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Research Article

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Microscopical, Morphological evaluation and fluorescent analysis of *Desmodium gangeticum* DC: An Ayurvedic medicinal plant

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ABSTRACT

Traditional and folklore medicines play an important role in health services around the globe. About three quarters of the world population relies on plants and plant products for health care. The plant Desmodium gangeticum DC has been used in folklore medicine in the treatment of various ailments. Many of the ayurvedic formulations contain this medicinal plant and are considered as master of medicinal plant in ayurveda due to its wide use in formulations. Desmodium gangeticum DC. Family- Fabaceae is an important medicinal herb commonly known as salparni. It is widely used in ayurveda formulations for the treatment of various ailments and neurological disorders. Pharmacognostical evaluation including examination of morphological and microscopical characters, fluorescent profile was carried out to set them as diagnostic indices for the identification/ validation of the raw material and standardization of its formulations in fixing quality control parameters.

Key words Fabaceae, anatomical features, Pharmacognosy, *Desmodium gangeticum* DC, Standardization

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INTRODUCTION

Desmodium gangeticum commonly known as Salparni is widely used medicinal ayurvedic plant. The plant is used in 'Ayurvedic' preparations like 'Dashmoolarishta', 'Dashmoolakwaath' and for treatment of nervous disorders. The plants have great therapeutic value in treating typhoid, piles, inflammation, asthma, bronchitis, and dysentery [1]. The plant has also been found to be a promising candidate for the management of dementia and Alzheimer disease [2].

The aqueous extract of *Desmodium gangeticum* has been reported to have strong anti-writhing and central nervous system (CNS) depressant activity, in improving memory and in healing different types of wounds [3-4]. *Desmodium gangeticum* DC, reported to contain various classes of bioactive principles such as flavonoid glycosides, pterocarpanoids, lipids, glycolipids, lactones and alkaloids from the whole plant *Desmodium gangeticum* (L.) DC. Is a well explored traditional Indian medicinal plant used to treat neurological imbalances. Recent pharmacological studies established its multi directional therapeutic significance as anti-leishmanial, anti-inflammatory, cardio-protective drug. Moreover, it has detoxifying, blood purification property which might be attributed to its immunomodulatory activity [5-6].

Taxonomy and botanical description [7-8]
The genus *Desmodium* is derived from Greek word 'Desmos' means 'bond' or 'chain' like due to the resemblance of the jointed seed pods to links of a chain. It is distributed mainly in tropical and subtropical regions of the world.

Among 20-25 different species, *Desmodium gangeticum* DC shows highest bio-diversity in India (Figure 1 & 2). The taxonomical classification of *Desmodium gangeticum* DC is as follows

Kingdom	:	Plantae
Division	:	Magnoliophyta
Phylum	:	Spermatophyta
Class	:	Magnoliopsida
Order	:	Fabales
Family	:	Fabaceae
Genus	:	Desmodium
Species	:	gangeticum (Linn.

D. gangeticum is a perennial erect or ascending shrub, grows up to 2 to 4 feet. The stem is angular, woody with numerous prostrate branches. Leaves are small (3–14 x 2–7 cm), ovate-oblong or rounded in shape, covered with numerous gray color numerous trichomes. Flowers are small (4-7 cm), purple or white in color. Calyx are 4–5 cm long, pubescent. Seeds are small, pale yellow, kidney-shaped. The lateral roots appear yellow with smooth texture. Its flowering–fruiting season is during the months of March to December

Fig.1. Aerial parts of *Desmodium gangitecum DC*

Root of *Desmodium gangitecum DC* **Legume of *Desmodium gangitecum* DC**

Fig.2. Showing Roots and Legume of *Desmodium gangitecum DC*

EXPERIMENTAL SECTION

Collection and Authentication of plant

The plant was collected from National Botanical Research Institute/Aminabad, Lucknow (U.P) and authenticated from National Botanical Research Institute, Lucknow by Dr. Alok Lahri Ref.No: NBRI/CIF/492/2015, Scientist and Head, Pharmacognosy and Ethanopharmacology Division.

Morphological evaluation

The organoleptic characters like size and shape, color, surfaces, venation, petiole, lamina apex, margin, base, texture, odor and taste were noted of the fresh leaf, stem, flowers and roots of *Desmodium gangeticum* DC [9-10]. The Morphological features were photographed using digital camera (DSC W220 – Sony Corp and Canon) while the microscopic observations Motic Japan Digital microscope Model B1 series and were done under stereoscopic microscope (Olympus BX50) with the help of Camera Lucida.

Anatomical studies:

The free hand sections of the freshly collected plant materials (leaf, petiole, stem and root) were taken using sharp razor blades and stained with (0.5 %) Tolueidene blue while fine grinded powder of the root was also examined using microscope (Olympus BX50). The quantitative microscopy on the anatomical section and the epidermal strips of the fresh leaf of the plant to determine the palisade ratio, stomatal index, vein islet and vein termination number were carried out as per the methods of Indian Pharmacopoeia [11-13]

Fluorescence analysis

The fluorescence behavior of plant powder was observed and recorded in daylight and ultraviolet light at 254 and 366 nm [14]. Results are tabulated in Table No.2.

Microscopical evaluation of *Desmodium gangeticum* DC

The thin transverse section of the *Desmodium gangeticum* DC root shows the presence of 3-7 layers cork, tangentially elongated cells, having a few prismatic crystals of calcium oxalate; cork cambium single layered; secondary cortex 4-10 layers of thin-walled, tangentially elongated cells having a few isolated cortical fibers; secondary phloem composed of parenchyma, sieve tubes, companion cells and fibers, traversed by phloem rays; sieve tubes collapsed in outer region, but intact in inner region; phloem fibers slightly elongated, lignified; phloem rays unit to multiseriate, 1-4 cells wide and 4-15 cells high; outer phloem region having occasionally prismatic crystals of calcium oxalate; cambium 2-3 layers; secondary xylem having 1-2 growth rings, consisting of vessels,, xylem parenchyma, and xylem fibers, traversed by xylem rays; vessels, lignified, large, narrow, with both reticulate thickening or bordered pits; xylem parenchyma with rectangular or slightly elongated179cells, resembling those of phloem parenchyma in shape but larger in size and xylem fibers resemble those of phloem fibers in shape but larger in size; xylem rays thick walled possessing simple pits, 1-5 cells wide and 4-12 cells high; simple, round to oval starch grains measuring 7-25 µ in dia. and prismatic crystals of calcium oxalate present in secondary phloem and secondary xylem [15].

Leaf anatomy: Occurrences of short and curved unicellular trichomes are observed on the midrib and veins of leaf lamina. Both, the upper and lower epidermis layers are composed of single layer of small cells which are thick walled, circular to elliptical in shape followed by 4-5 layered parenchymatous cells in the cortex of the midrib region. In the central region, 3-5 vascular bundles are arranged in triangular shape with the xylem tissues place towards the upper side and phloem on the lower side. In the blade part, spongy mesophyll tissue is divided into two layers of palisade tissue. The vascular bundles are conjoint collateral and open type besides; both the upper and lower epidermis possesses paracytic type of stomata.

Root anatomy: A thick layer of dead tissues which are hard and dry called periderm are found present at the peripheral position of root. The presence of lenticels is also observed where the bark was broken down as it protects the inner tissues viz. epidermis which is parenchymatous in nature and cork which are lignified. Inside the cork region compressed and thin walled cells of the cortex are present. Secondary phloem tissue is found to be present in patches or elements which are separated from very thick layer of secondary xylem by the cambium. Also the one or two cell layered radially elongated bands called medullary rays is found to differentiate the secondary xylem of the root and it extend from the primary xylem up to secondary phloem.

Results are showing in (figure 3-6) in result section.

RESULTS

Plant morphology The plant is a sub-erect, diffusely branched under-shrub up to 2-3 ft height, stem woody, branched, irregular angled, covered with white hairs. Leaves are unifoliate or trifoliate, with ovate, oblong to lanceolate in shape measuring 3-3.5 x 2-2.5 cm in size. The apex is acute or acuminate with wavy margins. Pinna is light green in color, with some yellowish green patches on it. In addition scarious stipules (6-8 mm) are located at the base of petioles that are triangular in shape and 1-2 cm in length. Flowers small pink to purple in color, arranged in terminal or auxiliary raceme which after fertilization form pods, having 5-8 seeds with curved beak like ends. The flower is complete with five hairy sepals (2 mm in size), triangular in shape; five petals (4 mm), violet or white in color, arranged papilionaceously and Androeciums (9+1) present around the single carpel. The flowering occurs from October to December. Pods were compressed, many-jointed, 12-20 x 2 mm in size, deeply indented on the lower edge and slightly indented on the upper edge. The taproot is poorly developed and large number of primary roots developed from very close positions which are 20 -50 cm long, 0.4 -1.2 cm thick, cylindrical in shape, light yellow in color and smooth in texture.

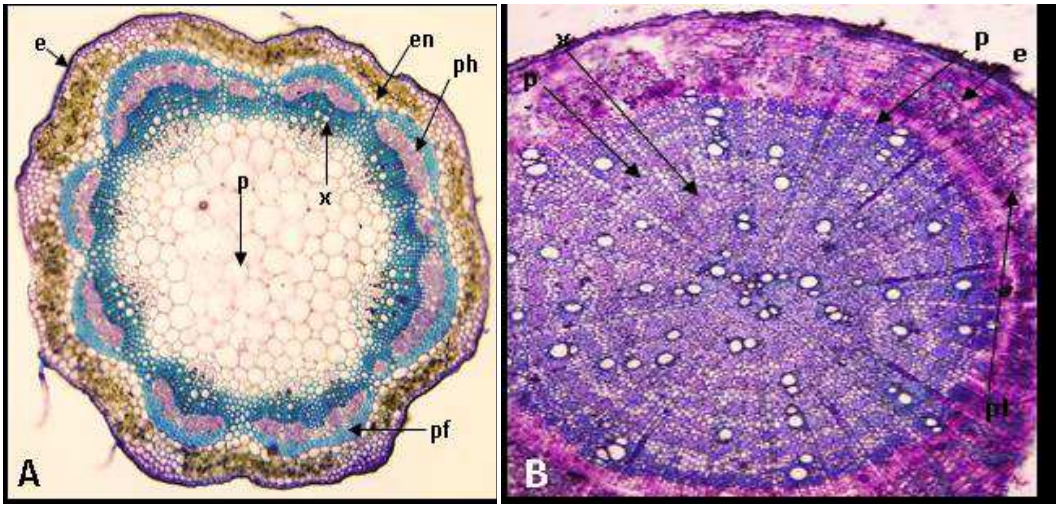
Plant micro-morphology the presence of parasitic type of stomata is observed in the leaf, with very low density on both of its adaxial (3-6/mm2) and abaxial (7-11/ mm2) surfaces. Moreover, the leaves possess uniseriate trichomes (hairs) with slightly curved beaklike the midrib and vein region of the leaf was fully covered by the trichomes. Besides, the stomatal number and stomatal index values, both were higher at the abaxial surface (7-11/ mm2 and 21-27/ mm2) than that of the adaxial surface (3-6/ mm2 and 14-17/ mm2) of the leaf. The vein islet number, vein termination number and palisade ratio were 15-23/ mm2, 9-17/ mm2 and 5.3-7.2 respectively. Results are tabulated in Table No. 1.

Table No. 1. Micro-morphological characters of *Desmodium gangeticum* DC leaf

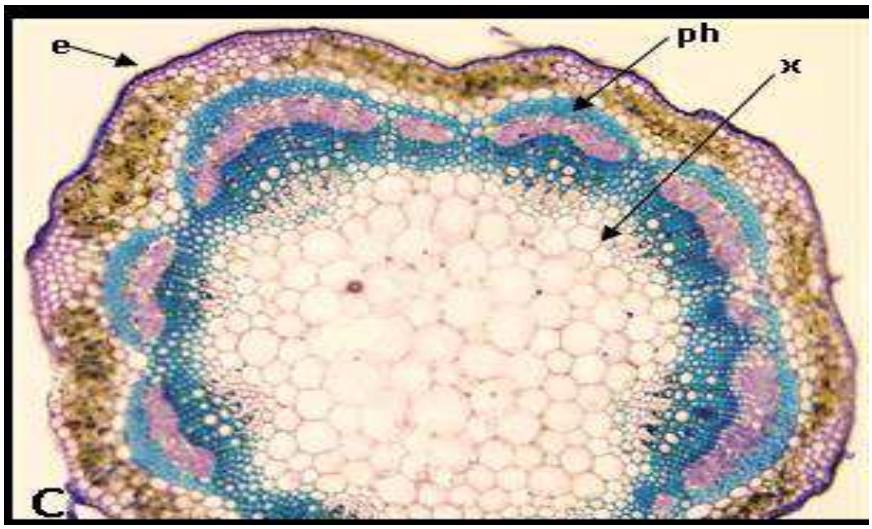
Parameter	Surface	Range
Stomata Number	Adaxial surface	3-5-6 / mm2
Stomatal Index	Adaxial surface	14-16-17 / mm2
Vein islet Number	----------	15-20-23 / mm2
Vein termination number	----------	9-13-17 / mm2
Palisade Ratio	----------	5.30 – 7.20

Table No. 2. Fluorescence analysis of *Desmodium Gangeticum* DC

Procedure	Day light	254nm	366nm
Powder as such	Light brown	Dark brown	Light brown
Powder +Hydrochloric acid	Brown	Dark brown	Green
Powder+ Nitric acid	Orange yellow	Brown	Yellowish Black
Powder +Sulphuric acid	Brownish black	Dark black	Green
Powder + glacial Acetic acid	Reddish brown	Brownish	Greenish black



A. T. S. of the stem of *D. gangeticum* **B. T. S. of the leaf of *D. gangeticum***



C. T. S. of the root of *D. gangeticum*
e - epidermis, en – endodermis, p – pith, pf – phloem fibre, ph - phloem, pl – palisade tissue, x – xylem
Fig. 3. Showing Transverse section of *Desmodium gangeticum* DC

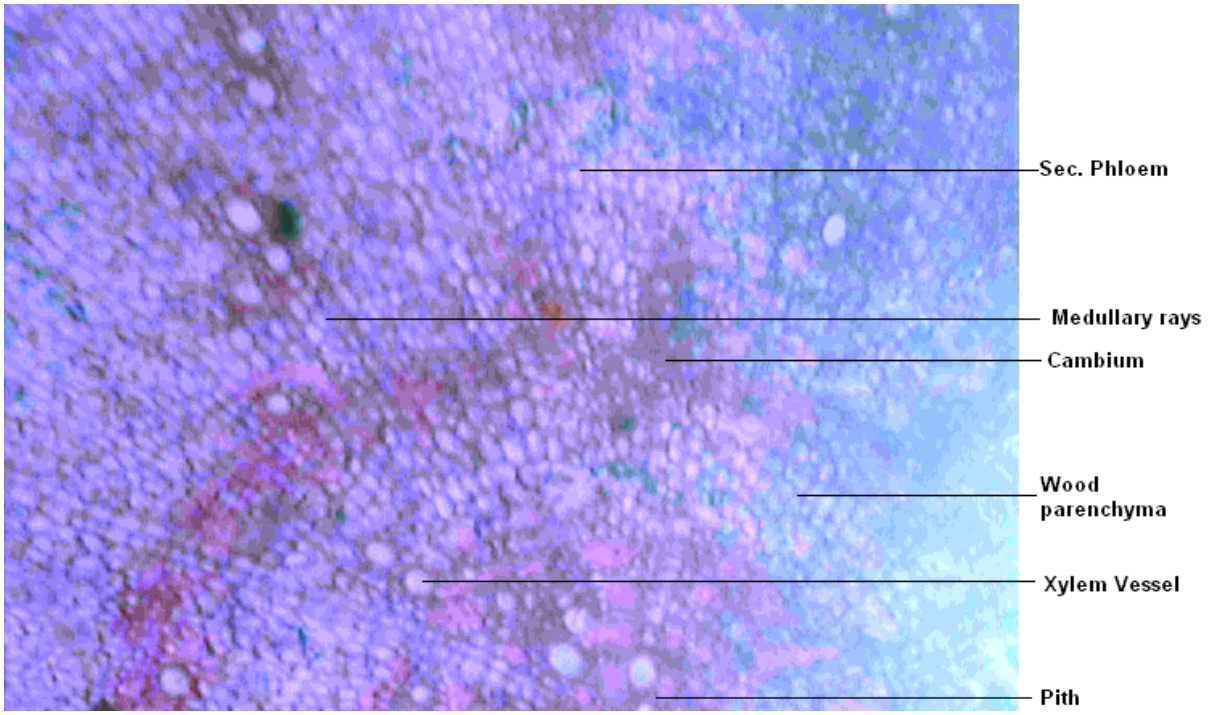


Fig No. 4. Transactional view of the root of *Desmodium gangeticum DC*

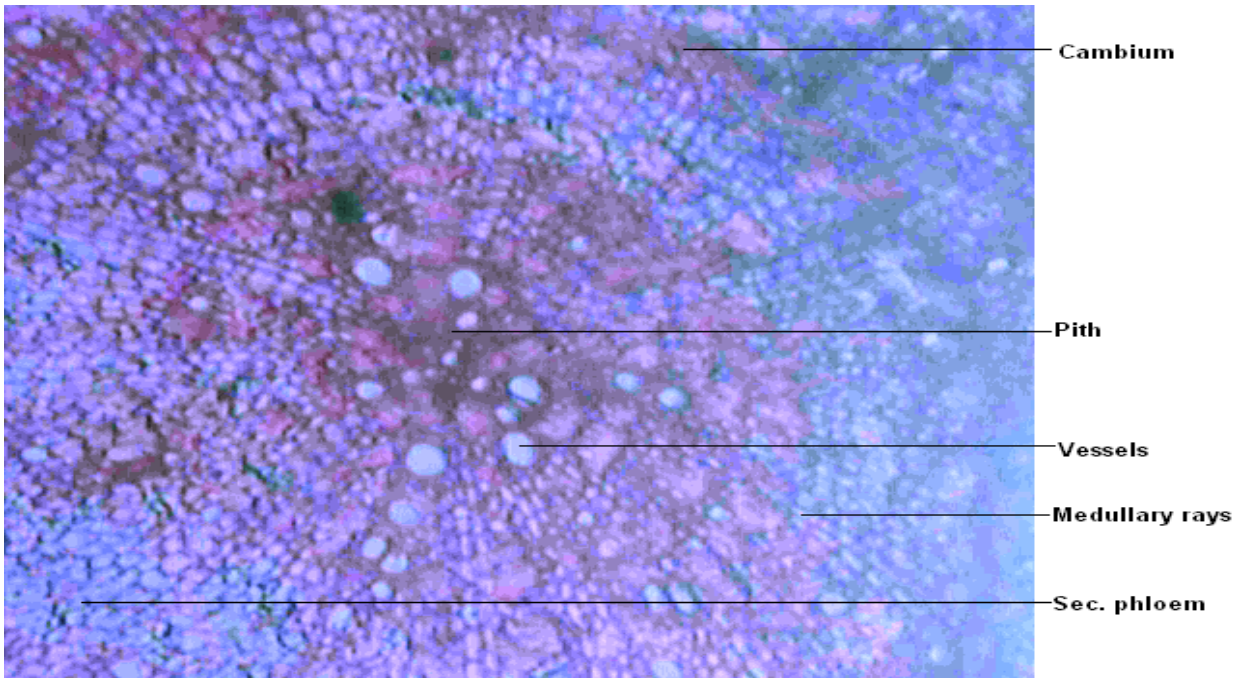


Fig No. 5. Transactional view of the root of *Desmodium gangeticum DC*

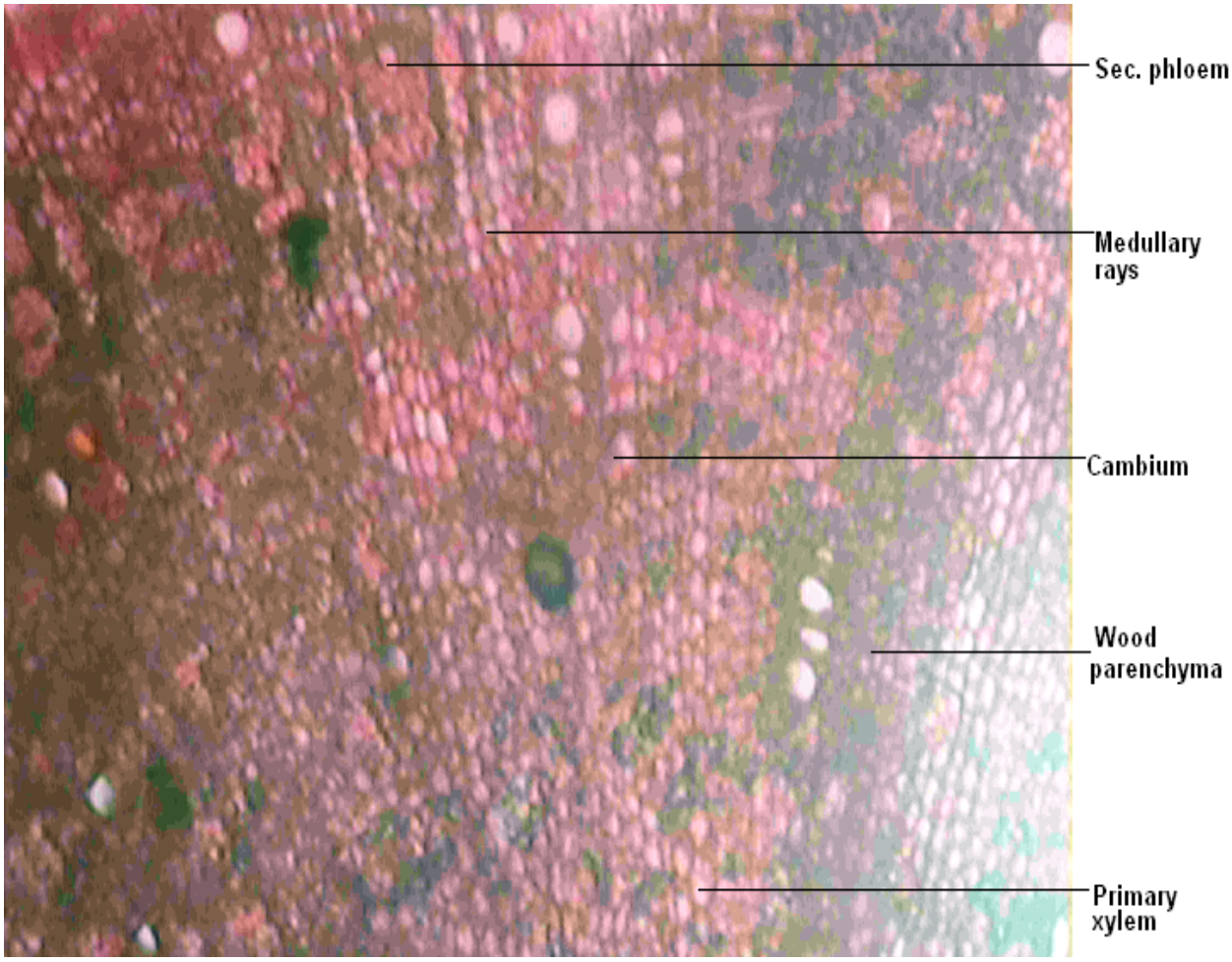


Fig No. 6. Transactional view of the root of *Desmodium gangeticum D*

DISCUSSION

Desmodium gangeticum DC is one of the important ingredients of Dasmula kwatha of Ayurveda. The name Dasmula signifies the mixture of roots of ten different plants. The species *Desmodium gangeticum* DC is a plant that has been confused with other species due to their relative similarities, therefore many a times some other materials are mixed or adulterated during the preparation of medicines. As standardization of a crude drug is an integral part of establishing its correct identity for its inclusion in herbal pharmacopoeia. For which pharmacognostical parameters and standards must be established. The results of the present investigations could, therefore serve as a basis for proper identification, collection and investigation of the plant. The macro and micro morphological and microscopical features of the various plant part described, distinguished it from other members of the genera. The vein islet and vein termination numbers are relatively constant for plants and can be used to differentiate closely related species. As there is no pharmacognostical, anatomical and Fluorescent analytical work on record of this much valued traditional drug, the present work was taken up with a view to lay down standards which could be useful to detect the authenticity of this medicinally useful plant.

CONCLUSION

In conclusion, the pharmacognostical features examined in the present study that includes morphological, anatomical, fluorescent analysis, may serve as a tool for identification/ validation of the raw material and standardization of its formulations in fixing quality control parameters as well as answer to the latest GMP norms and FDA guidelines on standardization of herbal drugs.

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