprises small squarish cells. Some of the epidermal cells are modified into dilated wide circular lithocysts or cystolith containing idioblasts. The ridges are filled with collenchymatous tissue and the region in between the ridges has chlorenchymatous tissue. The ridges are 150 µm thick. Cortex is 50 µm thick. The vascular cylinder is closed and continuous. It consists of six, thick wedge-shaped vascular bundles placed in the region inner to the ridges; in between the bundles is a continuous thick cylinder of secondary xylem comprising mostly xylem – fibers. The vascular bundles have 5 or 6 radial rows of angular thick-walled vessels mixed with fibres. Pith is wide and parenchymatous; the cells are wide, angular and thin-walled **Fig. 2A, B, C**.

Thick Stem: The structure of the thick (fairly old) stem is basically similar to the young stem, but secondary growth is slightly more in the thick stem. The stem is nearly 4 mm thick.

Microscopic Characteristics: The vascular bundles of the ridges are thick and have a number of vessels. The bundle is 450 µm in the radial plane as compared to the 250 µm of the bundles in the young stem. The secondary xylem fiber cylinder is 200 µm thick **Fig. 3A, B, C**.

Stem Diagnostic Characters:

1. Presence of cystoliths in the epidermis.
2. Presence of interfascicular tissue.
3. Pith is wide and parenchymatous.

Leaf Macroscopic Characteristics: Leaves on 1-1.7 cm long petioles; lamina ovate-elliptic to lanceolate, 4-6 × 1.5-4 cm, densely lineolate, ± pubescent especially on nerves beneath, basally rounded to acute, acute to acuminate at the apex.

Microscopic Characteristics: The midrib and lateral veins have the prominent, thick conical adaxial part and wide, squarish or semicircular abaxial part. The midrib is shallowly cleft in the median part. The midrib is 500 µm wide, the abaxial midrib is 300 µm wide. The midrib consists of the epidermal layer of small thin-walled cells. The abaxial part of the midrib has angular, thin-walled compact parenchyma cells. The subepidermal portion of the adaxial hump consists of a small group of collenchyma cells. Beneath the collenchyma tissue, the palisade layer is horizontally transcurrent across the hump. The vascular strand is single and bowl-shaped. It is 130 µm wide and is placed in the control part of the midrib. The vascular strand is collateral and comprises parallel, short rows of thick-walled angular xylem elements and a thin abaxial arc of phloem elements. Some of the epidermal cells are highly dilated into wide circular cavities in which the calcium carbonate cystoliths are located **Fig. 4A, B, C**.

Lamina: The lamina is dorsoventrally differentiated into adaxial palisade zone and abaxial spongy mesophyll. Both adaxial and abaxial epidermal layers are somniferous. Both the layers are thick comprising wide, thin-walled cells with thick, smooth cuticle. These are spherical, subsessile glandular trichomes sparsely seen on the lower epidermis. The mesophyll tissue is differentiated into an adaxial band of thick, cylindrical palisade cells and abaxial zone of 5 or 6 layers lobed stellate parenchyma cells of spongy tissue **Fig. 5A, B**. Leaf-margin is conical and gradually tapering **Fig. 5C**. The epidermal cells are radially stretched and are wider and thick-walled. The mesophyll tissues remain in the middle part of the lamina. The marginal portion is 80 µm thick.

Epidermal Cells and Stomata: The epidermal cells of both adaxial and abaxial sides are polygonal in outline. Their anticlinal walls are fairly thick and slightly wavy. The cells of the abaxial epidermis are more wavy and thin-walled. The stomata are diacytic type. The stoma has two unequal subsidiary cells; their common transverse

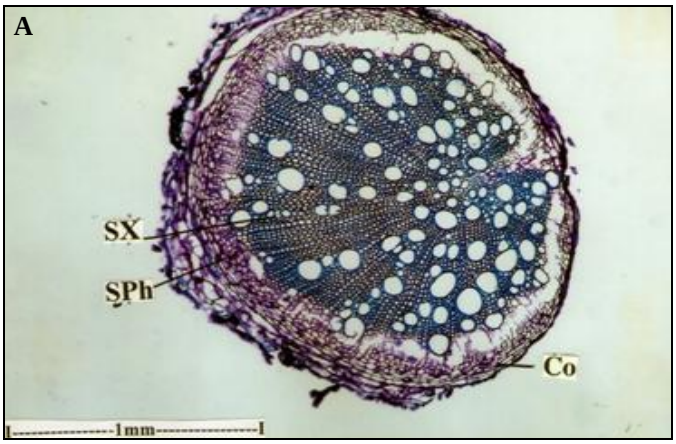
wall is at right angles to the guard cells and the subsidiary cells completely encircle the guard cells. The guard cells are elliptic-oblong measuring 20 µm long and 15 µm thick. The stomatal pores are wide and narrowly elliptic. Some of the epidermal cells are modified into long, narrow cystolith bearing idioblasts **Fig. 6A, B, C**.

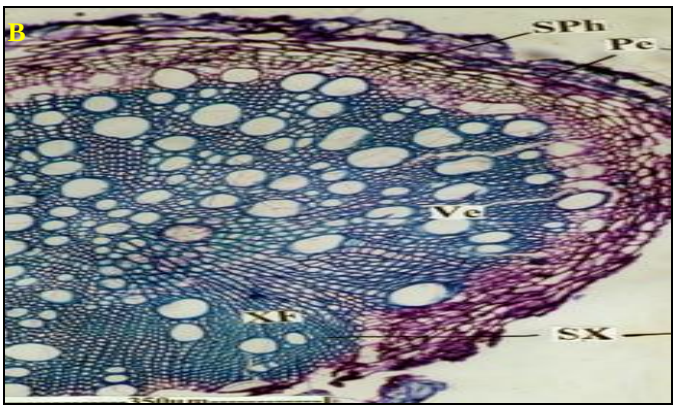
Leaf Diagnostic Characters:

1. Presence of cystoliths in the epidermis.
2. Stomata are diacytic.
3. Glandular trichomes are present in the lower epidermis.

PLATE 1: *PERISTROPHE PANICULATA* (FORSK.) BRUMMIT. ENLARGED TWIG WITH INFLORESCENCE AND ROOT

PLATE 2: *PERISTROPHE PANICULATA* (FORSK.) BRUMMIT. ENLARGED TWIG WITH INFLORESCENCE





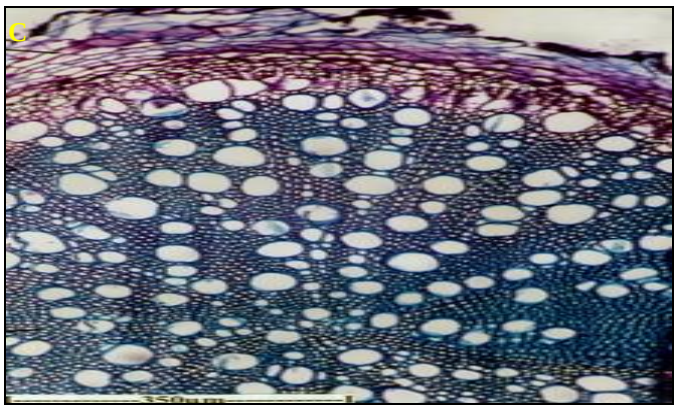


FIG. 1A: TS OF ROOT-GROUND PLAN, B: TS OF THIN ROOT-A SECTOR, C: TS OF THICK ROOT- A SECTOR. (Co: CORTEX; Pe: PERIDERM; Sph: SECONDARY PHLOEM; Sx: SECONDARY XYLEM; Ve: VESSELS; XF: XYLEM FIBRES)

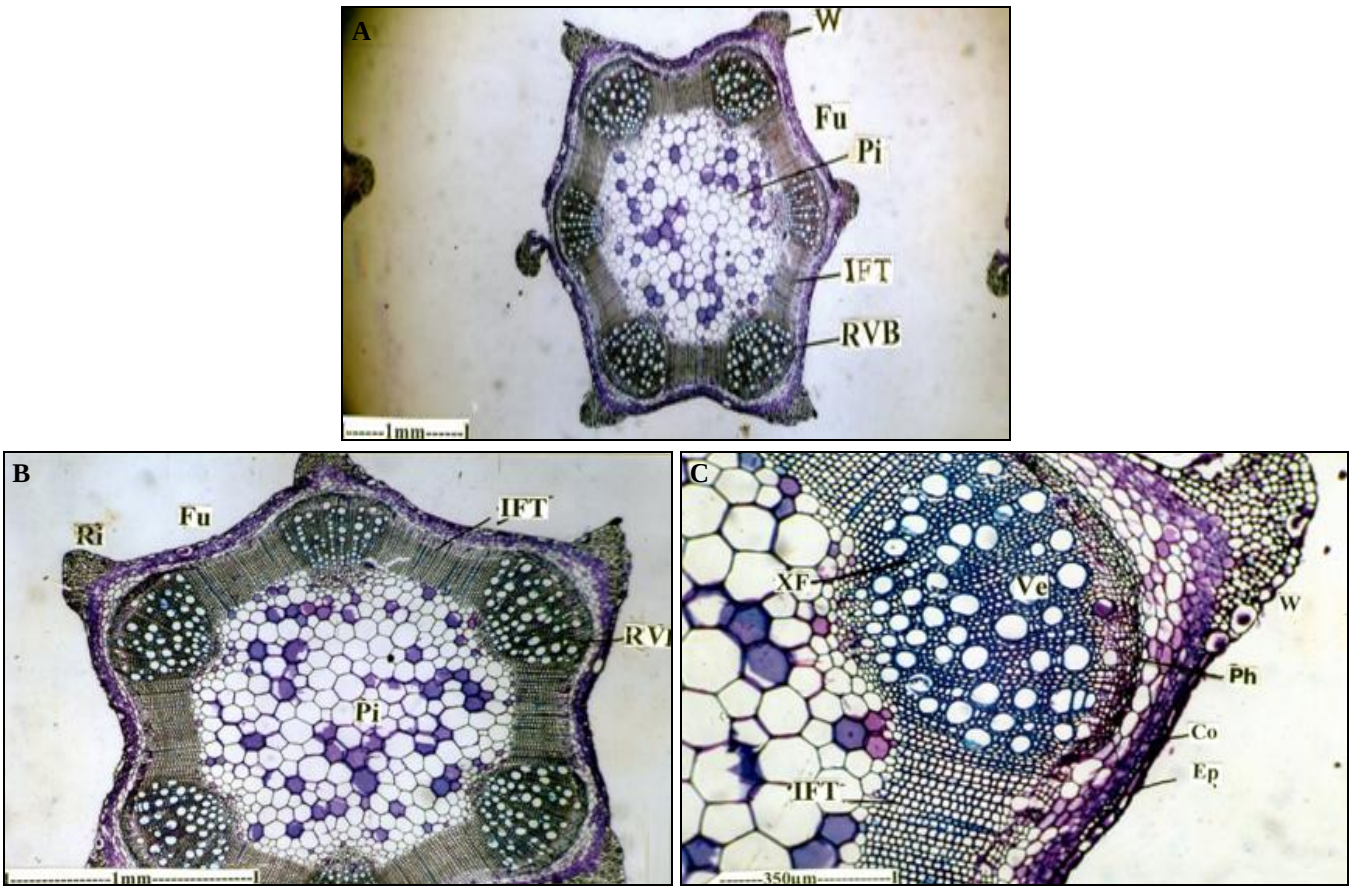


FIG. 2A: TS OF THE OLD STEM- GROUND PLAN, B: HALF SECTOR- ENLARGED, C: ONE RIDGE-BUNDLE-ENLARGED. (Co: CORTEX; Ep: EPIDERMIS; IFT: INTER FASCICULAR TISSUE; Fu: FURROW, Ri: RIDGE; RVB: RIDGE VASCULAR BUNDLE; Pi: PITH; Ph: PHLOEM; XF: XYLEM FIBRES)

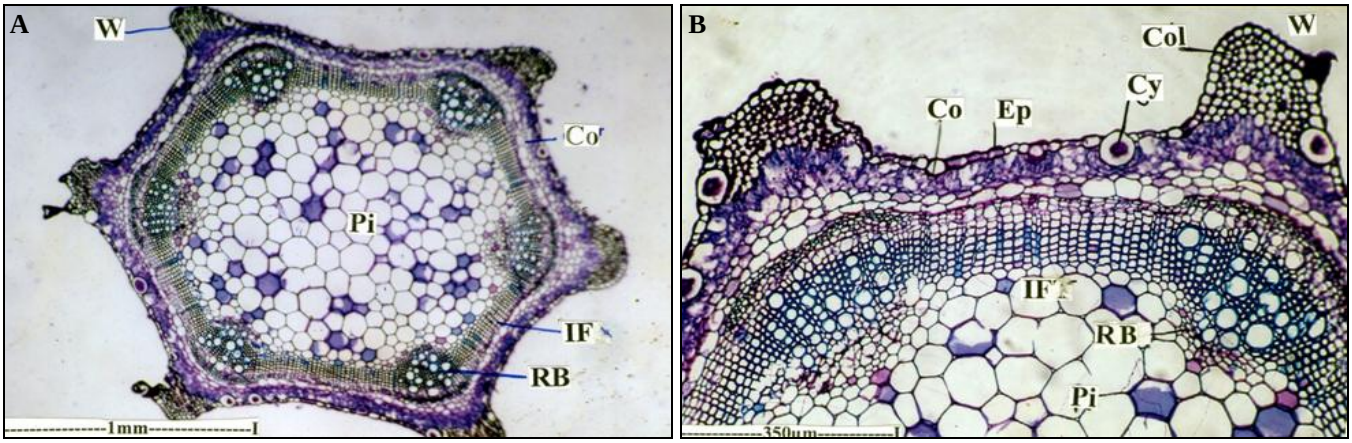


FIG. 3A: TS OF YOUNG STEM- GROUND PLAN, B: TS OF YOUNG STEM – A SECTOR ENLARGED. (Co: CORTEX; Col: COLLENCHYMA; Cy: CYSTOLITH; Ep: EPIDERMIS; IF: INTERFASCICULAR XYLEM FIBRES; Pi: PITH; RB: RIDGE BUNDLE; W: WING)

TABLE 1: HISTOCHEMICAL TESTS

Drug	Reagents	Test for	Reaction	Results
Section	Iodine solution	Starch	Blue colour	+
Section	Ferric chloride solution	Tannin	Black	+
Section	Phloroglucinol + dil. HCl + Alcohol	Lignin	Magenta	+
Section	Conc. HCl	Crystals	Little effervescence	+

Present (+); Absent (-)

TABLE 2: POWDER CHARACTERISTICS

Name of the Plant	Colour	Appearance	Odour	Taste
Peristrophe paniculata	Brown	Fine powder	No Characteristic smell	Slightly bitter

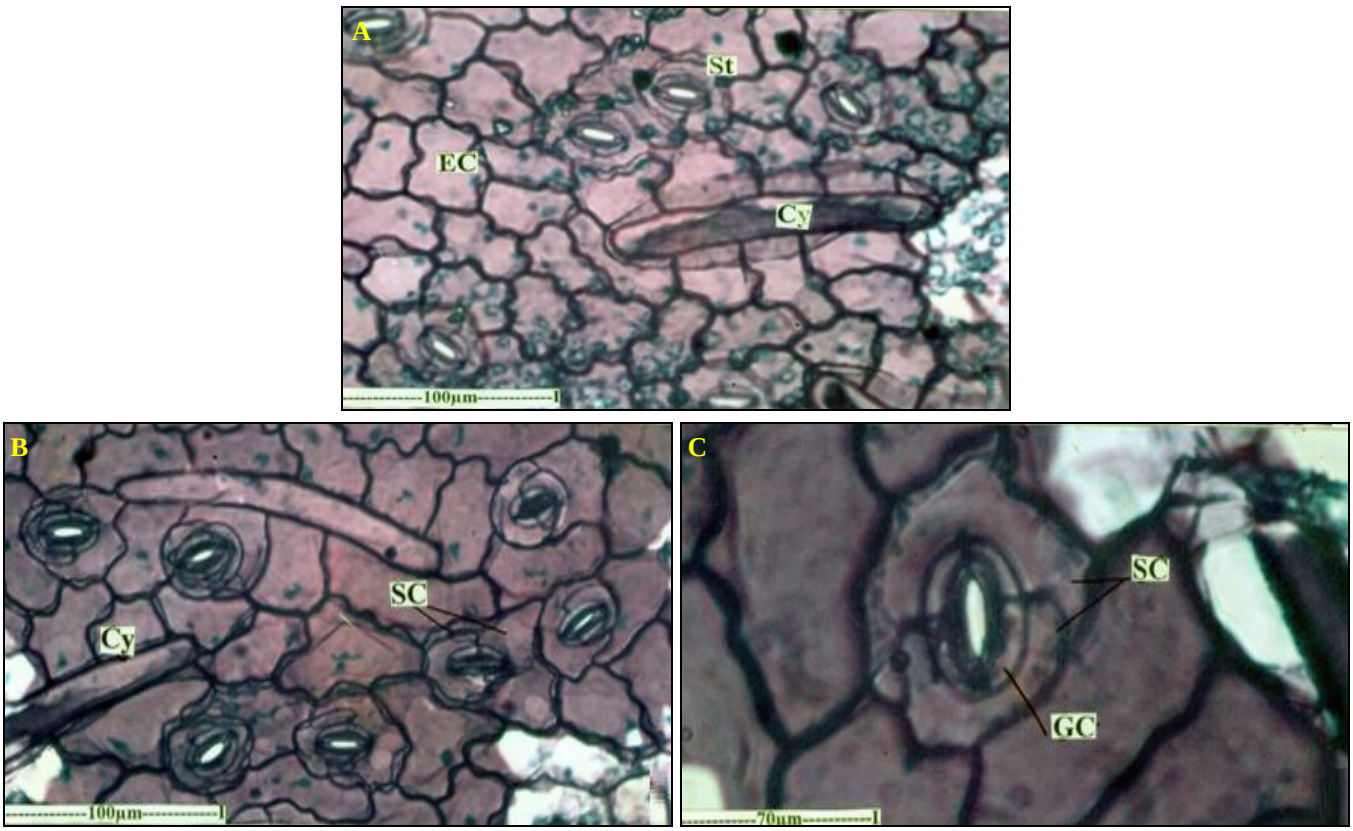


FIG. 4A: PARADERMAL SECTION OF ADAXIAL EPIDERMIS, B: PARADERMAL SECTION OF ABAXIAL EPIDERMIS, C: ONE STOMA WITH TWO SUBSIDIARY CELLS – ENLARGED. (CY: CYSTOLITH; EC: EPIDERMAL CELLS; GC: GUARD CELLS; SC: SUBSIDIARY CELLS: ST: STOMATA)

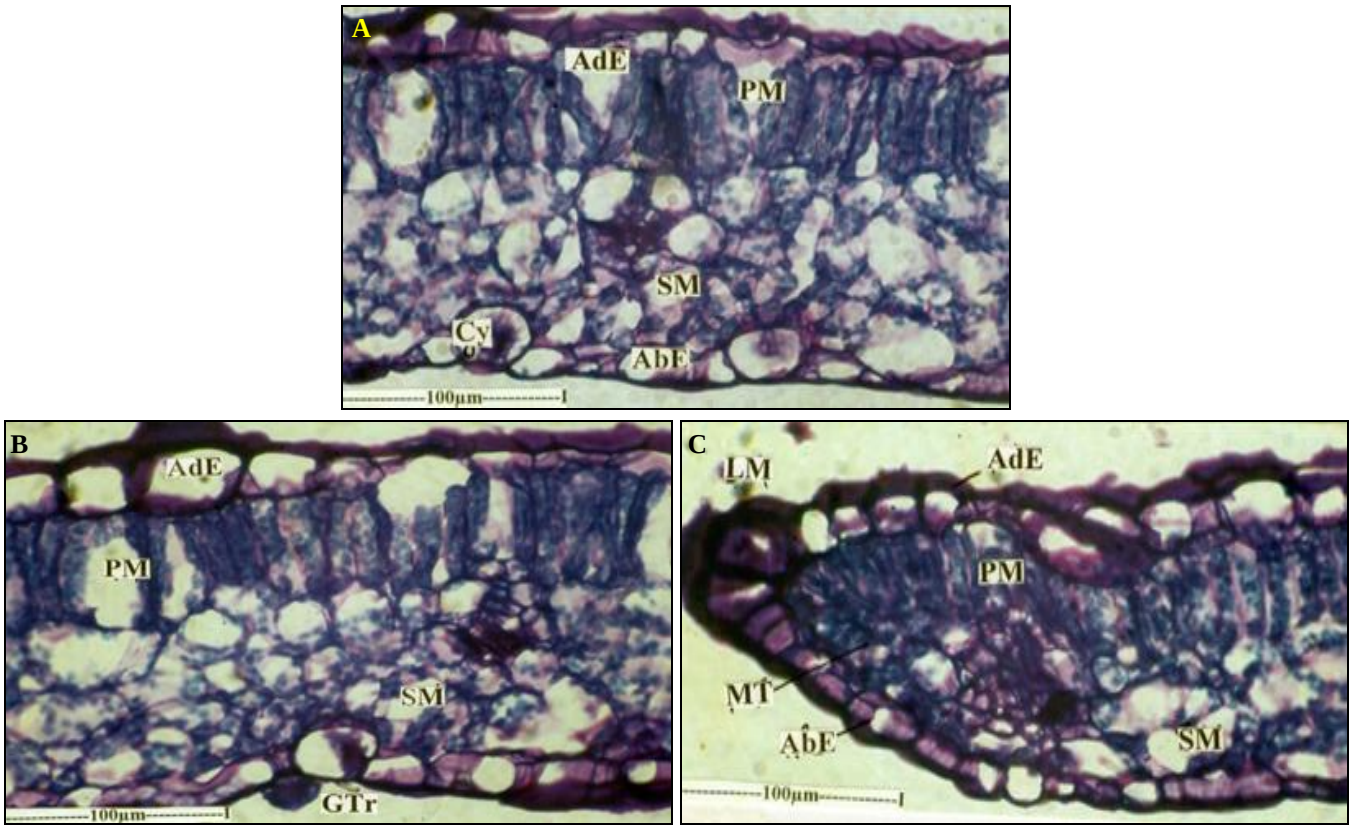


FIG. 5A: TS OF LAMINA, B: TS OF LAMINA WITH GLANDULAR TRICHOME, C: TS OF LAMINA THROUGH LEAF-MARGIN. (AbE: ABAXIAL EPIDERMIS: AdE: ADAXIAL EPIDERMIS; Cy: CYSTOLITH; GTr: GLANDULAR TRICHOME; LM: LEAF-MARGIN; MT: MESOPHYLL TISSUE; PM: PALISADE MESOPHYLL; SM: SPONGY MESOPHYLL.)

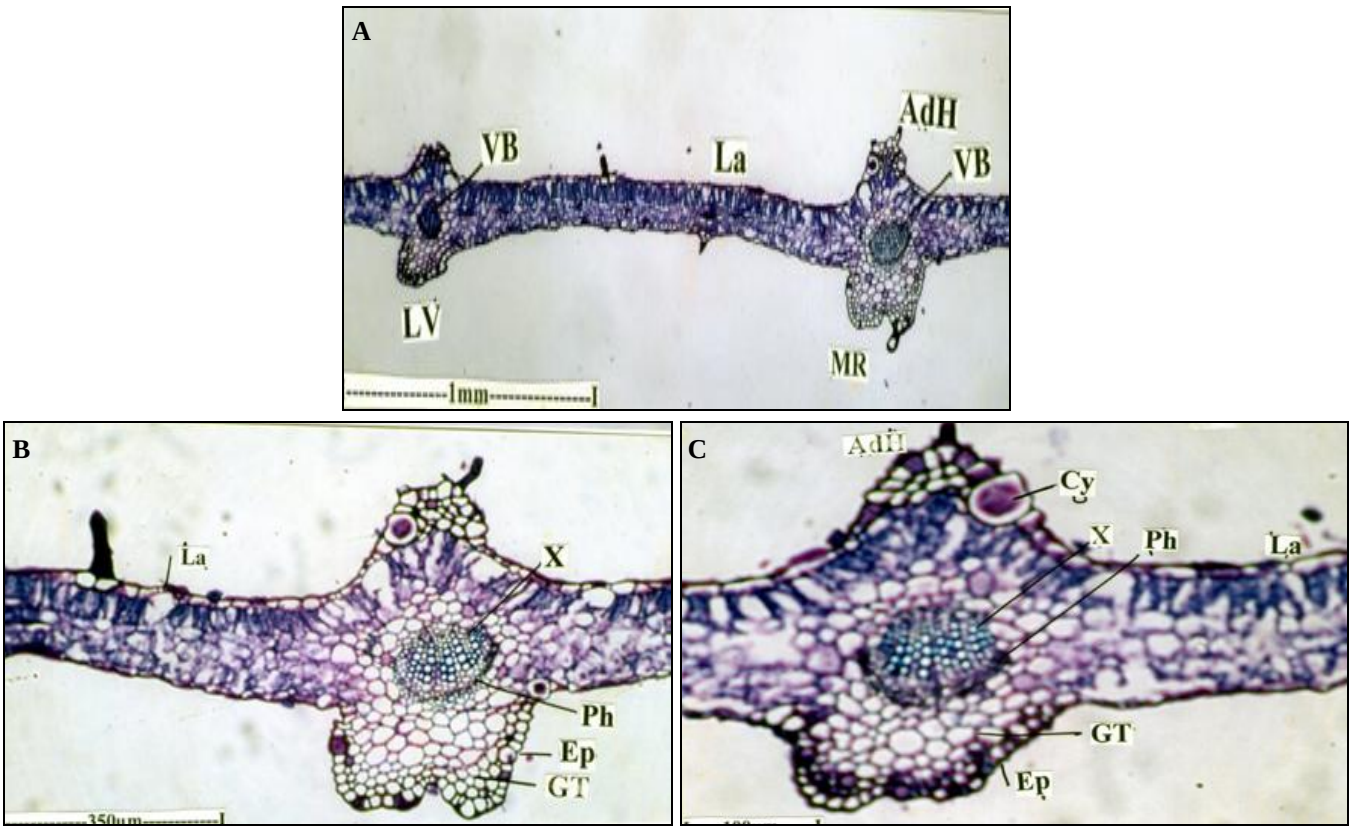


FIG. 6A: TS OF LEAF-THROUGH MIDRIB AND LATERAL VEIN, B: TS OF LEAF THROUGH MIDRIB AND LAMINA, C: TS OF MIDRIB-ENLARGED. (AdH: ADAXIAL HUMP; Cy: CYSTOLITH; Ep: EPIDERNUS; GT: GROUND TISSUE; La: LAMINA; LV: LATERAL VEIN; MR: MIDRIB; Ph: PHLOEM; VB: VASCULAR BUNDLES; X: XYLE)

TABLE 3: POWDER ANALYSIS

Treatment	*Peristrophe paniculata*
Powder treated with water	Non-sticky
Powder shaken with water	Foam like froth
Powder treated with 5% aqueous NaOH	Brown
Powder treated with 60% aqueous sulphuric acid	Reddish brown
Powder pressed between filter paper for 24 hours	No oil stain

TABLE 4: ASH VALUES

Name of the Plant	Total ash (%)	Water soluble ash (%)	Alkalinity of water soluble ash (ml)	Acid insoluble ash (%)
P. paniculata	20.6	3.30	2.10	5.72

TABLE 5: EXTRACTIVE VALUES

Name of the Plant	Alcohol soluble extract (% w/w)	Water soluble extract (% w/w)	Hexane soluble extract (% w/w)	Chloroform soluble extract (% w/w)
Peristrophe paniculata	1.5	3.60	0.91	1.05

TABLE 6: FLUORESCENCE ANALYSIS

Experiments	Visible / Day light	UV Light	
		254 nm	365 nm
Drug powder	Pale brown	Pale brown	Dark brown
Drug powder + 1 N NaOH (aq.)	Pale brown	Fluorescent green	Green
Drug powder + 1 N NaOH (alc.)	Brown	Fluorescent green	Black
Drug powder + 1 N HCl	Pale brown	Pale brown	Black
Drug powder + 50% H_2SO_4	Reddish brown	Green	Brown
Drug powder + 50% HNO_3	Brown	Green	Black
Drug powder + Picric acid	Brown	Fluorescent yellow	Green
Drug powder + Acetic acid	Brown	Brown	Black
Drug powder + Ferric chloride	Green	Green	Dark green
Drug powder + HNO_3 + NH_3	Reddish brown	Green	Green

TABLE 7: PRELIMINARY PHYTOCHEMICAL ANALYSIS

Name of the Test	*Alkaloids*	Flavonoids	Terpenoids	Steroids	Tannins	Carbohydrates	Phenols	Anthocyanidins	Anthraquinones	Lignans	Quinones
Aqueous extract	+	-	+	+	-	-	-	-	+	-	+
Ethanolic extract	+	+	+	+	-	-	+	-	+	+	+

DISCUSSION: The present study deals with the studies on standardization of the controversial Ayurvedic drug Parpataka with respect of *Peristrophe paniculata*. Parpataka is a well-known Ayurvedic drug, esteemed as a specific remedy for all types of fevers. The drug is diuretic, anthelmintic, digestive and constipating.

The accepted botanical source of the drug is *Peristrophe paniculata*, which is a tall erect much branched annual herb with angled stems. The whole plant of Parpataka is used as a drug. The roots are bitter, characterized by narrow cortex. Secondary xylem is dense, solid and lignified xylem fibres were also present. The stem is bitter in taste. The vascular bundles of the ridges are thick and have more number of vessels.

The main identification characters of stem are the presence of cystoliths and interfascicular tissue in the epidermis, the pith is wide and parenchymatous. Leaf is bitter in taste. Presence of cystoliths in the epidermis, diacytic stomata and glandular trichomes in the lower epidermis are the diagnostic characters of the leaf. Histochemical tests, powder characteristics, powder analysis, ash values, extractive values, fluorescence analysis and preliminary phytochemical profile were established and results are presented in **Table 1-7**.

CONCLUSION: The results of different standardization parameters and powder drug analysis revealed specific identities and characteristics of crude raw drug obtained from *Peristrophe paniculata* plant. This will be useful in identification of genuine drug and would help in preparation of the formulations used in Ayurveda and Siddha systems.

These findings are important for the evaluation of quality control parameters for Ayurvedic formulation and also help in establishing pharmacopoeial standards, which are primarily needed not only for the survival of the age-old conventional system of medicine but also to achieve global importance.

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