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EVALUATION OF MACROSCOPICAL AND MICROSCOPICAL STUDY OF *BRYOPHYLLUM PINNATUM* PLANT

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ABSTRACT: *Bryophyllum pinnatum* (Lam.) Kurz. widely used in traditional as well as folk medicinal systems are locally known as Panphuti. Traditionally, it is used for the treatment of kidney stones, urinary tract infection, burns, and diarrhea. In the present study, pharmacognostic studies of root, stem, and leaf of *B. pinnatum* (Lam.) Kurz. For standardization of plant material morphological and anatomical characterization was carried out. Intra-stelar and extra-stelar secondary growth with wood and periderm formation along with deposition of starch grains were observed in the pith region of the root and cortical region of the stem. Calcium oxalate crystals were also present in the cortical region of the stem. Leaf lamina showed spongy parenchyma in mesophyll region and anisocytic type of stomata. Anthocyanin pigment was present below epidermal cells in the petiole. He results of the study could be useful in setting some diagnostic indices for the identification and preparation of monograph of the plant.

Keywords: *Bryophyllum pinnatum* (Lam.) Kurz., Pharmacognosy, Macroscopical, and Microscopical

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INTRODUCTION: Medicinal plants have been part and parcel of human society to combat diseases since the dawn of human civilization. The earliest description of curative properties of medicinal plants was described in the Rigveda (2500-1800 BC), Charak Samhita and Sushruta Samhita. Herbal medicine remains one of the most common forms of therapy widely available throughout the world population [1]. Nature bestowed our country with an enormous wealth of medicinal plants.

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Plants have been used as a traditional healthcare system from the centuries. The WHO has listed 20,000 medicinal plants globally in which contribution of India is 15-20% [2]. Herbal medicines have a vital role in the prevention and treatment of cancer, and medicinal herbs are commonly available and comparatively economical [3].

Plant Description: *Bryophyllum pinnatum* (Lam.) Oken plant is an environmental weed from the family Crassulaceae but commonly used traditionally as a medicine in different regions of India mainly to treat urinary stones, as well as in other parts of world [4]. *Bryophyllum pinnatum* is derived from Greek word Bryo means to sprout, and phyllon means leaf. The secondary metabolites which are obtained from different parts of the plant such as alkaloid, flavonoid, tannin, glycoside, phenolic compounds, which have therapeutic value.

The plant is used in different pharmacological activities such as anti-diabetic antihypertensive, anti-leishmanial, antimicrobial, analgesic, and anti-cancer. These are also used in bleeding disorder and ulcer and diarrhea [5].

FIG. 1: PLANT OF *BRYOPHYLLUM PINNATUM*

Taxonomical Classification: [6]

Kingdom	:	Plantae
Subkingdom	:	Tracheobionta
Division	:	Spermatophyta
Subdivision	:	Magnoloiphyta
Class	:	Mangnoliopsida
Subclass	:	Rosidae
Order	:	Saxifragales
Family	:	Crassulaceae
Genus	:	*Bryophyllum*
Species	:	*pinnatum*

Vernacular Name: [5]

Sanskrit	:	Pashanabheda
English	:	English
Hindi	:	Zakhmhaiyat, Patharchoor
Kannada	:	Gandukalinga
Tamil	:	Malaikalli, Ranakalli
Telgu	:	Ranapaluka
Marathi	:	Gayamari
Bengali	:	Koppatha, Patharkuch

Geographical Indication: It is perennial herb growing widely and used in Folkoric medicine in tropical Africa, Tropical America, India, China, Australia, Asia, New Zealand, the Philippines The plant grows all over India in hot and moist areas, especially in Bengal and Uttarakhand [6].

MATERIALS AND METHODS:

Plant Material: The whole plant was collected from the local park (Narayan Bagh) of Jhansi in November 2015. The plant was identified by local people of that park and authenticated by Dr. Rama Shanker National Vrkshayurveda Research Institute Gwalior Road Jhansi Uttar Pradesh. A herbarium specimen of the plant 826 was preserved in the Department of Pharmacognosy of our Institute for further reference. The leaves were separated and dried under shade, pulverized by the mechanical grinder, passed through 40 mesh sieve and stored in a closed vessel for further use.

Macroscopy: The roots were simple, taproot, greenish-brown when young and light brown when old. Root was 7-10 cm in length **Fig. 2**. Root powder had a pleasant odor and was sweet. The stem of *B. pinnatum* (Lam.) Kurz. was light green when young and light brown when old **Fig. 2**. The old stem was rough and had lenticels on the surface. Stem powder had a pleasant odor and slightly bitter. The leaves were opposite, decussate, succulent, 10-20 cm in length. The lower leaf was simple, whereas, the upper leaf is 3-4 foliate with long petiole with dark green in color and fleshy, which are distinctively scalloped and trimmed in red. The leaves are furnished with rooted vegetative buds, and leaf apex is obtuse. Petiole was 2-4 cm in length; leaflet blades were oblong to elliptic, margin crenate with each notch bearing a dormant bud competent to develop into a healthy plantlet **Fig. 2**.

Microscopy:

Microscopical Characters of Young Root: Young root was circular in outline and showed outer epiblema, followed by the outer and inner cortex. Outer cortex was 3-4 layered thick walled made up of sclerenchymatous cells known as exodermis. Inner cortex was thinly walled made up of parenchymatous cells with deposition of starch grains. Stelar region showed the presence of vascular tissue (xylem and phloem). Metaxylem was prominent towards center surrounded by protoxylem toward the periphery. Parenchymatous pith occupied the central portion of the root section (siphonostele) **Fig. 3**.

Microscopical Characters of the Old Root: Old root was circular in outline with prominent

secondary growth in extra and intra stelar region. Extrastelar secondary growth showed the presence of periderm, which gets differentiated into phellem, phellogen, and phelloderm. Parenchymatous cells of secondary cortex or phelloderm showed the deposition of starch grains. In the intra-stelar growth, secondary xylem (wood) occupied the major portion in the form of a ring. Primary xylem and phloem get pushed towards the center surrounding the pith. Secondary xylem chiefly made up of tracheids along with fibers, xylem parenchyma, and few vessels. Pith showed deposition of starch grains **Fig. 3**.

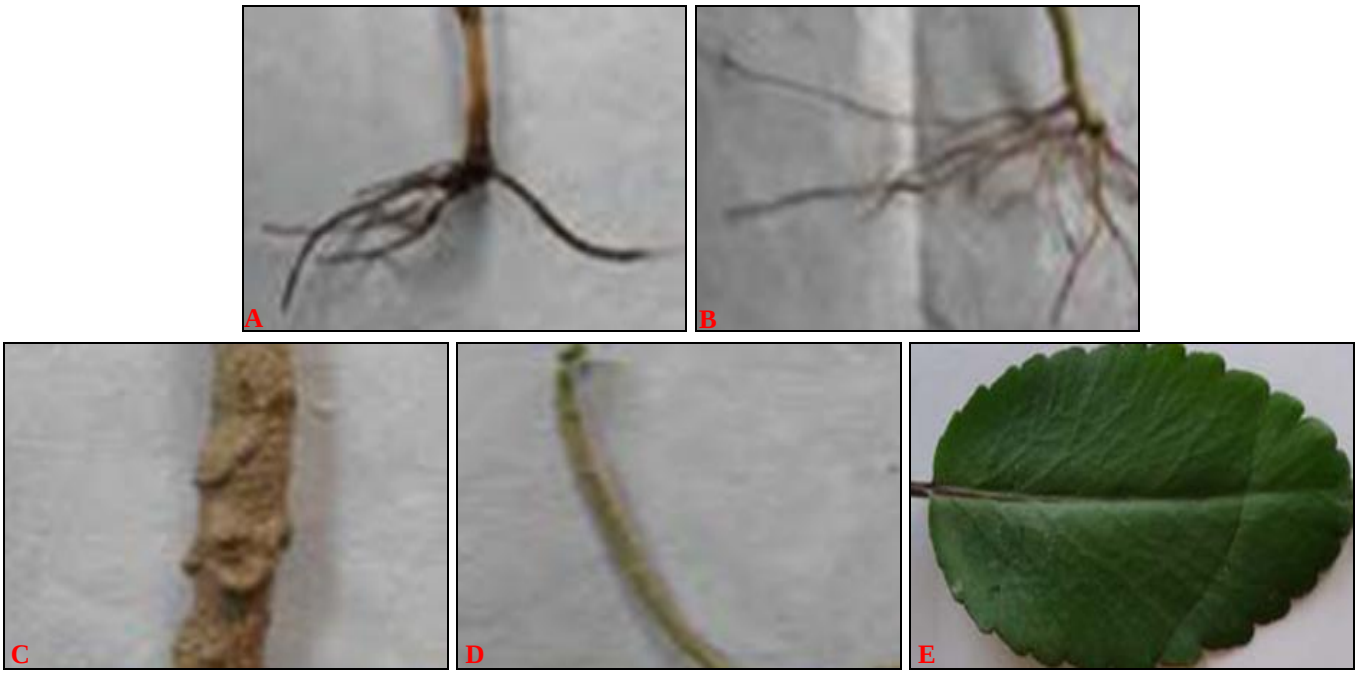

FIG. 2: MACROSCOPICAL CHARACTERS OF ROOT STEM AND LEAF OF AND PITH: PITH. *BRYOPHYLLUM PINNATUM* (LAM.) KURZ. A: Old root; B: Young root; C: Old stem; D: Young stem; E: Crenate shaped leaf.

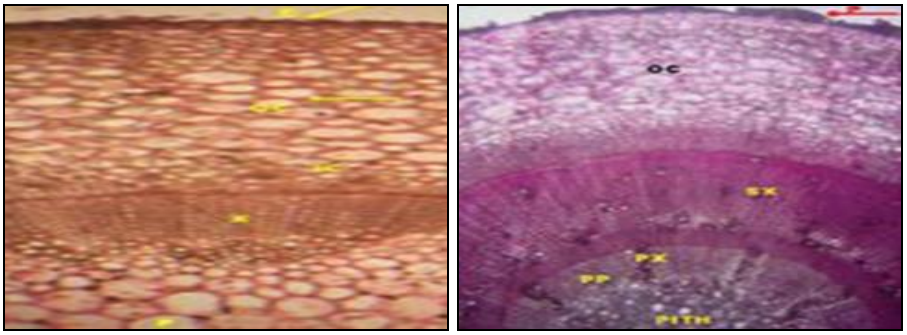

FIG. 3: TRANSVERSE SECTION OF YOUNG AND OLD ROOT OF *BRYOPHYLLUM PINNATUM* (LAM.) KURZ. Young root-E: Epiblema; OC: Outer cortical region; IC: Inner cortex; X: Xylem; and P: Pith. Old root-P: Periderm; OC: Outer secondary cortical region; SX: Secondary xylem; PP: Primary phloem; PX: Primary xylem and PITH: Pith

Microscopical Characters of Young Stem: Young stem was circular in outline and showed an outer layer of thick-walled epidermis with cuticle. Beneath the epidermis 3-4 layered hypodermis made up of sclerenchymatous cells was observed. Inner cortex was thin walled parenchymatous, loosely arranged with deposition of starch grains. Endodermis was not prominent. In stelar region, vascular bundles were arranged in a ring. Each vascular bundle was conjoint, collateral, and open. Xylem elements were mainly in the form of tracheids, xylem parenchyma fibers with few vessels. Parenchymatous pith in the center showed the deposition of starch grains, **Fig. 4**.

Microscopical Characters of Old Stem: Old stem was wavy in outline and showed both extra-stelar and intra-stelar secondary growth. Extra-stelar secondary growth gave rise to periderm composed of phellum, phellogen and phelloderm forming a bark. While intrastelar secondary growth showed the development of a broad region of secondary

xylem (wood). Secondary xylem was made up of pith, which was broad made up of thin-walled parenchyma cells with depositions of starch grain and calcium oxalate crystals **Fig. 5**.

Microscopical Characters of Leaf: Leaf of *B. pinnatum* (Lam.) Kurz. showed upper and lower epidermis with cuticle. Midrib region was broad with distinct upper and lower epidermis. The cells between upper and lower epidermis were homogenous and parenchymatous deposited with starch grains and chlorophyll with two vascular bundles found in the center. Each vascular strand was conjoint, collateral with xylem facing toward the upper side. The mesophyll region of the lamina was homogenous and chlorenchymatous and showed spongy parenchyma. Lamina showed distinct upper and lower epidermis with the presence of anisocytic type of stomata specifically on the lower epidermis **Fig. 6**.

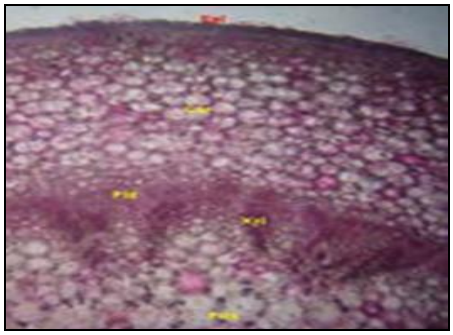

FIG. 4: TRANSVERSE SECTION OF STEM (YOUNG) OF *BRYOPHYLLUM PINNATUM* (LAM.) KURZ. Epi: Epidermis; Cor: Cortical region; Phl: Phloem; Xyl: Xylem and Pith: Pith

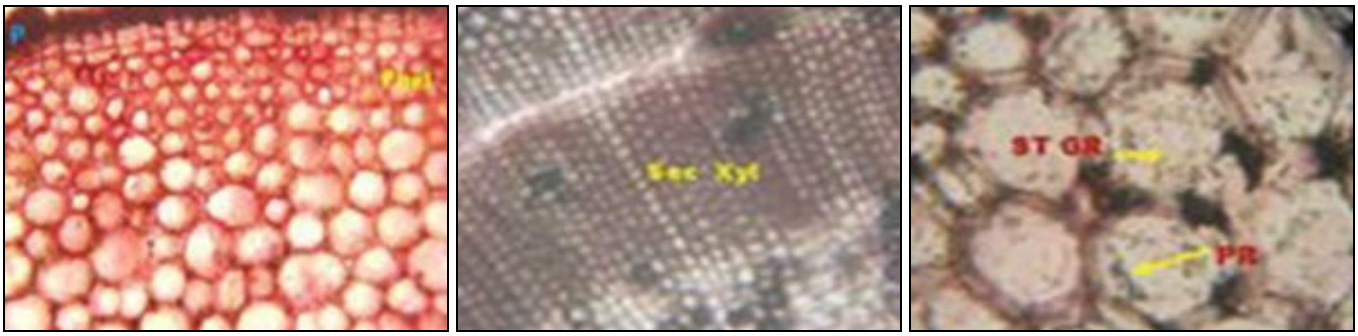

FIG. 5: TRANSVERSE SECTION OF OLD STEM OF *BRYOPHYLLUM PINNATUM* (LAM.) KURZ. P: Phellum (Cork); Phel: Phelloderm (secondary cortex); Sec XYL: Secondary xylem; PR CRS: Prismatic crystal and ST GR: Starch grain.

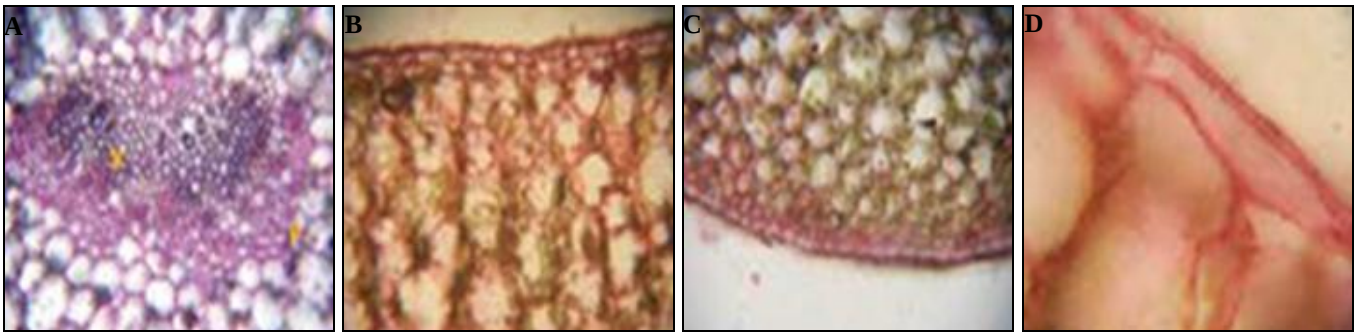

FIG. 6: TRANSVERSE SECTION (T.S.) OF LEAF OF *BRYOPHYLLUM PINNATUM* (LAM.) KURZ. A: T.S. of leaf midrib showing vascular bundle – X: Xylem; P: Phloem: B) T.S. of midrib with upper epidermis; B: C: Midrib showing lower epdidermis D: Cuticularized epidermis.

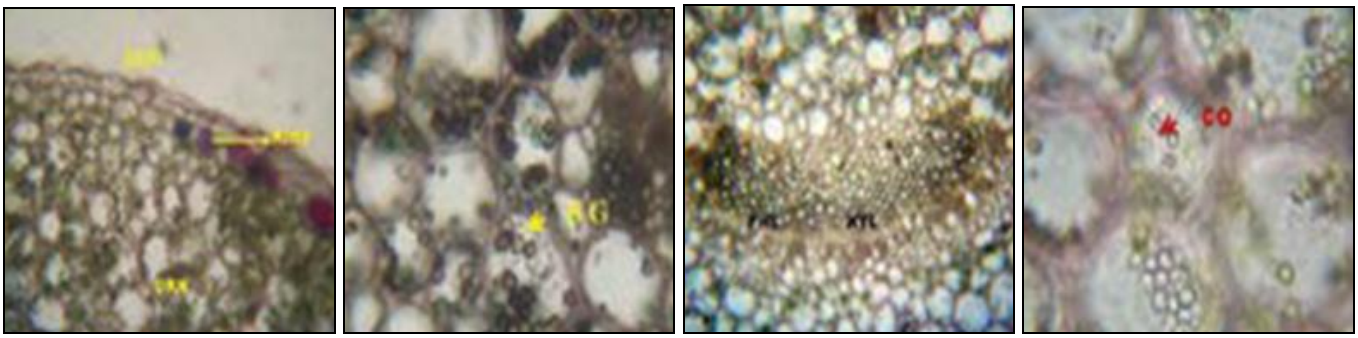

FIG. 7: TRANSVERSE SECTION OF PETIOLE OF *BRYOPHYLLUM PINNATUM* (LAM.) KURZ. CEPI: Cuticularized epidermis; Anto: Anthocyanin pigment; GRN: Ground tissue; PHL: Phleom, XYL: Xylem starch grain and CO: Calcium oxalate crystal.

Microscopical Characters of Petiole: Petiole of *B. pinnatum* (Lam.) Kurz. was circular in outline with single layered outer cuticularized epidermis. Beneath the epidermis was a broad region of ground tissue made up, loosely arranged thin-walled parenchymatous cells with chlorophyll, starch grains, and calcium oxalate crystals. Outermost few cells of ground tissue toward epidermis showed deposition of pink colored anthocyanin pigments, which turned to purple color after staining with safranine. Vascular tissue was grouped to form a crescent-shaped structure with phloem surrounding xylem on one side **Fig. 7**.

RESULTS AND DISCUSSION: In the present work, macroscopic characters of root, stem, and leaf were studied, which may help to identify the plant by its external morphology. Microscopic section of root showed a broad region of secondary xylem; stem showed the development of periderm after secondary growth. Leaf showed anisocytic type of stomata, presence of starch grains. Presence of anthocyanin pigment and prismatic crystals was seen in the petiole. These anatomical characters can be used for proper identification of *B. pinnatum* (Lam.) Kurz. The major problem faced in the herbal industry is the identification of authenticated raw material, and in the absence of data, one can use adulterant in the drug formulation [7].

The detailed systematic pharmacognostical evaluation of plant and plant material provides means of standardization of an herb that can be used as a drug or as raw material [8]. The anatomical characters studied can be used for proper identification and will avoid the use of the adulterant of plant raw material to be used in herbal pharmaceutical industries. Data obtained from macroscopic and microscopic studies may be considered as a distinguishing parameter to identify and decide the authenticity of the plant material, and this can be included as pharmacognostic standards in the pharmacopeia. As per the WHO guidelines, the quality control of the medicinal or herbal plant is mandatory before using for consumption [9].

CONCLUSION: The standardization of a crude drug is an integral part of establishing its correct identity. Before any crude drug can be included in a herbal pharmacopeia, pharmacognostic parameters and standards must be established. The results of the present investigations could serve as a basis for proper identification, collection, and investigation of the plant. Further, studies are required to be carried out for; *in-vivo* evaluation of *B. pinnatum* (Lam.) Kurz.; efficacy study, which may provide the necessary evidence for rational use of the plant as potent herbal medicine.

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CONFLICT OF INTEREST: We declare that we have no conflict of interest.

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