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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/19068
DOI URL: http://dx.doi.org/10.21474/IJAR01/19068

RESEARCH ARTICLE

STUDY ON ANATOMICAL CHARACTERIZATIONOF *RHINACANTHUS NASUTUS* (L.) KURZ

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Manuscript Info

Manuscript History
Received: 15 May 2024
Final Accepted: 18 June 2024
Published: July 2024

Key words: -
Leaf Anatomy, Petiole Anatomy, Stem Anatomy, *Rhinacanthus nasutus*.

Abstract

Rhinacanthus nasutus (L.) Kurz, belonging to the family Acanthaceae, is an herbaceous shrub. This plant holds significant value in traditional medicine. The leaves of *R. nasutus* are commercially available as "tea bags," marketed as a natural remedy for various ailments. However, the conservation status of *R. nasutus* necessitates appropriate protective measures to ensure its sustainability. Anatomical studies provide various histological layers, including the epidermis, cortex, vascular bundles, and pith. The leaves feature numerous diacytic stomata and hypostomatic nature. The leaf midrib exhibits a narrow epidermis with numerous glandular hairs. The medulla contains arc-shaped vascular bundles and lateral accessory bundles, with the stele comprising linear xylem elements towards the inner side and phloem elements on the outer region. Transfusion tracheids are present between the palisade and spongy cells, with tissues containing large quantities of oil droplets. The petiole shows a narrow epidermis with numerous glandular hairs. The vascular region features a V-shaped stele. The stem reveals the stelar region is extensive and the inner region is rich in developed xylem elements with linear multiple vessels. The medullary ray cells are narrow, and the pith region displays intruded primary xylem with thick-walled parenchyma cells. Wood anatomical analysis shows xylem parenchyma cells that are paratracheal. The vessel elements possessing perforation plates and transverse walls with bordered pits. Tracheids have a narrow lumen, and the lateral walls contain simple pits. The wood demonstrates multiseriate ray parenchyma and the bark consists of phloem rays and narrow fibers. In conclusion, *R. nasutus* exhibits a variety of histological and anatomical characteristics that support its traditional medicinal uses. The detailed anatomical studies contribute to understanding the plant's structural adaptations and potential environmental interactions, thereby facilitating its identification and utilization in herbal medicine. The conservation of this species is critical to preserving its medicinal value and ensuring its availability for future research and therapeutic applications.

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Introduction:-

Rhinacanthus nasutus (L.) Kurz coming under the family Acanthaceae, is an herbaceous shrub native to Thailand and much of South and Southeast Asia. Rhinacanthus genus comprising of about 25 species belongs to the family Acanthaceae and distributed throughout tropical and subtropical regions Bukke et al (2011).

Several reports have revealed the folklore and traditional medicinal practices using Rhinacanthus ranging from antioxidant, antimicrobial to anticancer and neuroprotectant.The leaves are available to the public for purchase in the form of "tea bags" as a natural herbal remedy for a long list of disorders, including diabetes, skin diseases, gastritis, raised blood pressure, improved blood circulation, early-stage tuberculosis antitumor activity, and as an antipyretic.Traditionally seeds, roots and leaves of the plant have been used against scabies, eczema and various skin conditions. Leaves are used for prickly heat as well as scurf, and roots are being boiled along with milk and used as an aphrodisiac. A decoction of roots is used as an antidote for snake bites.Rhinacanthus 'Snake Jasmine' is natures awesome antioxidant. Because it's rare for snake plants to bloom indoors, a snake plant flower symbolizes prosperity.Plant described in this manuscript have had their names checked at 'The Plant List'.The plant has neuroprotective properties, with potential for the treatment of Alzheimer's and aneurysm patients. The crude extract or its active components have both shown potential for reducing neuroinflammation and providing protection against reperfusion injury.Traditionally the extracts from Rhinacanthus have been used for the treatment of skin infections with fungi, such as ringworm and tinea cruris Ponglux (1987).

Relevance of the Study

The current status of the *Rhinacanthus nasutus*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 stem characters.

Materials and Methods:-

Material:-

Materials were collected from VyaskaraKunnu, Kottayam (N 09^0 35' 15.07", E 076^0 31' 15.33")Kottayam district in Kerala (Plate-1). The leaf and stem samples were freshly used for the anatomical studies.
Family (Bentham & Hooker): Acanthaceae; Family (APG): Acanthaceae.
Habit: Shrub; Habitat: Wet areas in moist deciduous forestsalso in the plains.
Location: All Districts in Kerala; Flower: White; Fruit: Dry; Distribution: Tropical Asia.
Local Name (Malayalam): Kottipoo, Nagamulla, Orukaalmudanthi, Pushpakedal, Vellakkurunji.
Local Name (English): Snake jasmine, Dainty Spurs; Flowering & Fruiting: November-February.
Others: It is a Medicinal plant.

Citation:

Rhinacanthus nasutus (L.) Kurz, J. Asiat. Soc. Bengal 39: 79. 1870; Sunil, Fl. Pl. Diver. Ernakulam Dist. 302. 2016.

Description:

Erect shrubs, stem terete, tomentose. Leaves simple, opposite, 8-12 x 4-8 cm, elliptic, acute at both ends, crenulate, minutely pubescent; nerves 7-10 pairs. Flowers in terminal, panicled cymes; bracts and bracteoles similar, 2 mm long, hispid. Calyx lobes 5, 5 mm long, linear-lanceolate, hispid. Corolla white, tube 25 mm long, slender, hispid; upper lip entire, oblong, acuminate; lower lip broad, 3-lobed, obtuse. Stamens 2, inserted near the throat of the tube, equal; one anther lobe lower than other, glabrous. Ovary cell 2-ovuled, style slender. Capsule 2 cm long, clavate, with a lower solid slender stalk, glabrous; seeds 1 or 2 in each cell, rugose.

Plate 1:- Habit and Inflorescence with open flower of *Rhinacanthus nasutus* (L.) Kurz.

Methods:-

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.

Anatomical studies of Leaf, Petiole 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, stained with safranin and mounted in glycerine. The micro-preparations were observed under the microscope. The epidermal peel was taken to prepare paradermal sections of leaf, 3 cm^2 sized portion from the middle part of leaf including leaf margin. Peeled off leaf surfaces were stained with safranin in 50% alcohol for about 2 minutes.

Handmade sections of leaf lamina, midrib, petiole and stem were stained in 1% safranin and washed in 50% alcohol to remove the excess stain. The microscopic observations through theT.S., R.L.S. andT.L.S. of the stem were done, using the same staining procedure. The terminology used by following International Association of Wood Anatomists.

Results:-

Organoleptic Characters of Leaf.

The following table shows the organoleptic characters of *Rhinacanthus nasutus* (L.) Kurz.For the easy identification of plant, primarily organoleptic evaluation was done in easiest and fastest way.

Table1:- Organoleptic characteristics of *Rhinacanthus nasutus* (L.) Kurz.

Characters	***Rhinacanthus nasutus* (L.) Kurz.**
Colour	Green
Shape	Elliptic
Odour	No odour
Texture	Minutely Pubescent
Apex	Acute
Base	Acute
Margin	Crenulate
Venation	Reticulate
Petiole	Petiolate

Stomata were numerous in number and caryophyllaceous (Diacytic).Stomata were confined to abaxial surface-Hypostomatic. The LM analysis showed stomata were in the same plane of epidermal cells and having ellipsoid shape.

Anatomy of Midrib.

The midrib of leaf shows narrow epidermis and having numerous glandular hairs. The cortex is moderately large and composed of homogenous parenchymatous tissue. It shows small cells at the outer region and inner portion with large angular parenchyma cells. The medulla having arc-shaped vascular bundles and also accessory bundles at the lateral sides. The stele consists of linear xylem elements towards inner side and outer region with phloem elements (Plate-2).

Plate 2:- The anatomy of leaf midrib in *Rhinacanthus nasutus* (L.) Kurz.

Anatomy of Leaf Lamina.

The lamina shows large upper and lower epidermis with thick cuticle. The lower epidermis appears as crusted with numerous stomata. The inner portion is clearly differentiated with palisade and spongy tissues. The transfusion tracheids were present between the palisade and spongy cells. The tissues were deposited with large quantities of oil droplets. The abaxial side of the leaf showed diacytic stomata and are slightly pigmented. The epidermal peel showed fimbriated epidermal cells (Plate-3).

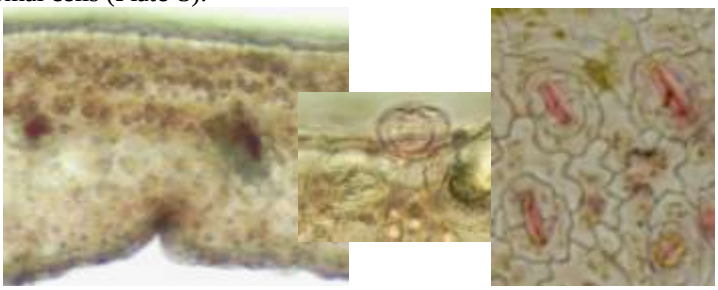


Plate 3:- The anatomy of leaf lamina and stomata in *Rhinacanthus nasutus* (L.) Kurz.

Anatomy of Petiole.

The transverse section of petiole showed narrow epidermis and it possess numerous glandular hairs. The hypodermis composed of wide layer of collenchymatous tissue and cortex composed of pigmented parenchyma cells. The vascular region showed the endodermis and V-shaped stele. The stele consists of linear xylem and outer phloem elements. The posterior side of the cortex having two accessory bundles. The medulla composed of prosenchymatous tissue (Plate-4).

Plate4:- The anatomy of leaf petiole in *Rhinacanthus nasutus* (L.) Kurz.

Anatomy of Stem.

The transverse section of stem showed periderm at the outer region and a narrow-pigmented cortex. The stelar region become large in appearance and is delimited with an endodermis. The outer region of vascular area possesses primary and secondary phloem tissue. The inner region consists of highly developed xylem elements and having linear-multiples of vessels. The medullary ray cells are narrow in appearance. The pith region showed intruded primary xylem. The parenchyma cells are thick walled at the centre (Plate-5).

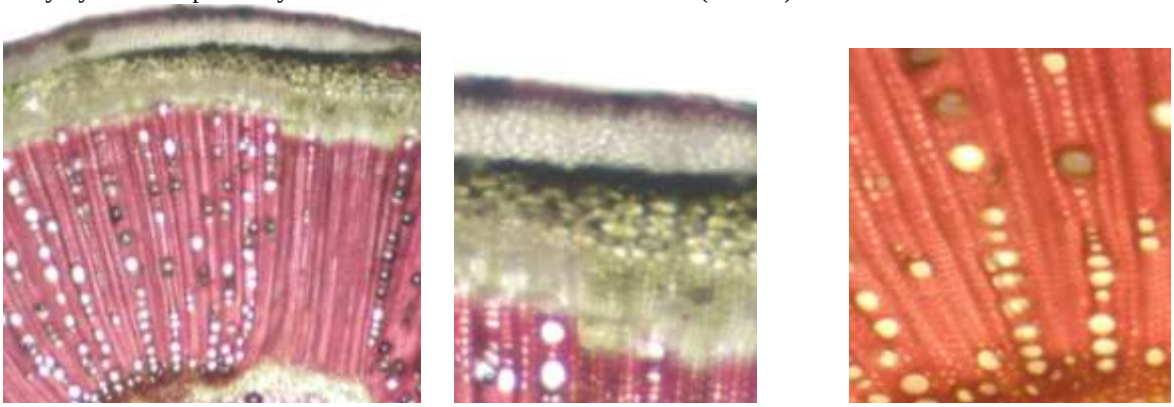
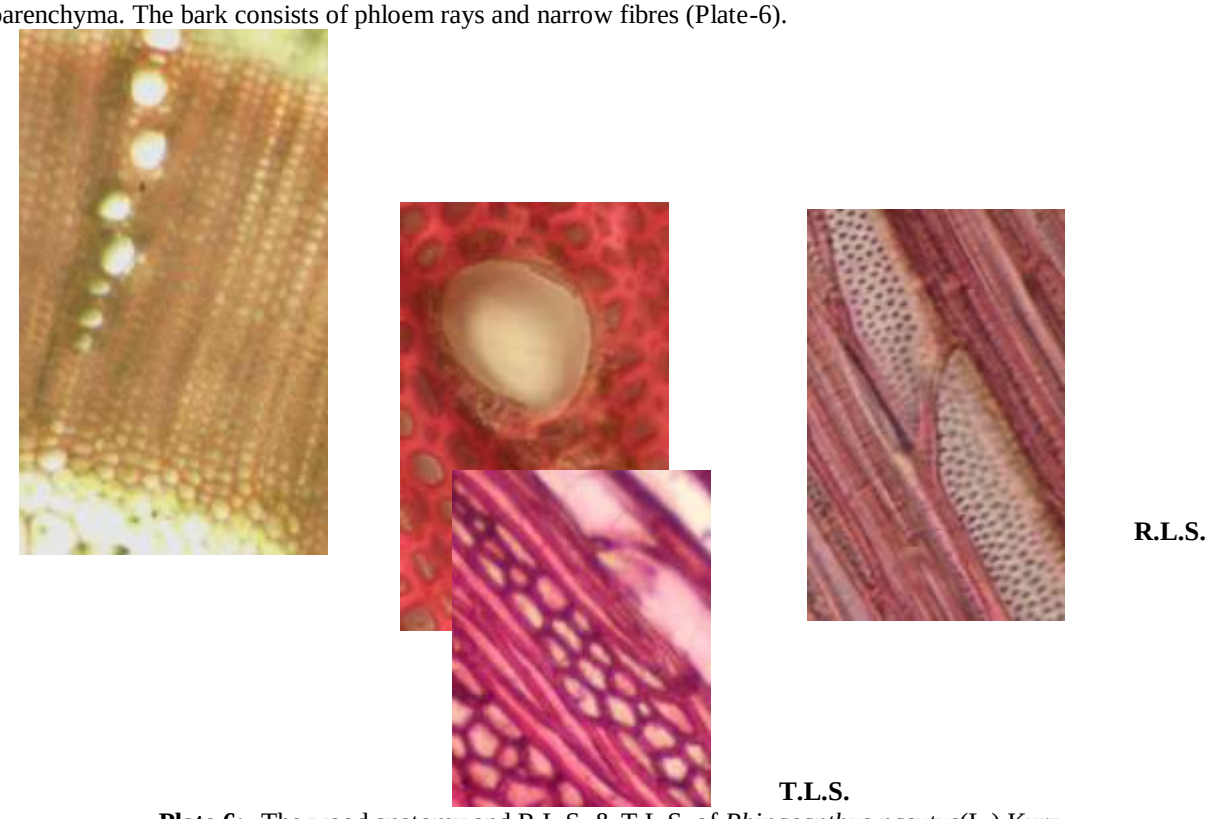


Plate 5:- The anatomy of stem in *Rhinacanthus nasutus* (L.) Kurz.

Wood anatomy.

The wood showed linier arrangement of vessel elements and having numerous xylem parenchyma cells and are paratracheal in appearance. The radial longitudinal section (RLS) showed elongated vessels and tracheids. The vessel elements with perforation plates and the transvers walls with bordered pits. The tracheids with narrow lumen and the lateral wall consist of simple pits. The transverse longitudinal section (TLS) showed the multi-seriate ray parenchyma. The bark consists of phloem rays and narrow fibres (Plate-6).



R.L.S.

T.L.S.

Plate 6:- The wood anatomy and R.L.S. & T.L.S. of *Rhinacanthus nasutus*(L.) Kurz.

Discussion:-

Anatomical Characters of Leaf.

Stomata are caryophyllaceous andhypostomatic,and epidermal cells are ellipsoid in shape.The midrib having glandular hairs. The medulla having arc-shaped vascular bundles and accessory bundles. The stele consists of linear xylem elements towards inner side and outer region with phloem elements.The lower epidermis appears as crusted with numerous stomata.The transfusion tracheids were present between the palisade and spongy cells. The tissues were deposited with oil droplets. The epidermal peel showed fimbriated epidermal cells.The stomatal type is one of the important leaf epidermal characters constants within the genus and therefore has a high diagnostic value (Metcalfe and Chalk, 1950). Leaf epidermal features were studied in Fabaceae (Alege and Shaibu, 2015), with the major objective of evaluating the systematic and phylogenetic relevance that could be used to resolve systematic and phylogenetic problems.

Anatomical Characters of Petiole.

The showed narrow epidermis and numerous glandular hairs. The hypodermis with collenchymatous tissue and cortex composed of pigmented parenchyma cells. The vascular region become V-shaped. The stele consists of linear xylem and outer phloem. The posterior side of the cortex having two accessory bundles. The medulla composed of prosenchymatous tissue.Petiole anatomy is considered a systematically important characteristic as it is less liable to environmental variation (Dickison, 2000; Talip et al., 2017). Petiole with a cordate outlineand two laterally extended leaf trace bundles also act as an identification tool (Solereder, 1908).

Anatomical Characters of Stem/Wood.

The stem showed periderm and a narrow-pigmented cortex. The xylem elements having linear-multiples of vessels and medullary ray cells are narrow. The pith region showed intruded primary xylem and the parenchyma cells are thick walled at the centre.The wood showed linier arrangement of vesselsand xylem parenchyma cells are paratracheal. The vessel elements with perforation plates and the transvers walls with bordered pits. The tracheids with narrow lumen and the lateral wall consist of simple pits. The multi-seriate ray parenchyma is present. The bark consists of phloem rays and narrow fibres.A detailed study had been made of several wood features that are presented in numerical codes taken from the IAWA Hardwood (1989) and Softwood (2004) Lists of microscopic features for wood identification (Gasson et al., 2011).

Summary and Conclusion:-

In conclusion, **Rhinacanthus nasutus** exhibits a variety of histological and anatomical characteristics that support its traditional medicinal uses. The detailed anatomical studies contribute to understanding the plant's structural adaptations and potential environmental interactions, thereby facilitating its identification and utilization in herbal medicine. The conservation of this species is critical to preserving its medicinal value and ensuring its availability for future research and therapeutic applications.This study reveals the potentialities of stem, petiole and leaf anatomy that can be used as an aid for taxonomical identification of *Rhinacanthus nasutus* species.

References:-

1. **Akinsulirea**, O. P., Oladipoa, O. T., Akinkunmib, O. C., Adeleyea, O. E., &Akinloyea, A. J. (2020). On the systematic implication of foliar epidermal micro-morphological and venational characters: diversities in some selected Nigerian species of Combretaceae. Acta BiologicaSlovenica, 63, 1.
2. **Alege**, G. O. & D.O. Shaibu. 2015. Phylogenetic and Systematic Value of Leaf Epidermal Characteristics in some Members of Nigerian Fabaceae. International Journal of Applied Sciences and Biotechnology, 3(2): 301–307.
3. **Arber**, A.1950.The natural philosophy of plant form. Cambridge university press, Cambridge.
4. **Baretta- Kuipers**., T. 1976. Comparative wood anatomy of Bonnetiaceae, Theaceae and Guttiferae. Institute of Systematic Botany, Utrecht, the Netherlands, 438(1): 76-101. ISSN-2352-5754.
5. **Barwick** M. (2004). Tropical and Subtropical Trees-A Worldwide Encyclopedic Guide. Thames and Hudson, London.
6. **Bryan**, G.B. & M.D. James.2008. Plant structure-A colour guide. 2ndEd.Manson Publishing Ltd.
7. **Bukke** S., Raghu P.S., Sailaja G., & Kedam T.R. (2011). The study on morphological, phytochemical and pharmacological aspects of *Rhinacanthus nasutus*. (L) kurz (A review) J. Appl. Pharm. Sci.; 1:26–32.
8. **Carlquist**, S. (2013). Comparative wood anatomy: systematic, ecological, and evolutionary aspects of dicotyledon wood. Springer Science & Business Media.

9. **Dickison**, W. C. (1975). The bases of angiosperm phylogeny: vegetative anatomy. Annals of the Missouri Botanical Garden, 590-620.
10. **Dickison**, W. C. (2000). Integrative plant anatomy. Aca demic Press.
11. **Eames**, A. J. 1961. Morphology of the Angiosperms. New York: Mc Graw Hill.
12. **Esau**, K. 1979. Anatomy of the seed plants. 2nd Ed. New York, John Wiley, and Sons.
13. **Gasson**, P., Baas, P., & E.Wheeler. 2011. Wood anatomy of CITES-listed tree species. IAWA Journal, 32(2):155– 198.
14. **Huxley** A. (1992). The New RHS Dictionary of Gardening. MacMillan Press.
15. **IAWA** Committee. 1989. IAWA list of microscopic features for hardwood identification. In: Wheeler, E.A.; Baas, Gasson, P., eds. IAWA Bull. 10. ISSN: New Series 10(3): 219–332.
16. **IAWA** Committee. 2004. IAWA list of microscopic features of softwood identification. In: Richter, H.G.; Grosser, D.; Heinz, I.; Gasson, P., eds. IAWA Journal. 25(1): 1–70.
17. **Maguire**, B. 1972. Bonnetiaceae. In The Botany of the Guayana Highland 9. Mem. N.Y. bot. Gdn 23: 131-165.
18. **Metcalfe**, C. R., & Chalk, L. (1950). Anatomy of the Dicotyledons: leaves, stem, and wood, in relation to taxonomy, with notes on economic uses. Anatomy of the Dicotyledons: leaves, stem, and wood, in relation to taxonomy, with notes on economic uses.
19. **O'Brien**, T.P. &K.V.Thiman. 1965. Histological studies of the Coleoptile I. tissue and cell types in the coleoptile tip. Am.J.Bot.52:910-918.
20. **Priya**, C., & Hari, N. (2018). A study on leaf and petiole anatomy of endemic and vulnerable species of
21. Garcinia. Life Sciences International Research Journal 5 (2), 104-109.
22. **Ponglux**D. (1987). Medicinal Plants. Committee; Bangkok, Thailand:International Congress on Natural Products.
23. **Rao** P.V., Madhavi K., & Naidu M.D. (2011). Hypolipidemic properties of *Rhinacanthus nasutus* in streptozotocin induced diabetic rats. J. Pharmacol. Toxicol.; 6:589–595.
24. **Solereder**, H. (1908). Systematic Anatomy of the Dicotyle dons A Handbook for Laboratories of Pure and
25. Applied Botany. Volume 1. Clarendon Press.
26. **Talip**, N., Cutler, D. F., Puad, A. A., Ismail, B. S., Ruzi, A. R. &Juhari, A. A. (2017). Diagnostic and systematic sig nificance of petiole anatomy in the identification of Hopea species (Dipterocarpaceae). South African Journal of Botany, 111, 111-125. https://doi.org/10.1016/j.sajb.20 17.03.008
27. **Vigi** George M., & Hari N. (2021). Three simple methodologies for the microanatomical study of dicot leaf samples. International Journal of Botany Studies 6 (6), 142-144.
28. **Whistler** W. Arthur (2000). Tropical Ornamentals: A Guide. Timber Press Inc. Oregon.
29. **Wilkinson**, H.P.1979. The plant surface. In: Anatomy of the dicotyledons.C.R. Metcalfe and L. Chalk (eds).
30. Oxford: Clarendon 97-165.

Webliography:

http://www.theplantlist.org
http://eflorakerala.com