



RESEARCH ARTICLE

STUDY ON ANATOMICAL CHARACTERIZATION OF EXOTIC SPECIES *AMHERSTIA NOBILIS* WALL.

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Abstract

Amherstia nobilis, known as the "Pride of Burma" and colloquially referred to as 'Simshipa-vriksham', is a remarkable and rare tropical tree celebrated in Indian mythology, especially within the context of the epic 'Ramayana'. Often dubbed the 'Queen of Flowering Trees'. The species was named in honour of Lady Sarah Amherst, an early collector of Asian plants, and it stands as the sole representative of its genus. This study involves microscopic examination of various parts of the plant, revealing intricate details about its cellular structure, vascular arrangements, and overall morphology. Mature leaves of *A. nobilis*, for instance, have been analyzed micro-morphologically, with an average leaf area calculated. The leaves are characterized by numerous rubaceous stomata, as hypostomatic. In the leaf midrib, the vascular area appears oval and vascular elements are U-shaped. The leaf lamina flanked by highly cutinized upper and lower epidermis layers. The palisade tissue is bi-layered, while the lower leaf lamina features loosely packed spongy layers with numerous vein bundles and large air spaces and contains starch grains. Histological examination of the rachis reveals an oval shape with a slightly thick-walled epidermis and hypodermis containing air cavities. The vascular region is well-differentiated with xylem elements in linear multiples. The secondary phloem elements possess numerous prismatic crystals and patches of phloem fibers. In the mature stem, periderm formation, with a highly reduced cortical region containing chlorenchymatous cells. The vascular region comprises phloem tissues with patches of phloem fibers. The xylem is with large vessels arranged in linear multiples. The pith is highly reduced with included phloem elements. Wood anatomy reveals the vessels displaying paratracheal parenchyma distribution, appearing as aliform or eyelet type. The vessel elements are arranged in linear multiples, and the radial longitudinal section shows large vessel elements with bordered pits separated by end plates. The bark showed uni- and multi-seriate ray cells, long and narrow phloem parenchyma, and prismatic crystal deposits in phloem ray-parenchyma cells. The parenchyma cells are traversed by numerous phloem fibers, with starch granules deposited in phloem parenchyma. In conclusion, *Amherstia nobilis*, the Pride of Burma, exemplifies a unique combination of aesthetic appeal and complex anatomical structure, making it a subject

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of significant interest in botanical and horticultural research. Detailed histological and anatomical studies provide crucial insights into the species' unique adaptations and structural features, underscoring the need for continued conservation efforts to protect this majestic and rare tropical tree.

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Introduction:-

Introducing the breath taking “Pride of Burma” (*Amherstia*), also known as ‘Simshipa-vriksham’; a stunning and rare tropical tree, holds a special place in Indian mythology. With a captivating history tied to the epic ‘Ramayana’, this majestic tree adds an air of enchantment and charm to any garden or landscape. It is also known as the Orchid Tree, a name otherwise reserved for members of the genus *Bauhinia*. The extravagant flowers are seen hanging from the long inflorescence, or flower stalk, which is a bright crimson red at the end. There are five petals although two of these are minute and the rest are of unequal in size. The common name is, Pride of Burma, Queen-of-Flowering Tree, Orchid Flower and Noble *Amherstia*.

The *Amherstia nobilis* is the only member of the genus *Amherstia*, named after ‘Lady Sarah Amherst’. She was an early collector of Asian plants and was honored with the plant's name after her death. This plant is also called the Queen of flowering trees, which references its incredibly attractive blooms. Perhaps the most beautiful among all tropical flowering trees, the Pride of Burma is best known in the botanical and horticultural world for its exotic-looking blooms and even celebrated as the ‘Queen of Flowering Trees’. The plant species widely cultivated for ornament in the humid tropics, but is very rare in the wild and has only been collected from its native habitat only a few times. It is native to Burma (Myanmar), hence the common name. This plant species was introduced in to Bangladesh, India, Jawa, Malaya, New Guinea and Sri Lanka.

It is an evergreen tree growing around 18 meters tall with a wide, spreading canopy. The young flowers and leaves are sometimes eaten (Barwick, 2004). It is not often found in gardens but is cultivated in botanical gardens in tropical areas. It grows generally at moist, humus-rich, fertile soil in a humid, sunny to partially shaded place (Whistler, 2000). The extravagant flowers are seen hanging from the long inflorescence, or flower stalk, which have a bright crimson red at the end. The ‘Flower of Heaven’, *Amherstia nobilis* Wall., of Fabaceae is a tropical tree with exceptionally beautiful flowers. This species has a symbiotic relationship with certain soil bacteria; form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant and also be used by other plants growing nearby (Huxley, 1992).

Relevance of the Study

The current status of the *Amherstia nobilis* species seeks proper conservational measures for the protection. The histological profile reveals about the peculiar superficial and anatomical characters of the species. The evaluations are essential in describing and tracing various ultrastructure developments of plant parts. The anatomical study helps to identify the diverse nature in relation to their environmental impact.

Objectives of the Study:-

1. To establish an anatomical profile (Microscopy) on leaf characters.
2. To establish an anatomical profile (Microscopy) on leaf petiole characters.
3. To establish an anatomical profile (Microscopy) on leaf rachis characters.
4. To establish an anatomical profile (Microscopy) on stem characters.

Materials And Methods:-

Material:-

Materials were collected from Children’s Municipal Park Kottayam (N 09° 35’ 34.97”, E 076° 31’ 40.71”) Kottayam district in Kerala (Plate-1). The leaf and stem samples were freshly used for the anatomical studies.

Family (Bentham & Hooker): Fabaceae/Leguminosae (Subfamily: Caesalpinioideae). Family (APG): Leguminosae; Habit: Tree; Habitat: Grown as garden plant; Location: All Districts in Kerala; Flower: Red; Fruit: Dry; Distribution: Native of Myanmar, grown as ornamental tree; Local Name (Malayalam): Simshipa-vriksham; Local

Name (English): Pride of Burma, Orchid Tree; Flowering & Fruiting: May-August; Others: It is an Exotic and a Garden plant.

Citation

Amherstia nobilis Wall. in Taylor & Phillips, Philos. Mag. J. 68: 323. 1826; Baker in Hook.f., Fl. Brit. India 2: 272. 1878; Sanjappa, Legumes India 1. 1992; Sasidh., Biodiv. Doc. Kerala- Fl. Pl. 151. 2004.

Description:

Young parts puberulent. Leaves paripinnate, alternate; rachis 20-34 cm long, stout, pulvinate, glabrous; stipules 2.5 cm long, intra petiolar, ovate-lanceolate; leaflets 8-14, opposite, 10-25 cm x 4-6 cm, ovate, ovate-lanceolate, oblong or elliptic-oblong, base obtuse, apex acuminate, glaucous beneath; lateral nerves 7-20 pairs, pinnate, prominent; petiolule to 10 mm long, stout. Flowers bisexual, yellowish-red, in drooping terminal panicles to 60 cm long; pedicels to 7 cm long; bracts and sepals bright red; bracts to 6 cm long, ovate. Calyx tube to 4 cm long, lobes rolled to back. Petals 4.5-7.5 cm long; mixed reddish and yellow. Stamens 9, tube to 4 cm long, filaments alternately long and short, curved back; anthers dimorphic. Ovary pubescent, stipe to 1 cm long; style curved; stigma capitate. Fruit a pod, 15-20 x 3.5-4 cm, oblong, brown, compressed; seeds 3-6, young fruit red. Fruit setting is not common.



Plate1:- The habit and inflorescence with open flower of *Amherstia nobilis* Wall.

Methods:-

Mature leaves were collected for analyzing the micro-morphology and average leaf areawere calculated by using graph paper. Anatomical studies: The distribution of different histological layers of cells like epidermis, cortex, vascular bundles, pith, etc., was observed from the microscopic examination. All the sections were observed and images were taken by using Magnus MLXi Plus microscope and Magnus camera adapter.

Anatomical studies of Leaf, Petiole, Rachis and Stem.

Anatomical specimen preparation methods could be a simple but comprehensive way. So that no plant could be kept away from exploring the anatomical diversity (Vigi and Hari, 2021).

The transverse sections of the midrib, lamina, petiole and stem were taken. The micro-preparations were observed under the microscope. To prepare paradermal sections of leaf, 3 cm² sized portion from the lamina including leaf margin were stained by using safranin in 50% alcohol for about 2 minutes.

Handmade sections of leaf lamina, midrib, petiole, rachis and stem were stained in 1% safranin and washed in 50% alcohol to remove the excess stain. The microscopic observations through the transverse section, radial longitudinal section and tangential longitudinal section of the stem were done, using the same staining procedure. Sections were mounted in 50% glycerine. All the samples were analysed using Magnus MLXi Plus microscope. The terminology followed to describe are International Association of Wood Anatomists.

Results:-

The following table shows the organoleptic characters of *Amherstia nobilis* Wall. For the easy identification of plant, primarily organoleptic evaluation was done in easiest and fastest way.

Table1:- Organoleptic characteristics of *Amherstia nobilis* Wall.

Characters	<i>Amherstia nobilis</i> Wall.
Colour	Green
Shape	ovate-lanceolate
Odour	No odour
Texture	Smooth
Apex	Acuminate
Base	Obtuse
Margin	Paripinnate
Venation	Reticulate
Petiole	Petiolate

The leaf area measured using five replicates and the average leaf area was 8646 mm².

Stomata were numerous in number and rubiaceous (Paracytic). Stomata were confined to abaxial surface-Hypostomatic. The LM analysis showed protruding stomata and having ellipsoid shape.

Anatomy of Midrib.

The Midrib is Plano-convex and shows thick cuticle. The lower and upper epidermis is clearly differentiated. The overall vascular area becomes an oval in shape. The cortex is highly reduced. The vascular zone is delimited with endodermis and inner to the endodermis, a complete ring of sclerenchymatous layer is present. The vascular elements are appeared as U-shaped nature. The radial bands of xylem elements are prominent and the phloem is comparatively reduced in nature. The midrib showed the parenchymatous medulla (Plate-2).



Plate 2:- Anatomy of leaf midrib in *Amherstia nobilis* Wall.

Anatomy of Leaf Lamina.

The micro section of midrib showing thick cuticle. The upper and lower side showed the uni-layered narrow epidermis. The midrib vasculature is oval shaped. The vascular cylinder showing a continuous layer of endodermis. Inner to the endodermis, a few layered sclerenchymatous cells. The phloem elements were arranged in between the xylem. The xylem elements are seen as radial bands. The vascular tissues over all appeared as 'U-shaped'. The section showing a thick parenchymatous medulla. The cortex become highly reduced (Plate-3).

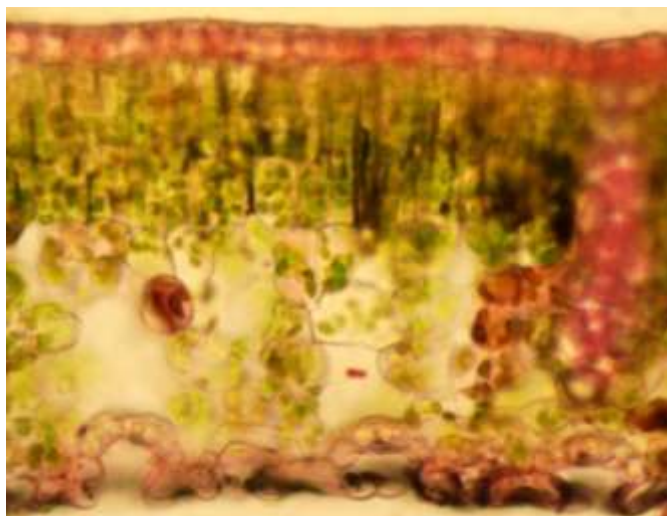


Plate 3:- Anatomy of leaf lamina in *Amherstia nobilis* Wall.

The leaf lamina become moderately wide in appearance and is limited with lower and upper epidermis, and is highly cutinised. The palisade tissue become bi-layered and are highly pigmented. The lower side of leaf lamina showed loosely packed spongy layers traversed with numerous vein bundles. The spongy layer possesses numerous large air spaces. The spongy parenchyma showed the deposition of starch grains. The lower epidermis showed stomatal openings and are slightly sunken nature (Plate-4).

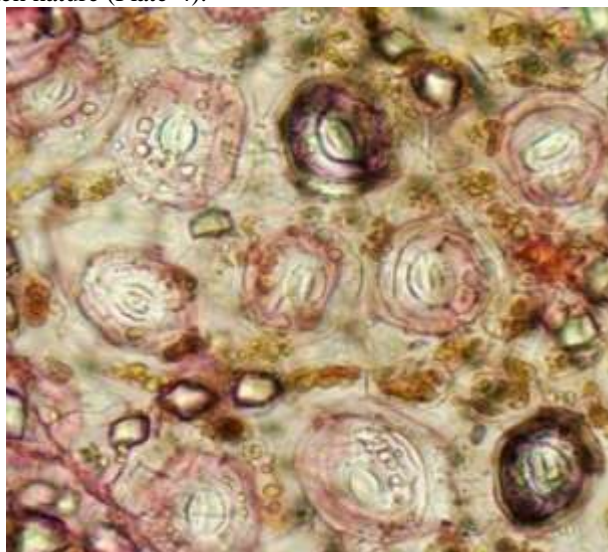


Plate4:- The anatomical structure of stomata in *Amherstia nobilis* Wall.

The stomatal peeling of the lower epidermis showed rubiaceous stomata. The stomatal unit showed stomatal pore and are guarded by two subsidiary cells. The epidermal cells showed the deposition of numerous prismatic crystals (Plate-4).

Anatomy of Petiole.

The transverse section showed an almost round structure with large cortex and a central vascular cylinder, appears as 'horse shoe' shaped. The outer region with a narrow epidermis and slightly thick-walled hypo dermis. The vascular region showed a thick layer of endodermis. The vascular bundle become bi-collateral. The bundles showing both the primary and secondary phloem elements and the outer region possesses numerous phloem fibers. The narrow-radial bands of xylem tissues were present. The medulla become somewhat reduced in appearance. The vast cortex composed of thin-walled parenchyma cells and are having enormous number of prismatic crystals (Plate-5).

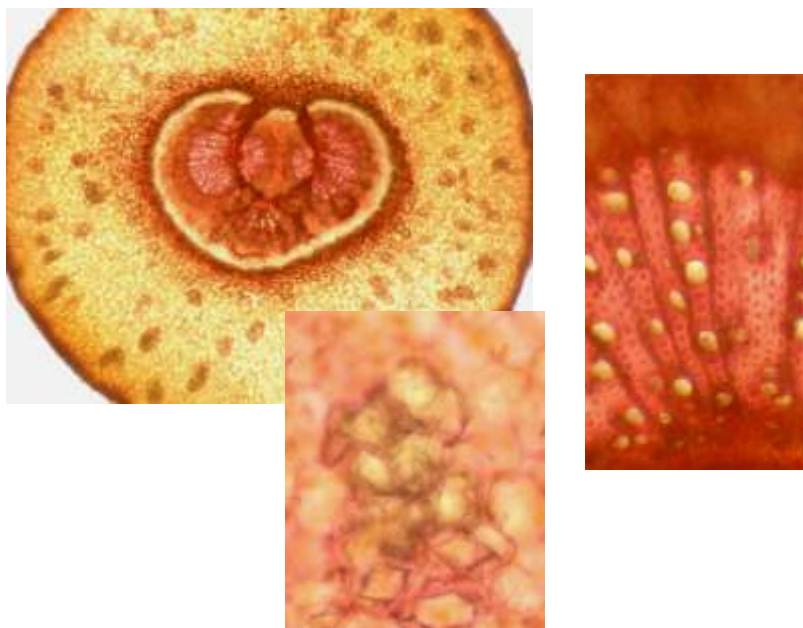


Plate 5:- The anatomical structure of leaf petiole in *Amherstia nobilis* Wall.

Anatomy of Rachis.

The cross section of rachis shows an oval shape. The epidermis and hypodermis were slightly thick walled with air cavities. The cortex is highly reduced in nature. The vascular region is delimited with an endodermis. The xylem elements are more differentiated with linear multiples of xylem vessels and are moderately large. The secondary xylem area was traversed with wider medullary rays. The secondary phloem elements are outer to the xylem with numerous prismatic crystals and the outer region showing patches of phloem fibers. The pith with parenchyma cells and are slightly thick walled. The outer rim of pith shows intruded primary phloem elements (Plate-6).

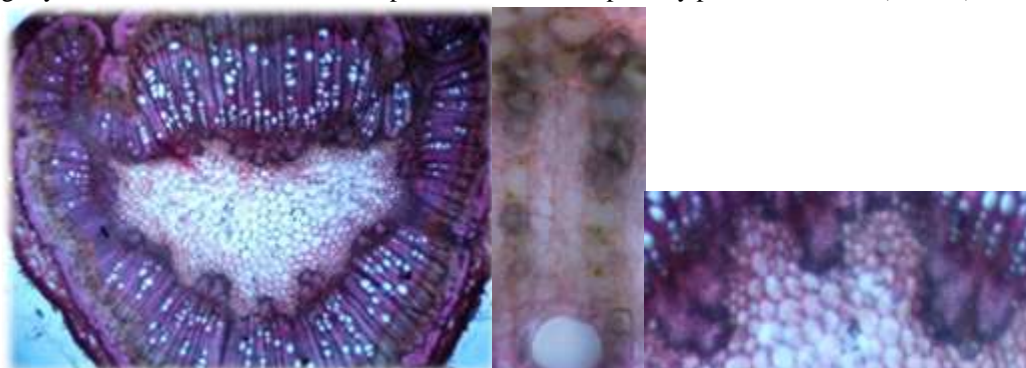


Plate 6:- The anatomical structure of leaf rachis in *Amherstia nobilis* Wall.

Anatomy of Stem.

The transvers section of mature stem showing the periderm formation. It possesses the outer phellum, middle phellogen and inner phelloderm. The cortical region was highly reduced and having chlorenchymatous cells. The outer vascular region possesses both the secondary and primary phloem tissues. The outer region of phloem showing patches of phloem fibers. The secondary xylem is wide and possesses large vessels and are Lenier multiples. The primary xylem elements were present at the inner most region. The medullary rays are slightly dilated in nature. The pith is highly reduced and showed the included phloem elements (Plate-7).

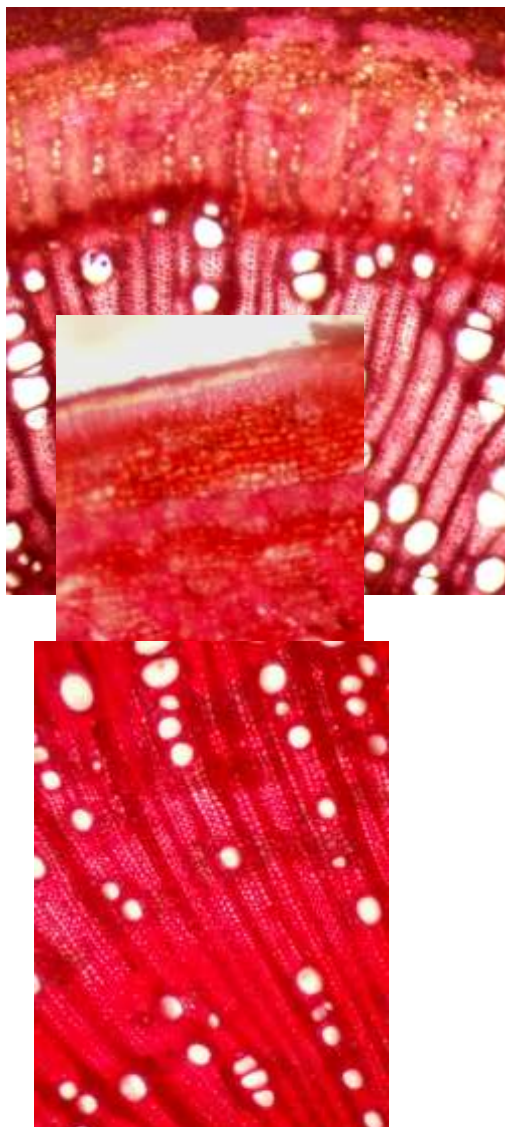


Plate 7:- Anatomy of stem in *Amherstia nobilis* Wall.

Wood anatomy.

The wood anatomy showed the stelar and extra-stelar thickenings. The xylem area showing vessels with paratracheal parenchyma distribution and is aliform/eyelet type. The vessel elements appear are linear multiples. The radial longitudinal section of the wood showing large vessel elements. Each vessel elements with bordered pit and are separated with end plate. The transverse longitudinal section showing the ray cells and are uni and multi-seriate. The narrow and long phloem parenchyma is present. The phloem parenchyma showed the deposition of numerous prismatic crystals. The phloem ray-parenchyma cells showed the deposition of starch granules. The parenchyma cells were traversed with numerous phloem fibers (Plate-8).



Plate 8:- Wood anatomy and R.L.S. & T.L.S. of stem in *Amherstia nobilis* Wall.

Discussion:-

Anatomical Characters of Leaf.

Stomata is rubiaceous and were confined to abaxial surface-Hypostomatic. The protruding stomata having ellipsoid shape. The midrib is Plano-convex and cortex is highly reduced. The vascular elements appeared as U-shaped. The radial bands of xylem. The midrib showed the parenchymatous medulla. The leaf lamina become moderately wide in appearance and palisade tissue become bi-layered and are highly pigmented. The spongy layer with numerous large air spaces and the deposition of starch grains. The lower epidermis showed slightly sunken stomata. The epidermal cells with numerous prismatic crystals. The foliar anatomical characters like cuticular striations, nature of epidermal cells, stomatal types, type of trichomes, restricted distribution of non-living inclusions are having systematic value at specific and familial level (Dickson, 1975). Presence of stomata, mucilage cells in the epidermis, indumentum on the leaf surface and distribution of prismatic crystals etc., are the prominent anatomical identification tools in systematics (Metcalf & Chalk, 1950).

Anatomical Characters of Petiole and Rachis.

The petiole with large cortex and central vascular cylinder, as 'horse shoe' shaped. The narrow epidermis and slightly thick-walled hypodermis. The vascular bundle become bi-collateral. The secondary phloem with phloem fibers and the narrow-radial bands of xylem. The medulla become reduced and the cortex having prismatic crystals. The rachis become oval shaped. The cortex is highly reduced. The linear multiples of xylem vessels and with wider medullary rays. The secondary phloem with numerous prismatic crystals and fibers. The pith shows intruded primary phloem elements. The petiole/rachis anatomy, especially the type of vascular system, is of considerable taxonomic importance, since its structure is least affected by the environment (Metcalf & Chalk, 1950).

Anatomical Characters of Stem/Wood.

The stem showed the periderm formation. The phloem showing fibers. The secondary xylem is wide and possesses large vessels and are linear multiples. Each vessel elements with bordered pits. The xylem tissue with paratracheal parenchyma distribution. The medullary rays are slightly dilated in nature. The pith with included phloem elements. The ray cells are uni and multi-seriate. The phloem parenchyma showed the deposition of prismatic crystals, phloem fibers and starch granules. Conserved characters with systematic affinities mainly reside in the stem anatomy, especially in the secondary xylem components (Carlquist, 2013). Presence of simple perforation plate, vessel pitting, and paratracheal parenchyma, uniseriate or rarely biseriate homogenous rays mainly composed of procumbent cells and libriform fibres with simple pits are the constant anatomical features of many family (Klassen, 1999).

Summary And Conclusion:-

In conclusion, *Amherstia nobilis*, the Pride of Burma, exemplifies a unique combination of aesthetic appeal and complex anatomical structure, making it a subject of significant interest in botanical and horticultural research. Detailed histological and anatomical studies provide crucial insights into the species' unique adaptations and structural features, underscoring the need for continued conservation efforts to protect this majestic and rare tropical tree. This study reveals the potentialities of stem, petiole, rachis and leaf anatomy that can be used as an aid for taxonomical identification of this species. This is the first of its kind and detailed report on the anatomy and micromorphology of *Amherstia nobilis* from Kerala. Further, in future more descriptive and comparative anatomical studies are recommended for taxonomical identification of plant species in its natural habitat.

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