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Research Article

COMPARATIVE MORPHO-ANATOMICAL STUDIES OF FOUR TAXA FROM CHITTOOR DISTRICT OF ANDHRA PRADESH

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ABSTRACT

In this article, comparative Morphoanatomical studies has been presented on four selected important medicinal taxa viz., *Hiptage benghalensis*, *Atalantia racemosa*, *Lagerstroemia parviflora* and *Litsea deccanensis*. These taxa are prescribed by ethnic, traditional, ayurvedic practitioners in chittoor district of Andhra Pradesh for different ailments. There is a claim that ethnic and traditional drugs are failing in curing the proposed ailments. To resolve this issue we worked out on the cause and we found unfortunate adulteration at different levels. In order to generate a relevant source, we attempted taxon identification, botanical characterization by morphoanatomical studies of the above selected taxa. Our observations reported that existence of significant differences in the micromorphological anatomical characters which are of great value in identification of the selected taxa and can avoid adulterations.

Keywords: *Morphoanatomy, Hiptage benghalensis, Atalantia racemosa, Lagerstroemia parviflora*

INTRODUCTION

Chittoor district of Andhra pradesh comprise different forest areas and high vegetation where the tribal healers and ayurvedic practitioners prescribe some important medicinal plants as drugs for different ailments. It was questionable and still unscientific claims by educated and common man and doubts the potency and efficacy of the prescribed medicinal taxa as drug by traditional and ethnic healers. In our previous studies, (Tulasirao *et al*., 2012; Sivaji *et al*., 2013; Ramesh *et al*., 2014) we found adulteration and misidentification was the route cause for this false claims. In order to generate a relevant source, we attempted taxon identification, botanical characterization by morphoanatomical studies becomes the source for cross check of such taxon.

On this point we have focused to reveal the microscopic anatomical comparision between these selected taxa viz., *Hiptage benghalensis*, *Atalantia racemosa*, *Lagerstroemia parviflora* and *Litsea deccanensis* to reveal misidentification and adultered fortunately or unfortunately which are prescribed as crude drugs by different practitioners.

MATERIALS AND METHODS

Transverse sections of fresh roots, stems and leaves of *Hiptage benghalensis* (Voucher No : SVUTY/MP-NPD/2369), *Atalantia racemosa* (Voucher No : SVUTY/RT-NPD/3908), *Lagerstroemia parviflora* (Voucher No : SVUTY/LY-NPD/3117) and *Litsea deccanensis* (Voucher No : SVUTY/LR-NPD/2969), were taken by using a microtome and were immobilized in FAA solution (formalin: glacial acetic acid:70% ethyl alcohol (5:5:90)) for macro and microscopic observations. Permanent mount was prepared using safranin fast green stain by double staining technique (Johansen, 1940) with some slight modifications according to the reference of Ramesh *et al*.,(2014).

The Light micrographs of photographs were taken by means of an Images were obtained with a digital camera (DPx26, Olympus) attached to a light microscope (BX-50, Olympus). Identification of the taxa

were done referring standard literature (Gamble 1915-1936; Madhavachetty *et al*., 2018). Citation of the taxon is followed according to The Plant List *Ver. 1.1* (http://www.theplantlist.org/). All the voucher specimens were deposited in the Herbarium, Department of Botany, Sri Venkateswara University, Tirupati for further references.

RESULTS AND DISCUSSION

In this investigation, morpho anatomical studies on of four important selected medicinal plants viz., *Hiptage benghalensis, Atalantia racemosa*, *Lagerstroemia parviflora* and *Litsea deccanensis* in Chittoor district of Andhra Pradesh were selected based on the prescriptions from ethnic, traditional and ayurvedic practitioners. **Table: 1** represents the Comparative Morphoanatomical characters of selected medicinal plants.

Description of selected taxa

***Hiptage benghalensis* (L.) Kurz. In J. Asia. Soc. Bengal 43: 136.1874.**

Hiptage benghalensis belongs to the family Malpighiaceae. Common names are Hiptage, Clustered hiptage, Helicopter flower. Vernacular names (Telugu) are Madhavilatha, Madhaviteega, Atimutamu, Kuruvenda, Potuvadla, Vedala, Chandravalli. Locality of specimen collection : Microwave station areas in Tirumala and Kambakkam hills near Satyavedu. The Adulterents noticed are *Ehretia laevis* Roxb. (Ehretiaceae)., *Petrea volubilis* L. (Verbenaceae) *Putranjiva roxburghii* Wall. (Putranjivaceae), *Hiptage glabra* L., (Malpighiaceae).

***Atalantia racemosa* Wight & Arn. Prodr. 91.1834.**

Atalantia racemasa belongs to the family Rutaceae (Citrus family). Common names are Bombay Atalantia, Wild lime. Vernacular names (Telugu) are Adavinimma, Adavinim, Kondanimma, Karunimma, Murikinimma. Locality of specimen collection : Akasaganga theertham, Papanasana theertham and Chakra theertham in Tirumala. The Adulterents noticed are *Glycosmis pentaphylla* (Retz.) DC.; *Pamburus missionis* (Wight) Swingle. and *Toddalia asiatica* (L.) Lam. of Rutaceae.

***Lagerstroemia parviflora* Roxb. Pl. Cort. 66.1795.**

Lagerstroemia parviflora belong to family Lythraceae. Commonly called as Crepe Flower, Small Flowered Crepe Myrtle, Ben teak. Vernacularly known as Chennangi, Gullakaraka, Nandi. Locality of specimen collection : SVU Campus. The Adulterents noticed are *Simarouba glauca* DC. - Simaroubaceae , *Aglaia elaeagnoidea* (A. Juss.) Benth. And *Walsura trifoliata* (A. Juss.) Harm. of Meliaceae; and *Lagerstroemia indica* L. (Lythraceae).

***Litsea deccanensis* Gamble. Fl. Madras 1235. 1925.**

Litsea deccanensis belongs to the family Lauraceae (Laurel family) .Its common names are Deccan Tallow Laurel, Ganapathy tree. Vernacularly known as Naramamidi, Pedda naramamidi. Collected from kasaganga theerthams in Tirumala; Nelakon in Talakona. The Adulterents noticed are *Actinodaphne maderaspatana* Bedd. ex Hook.f. *Neolitsea foliosa* (Nees) Gamble, *Litsea glutinosa* (Lour.) C.B.Rob. and *Persea macrantha* (Nees) Kost. (Lauraceae).

Table: 1 Comparative Morpho-anatomical characters of selected medicinal plants of Chittoor Dt. of Andhra Pradesh

MICROMORPHOLOGY OF LEAF				
Part of the taxa	***Hiptage benghalensis***	***Atlantia racemosa***	***Lagerstromia parviflora***	***Listea deccanensis***
Midrib	Planoconvex	Biconvex	Biconvex	Biconvex
Epidermis	Adaxial epidermal cells are larger than the abaxial epidermal cells	Adaxial epidermal cells are slightly smaller than the abaxial epidermal cells	Adaxial epidermal cells are larger than the abaxial epidermal cells	Adaxial and abaxial epidermal cells are almost equal in size
Vascular system	Very broadly bowl shaped, triangular and collateral	Broadly bowl shaped, circular and colletoral	Broadly semi-circular and bicolletoral	Broadly expanded circular and collateral
Xylem and phloem elements	Numerous short lines of xylem elements and basal several separate circular masses of phloem elements are present	Several vertical compact xylem elements and darkly stained horizontal layers of phloem elements are present	Numerous radial files of multiples of xylem elements and continuous layer of phloem strand is present	Numerous vertical lines of xylem elements with 6-8 clusters of isolated phloem elements are present
Sclerenchyma fibres	Phloem is ensheathed by a discontinuous layer of sclerenchyma fibres	Phloem is ensheathed by a continuous sclerenchyma fibres	Phloem is enseathed by a parenchymatous ground tissue	Each phloem is an isolated unit, its lower part is associated with a large mass of sclerenchyma cells
Lateral vein	Planoconvex, abaxial epidermal cells have T-shaped nonglandular trichomes	Biconvex, abaxial epidermal cells have no trichomes	Planoconvex, abaxial epidermal cells have nonglandular trichomes	Biconvex, abaxial epidermal cells have no trichomes
Lamina	Smooth on the adaxial side and abaxial side with T-shaped nonglandular trichomes	Dorsiventral and bifacial	Dorsiventral and bifacial	Thin dilated slightly of frequent intervals, so that the thick and thin portions are present
Hypodermis	Absent	Two layers of hypodermal cells	Absent	Absent

		are present		
Palisade	Single layer and darkly stained	Single layer	Consists of about six cells in each vertical row	Single layer of palisade cells
Spongy parenchyma	The cells are spherical, loosely arranged with wide intercellular spaces	The cells are 8-9 layered compact without intercellular spaces	The cells are 2-3 layered, inter connected with palisade cells forming wide air-chambers	The cells are 2-3 layered with small intercellular spaces
Tannins, calcium oxalate crystals and druses	The adaxial epidermal cells have dense accumulation of tannins and rarely druses	The abaxial epidermal cells have calcium oxalate crystals	Leaf phloem parenchyma have minute, uniseriate calcium oxalate crystals and ground tissue have larger uniseriate crystals	The vascular bundles of the lamina have spindle or stick shaped calcium oxalate crystals
Cross sectional view	Circulalr and smooth	Broken and fissured	Almost circular	Circular
MICROMORPHOLOGY OF STEM				
Part of the taxa	***Hiptage benghalensis***	***Atlantia racemosa***	***Lagerstromia parviflora***	***Listea deccanensis***
Epidermis	Made up of small intact cells covered with thick cuticle	Broken and fissured, covered with very thick cuticle	Made up of spindle shaped cells covered with thick cuticle	Made up of small rectangular cells and with bright cuticle
Periderm	It includes phellogen only	It includes 2 layers of phellem cells	It includes outer phellem, inner phelloderm is not evident	Periderm absent
Cortex	Many layered and thick walled parenchyma cells	Several layers of brick shaped parenchyma cells	2 to 3 layers of parenchymatous cells with calcium oxalate crystals	9 layers of collenchyma and 4 layers of parenchyma cells
Cortical fibres	Inner boundary of the cortex with a line of thick walled	Thick fragments of fibres are present	Absent	Absent

	and lignified fibres			
Secretary cavities	Absent in the cortex	Present in the cortex	Absent	Absent
Secondary phloem	Consists of one celled phlolem rays and phlolem parenchyma has calcium oxalate crystals	Consists of discontinuous blocks of sclerenchyma cells	Thick cylinder and encircling the xylem cylinder with outer layer of sclereids, rest with radial lines of phloem parenchyma	Consists of rectangular cells in compact files and outskrits with bundles of fibre masses, + shaped starch grains present in the phloem parenchyma and xylem fibres
Collapsed and noncollapsed phloem	Absent	Present in the secondary phloem	Absent	Absent
Secondary xylem	Consists of solitary vessels, lignified mucilaginous fibres and one celled xylem rays	Consists of solitary vessels of paratracheal banded and scanty types, xylem fibres and single row of xylem rays with pyramid shaped calcium oxalate crystals	Consists of central cylinder with small vessels and outer cylinder with solitary or multiples of 3 or 4 vessels.	Consists of outer few layers of xylelm fibres and followed by xylem vessels

MICROMORPHOLOGY OF ROOT

Part of the taxa	***Hiptage benghalensis***	***Atlantia racemosa***	***Lagerstromia parviflora***	***Listea deccanensis***
Cross sectional view	Slightly elliptical	Highly fissured	Broken and fissured	Broken
Epidermis	Made up of more or less uniform cells	Made up of small uniform cells	Made up of small and slightly larger cells	Made up of small rectangular cells
Periderm	Includes phellogen, which produces phellem outside and	Includes 3 highly fissured, broken periderm	Includes phellem outside, phelloderm is not evident	Only broken peridern is present

	phelloderm inside	cylinders, in between which cortical parenchyma cells are present		
Cortex	Four layers of parenchymatous cortex is present	Many layered cortical cells possess dense starch grains and wavy walled secretary cavities	Three or more layers of parenchymatous cortex is present	Few layers of parenchymatous cortex is present
Hypodermis	Absent	Present	Absent	Absent
Secondary phloem	It includes 2-3 discontinuous cylinders of sclerenchyma cells and straight phloem rays	It includes 6 successive segments of thick fibres, collaped and noncollapsed phloem	Collapsed phloem possess several discontinuous of fibres arranged in successive cylinders. Phloem parenchyma cells possess druses	It includes collapsed phloem with Q-shaped banded sieve elements, dilated parenchyma and wide phloem rays and noncollapsed phloem with radial files of sieve elements
Secondary xylem	It includes solitary vessels, tyloses and xylelm rays are weak and they proceed vertically	It includes central core of primary xylem possess outer zone with circlels of vessels and inner zone with solitary or short long multiples of vessels, xylem fibres and xylem ray cells possess starch grains	It includes 1-4 celled xylem rays, solitary or radial multiples of vessels, xylem fiber cells possess calcium oxalate crystals and starch grains	It is an isolated cylinder and possess 3-4 celled xylem rays, solitary or radial multiple files of vessels, xylem fibres and ray cells possess starch grains
Pith	Absent	Absent	Absent	Large pith is present

The studies conducted on morphology of the plants have proved valuable information for the identification of the plants in taxonomic studies and that rely virtually on the anatomical distinction.
The characteristics of anatomy of species are used for distinguishing species close to each other and to confirm the deemed status of many plant species (Eltahir *et al*., 2018).
Although some morph-anatomic characters a part of taxonomic identity were already reported elsewhere, present work re-investigate some of them and reports comparatively in accordance with misidentification and adulteration with other morphologically similar looking taxa.

CONCLUSION

We conclude that the Morpho-anatomical findings done on Root, Stem and leaf on selected important medicinal taxa from chittoor district revealed the significant distinction between tissue differentiation, vasculature, xylem and phloem arrangement, calcium oxalate crystals, starch granules, trichomes, and foliar architecture with micrographic information provided taxonomic value for identifying and classifying the desired plant taxon to the other against adulteration.

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