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RESEARCH ARTICLE

STUDY ON ANATOMICAL CHARACTERIZATION OFCLERODENDRUM QUADRILOCULARE (BLANCO) MERR

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Abstract

Clerodendrum quadriloculare (Blanco) Merr., commonly called as the bronze-leaved Clerodendrum, shooting star, or Starburst bush, is native to New Guinea and Philippines. It coming under the family Lamiaceae.Traditionally, C. quadriloculare is used in Filipino folk medicine. Despite its traditional medicinal use, systematic anatomical studies on the plant are limited. Investigating its anatomical featuresare crucial for authenticating traditional claims, preventing adulteration, and distinguishing sibling species. Microscopic examination of *C. quadriloculare*reveals distinct superficial and anatomical characteristics. The leaf anatomy shows lower lamina comprises starch grains. The leaves exhibit anomocytic stomata. Numerous glandular dots are present on the epidermal peel. The midrib shows a thick cuticular epidermis with glandular hairs. The medulla features vascular bundles, with the outer phloem region having fibrous bands. The pith consists of small prismatic crystals. The petiole's anatomy includes a thick-walled epidermis and numerous glandular trichomes. The vascular bundleswith brachysclereids as bundle caps. The stem's transverse section reveals an outer periderm with lenticels. The outer edge of the secondary phloem contains fibers. The xylem vessels are linearly arranged and uni-bi seriate, with the presence of xylem parenchyma and fibers. The pith is thick-walled, with primary bundles intruding into it. The wood highlights tracheids and large vessel elements, with lateral vessel walls featuring bordered pits. The bark is well-deposited with starch granules. In conclusion, the anatomical study of *C. quadriloculare* provides a comprehensive understanding of its internal structure, contributing to the scientific validation of its traditional medicinal uses. The findings highlight the plant's complex histological features, which are essential for its identification, potential medicinal applications, and conservation. This research underscores the importance of anatomical profiling in authenticating traditional knowledge and protecting valuable plant species from adulteration and misidentification.

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Introduction:-

Clerodendrum quadriloculare(Blanco) Merr., is native to New Guinea and Philippines. It is one of the species early included in the family Verbenaceae, but recently shifted to the Lamiaceae based on molecular studies.*C. quadriloculare* known as bronze-leavedspecies,shooting star or Starburst bush, occurring as a fast-growing monoecious shrub; seen as a small standard tree and produces suckers. The young stems are almost quadrangular in shape. The canopy become compact during full sun and the limbs were thin and widely spreading in shade.

Clerodendrum quadriloculare, named as bagawakmorado and the decoction of leaves were used to relieve abdominal pain in folklore.*C. quadriloculare* decoction of leaves is used for inflammatory conditions in folklore.The potential use of *C. quadriloculare*used as a safe and effective material for treatment of smooth muscle spasm.Among the several traditional claims, the usefulness of *C. quadriloculare* in stomach pain had been emphasized on the compilation of the ethnopharmacological uses.In Philippines, the plant parts currently used as alternative medicine for indigestion and stomach pain. Five or more leaves are boiled in water; decoction is taken half a cup twice daily. The bark from the plant is juiced and taken for stomach ache and gas pains.

Hence, it was considered that investigations for these medicinal properties, the anatomical profile maygive scientific authentication to the traditional claims and overcoming the adulterant and/or sibling species. Moreover, this plant has not been subjected to any systematic anatomical screening.

Relevance Of the Study

The current status of the 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 petiole characters.
3. To establish an anatomical profile (Microscopy) on stem characters.

Materials and Methods:-

Materials:-

Materials were collected from C M SCollege Campus, Kottayam (N 09^0 35’ 49.35”, E 076^0 31’ 13.38”) Kottayam district in Kerala (Plate-1). The leaf and stem samples were freshly used for the anatomical studies.
Family (Bentham & Hooker): Verbenaceae; Family (APG): Lamiaceae.
Habit: Shrub; Habitat: Grown as garden plant; Location: All Districts in Kerala;
Flower: White; Distribution: Native of New Guinea, Philippines.
Local Name (English): Starburst, Shooting stars; Flowering & Fruiting: October-April.
Others: It is an Exotic and a Garden plant.

Citation:

Clerodendrum quadriloculare (Blanco) Merr., Philipp. Gov. Lab. Bur. Bull. 35:63. 1905.

Description:

Large shrubs. Leaves simple, opposite, 12-20 cm x 5-10 cm; ovate to oblong, cordate at base and acute at apex; margins slightly wavy, dark green and dark brown beneath; lateral nerves ca. 5 pairs, arcuate and joining intramarginally. Flowers in terminal globose cymes, 10-20 cm across; peduncle to 1 cm long. Calyx lobes 1.5 mm long and narrowly triangular. Corolla tube become narrow 5-8 cm long; coral-pink; the lobes white, linear-oblong to 1 cm long, reflexed. Stamens exserted; filaments 5-8 mm long, glabrous; anthers bluish-black.

Plate 1:- Habit and inflorescence of *Clerodendrum quadriloculare*(Blanco) Merr.

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 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, stained by using safranin and were mounted in glycerine. The micro-preparations were observed under the microscope. The epidermal peel was taken to study the leaf surface characteristics and the stomata.To prepare the paradermal sections, 3 cm^2 sized leaf portion from the middle part of lamina including margin were stained by using safranin in 50% alcohol for a period of 2 minutes.

The sections of leaf lamina, midrib, petiole and stemwere stained, using 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 used. Sections were mounted in 50% glycerine. The samples were analysed by using microscope (Magnus MLXi Plus). Terminology wasfollowed by International Association of Wood Anatomists.

Results:-

Organoleptic Characters of Leaf.

The following table shows the organoleptic characters of Clerodendrum quadriloculare (Blanco) Merr. For the easy identification of plant, primarily organoleptic evaluation was done in easiest and fastest way.

Table1:- Organoleptic characteristics of *Clerodendrum quadriloculare* (Blanco) Merr.

Characters	***Clerodendrum quadriloculare*(Blanco) Merr.**
Colour	Dark Green
Shape	Oblong
Odour	No odour
Texture	Glabrous
Apex	Acute
Base	Cordate
Margin	Paripinnate

Venation	Reticulate
Petiole	Petiolate

Stomata were numerous in number and ranunculaceous (Anomocytic). Stomata were confined to abaxial surface-Hypostomatic. The LM analysis showed stomata were confined to the same surface of epidermal cells and having ellipsoid shape (Plate-3).

Anatomy of Leaf.

The section showed both upper and lower epidermis with thick cuticle. It became slightly wavy in nature.The upper side of lamina showed palisade tissues and are highly pigmented. The lower side composed of loosely arranged spongy parenchyma and are deposited with starch grains (Plate-2).

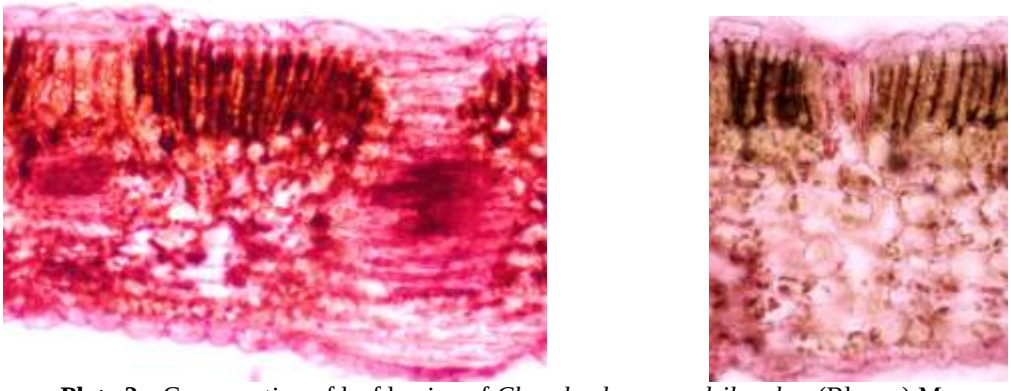

Plate 2:- Cross section of leaf lamina of *Clerodendrum quadriloculare*(Blanco) Merr.

The anomocytic stomata were present at the abaxial side and surrounded by large fimbriate parenchyma cells and are highly pigmented. The epidermal peel showed numerous gland dots (Plate-3).

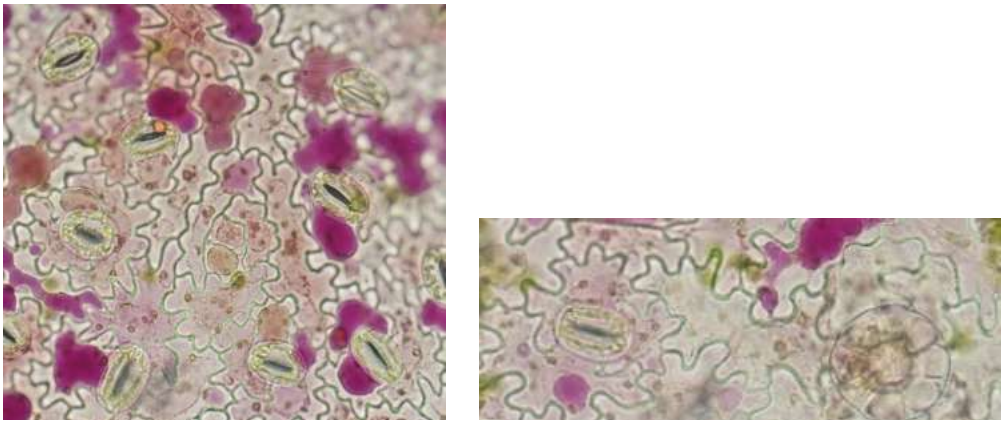

Plate3:- Lower epidermis with stomata and gland dots in*Clerodendrum quadriloculare*(Blanco) Merr.

Anatomy of Midrib.

The cross section of midrib showed thick layer of epidermis and is highly cuticular. It consists of numerous glandular hairs.The hypodermis consists of multilayered collenchymatous layer. The outer cortex showed chlorenchymatous tissue and are restricted only at the upper and lateral sides of the vascular region. The medulla consists of numerous broken rings of vascular bundles having xylem and phloem elements. The outer region of phloem having bands of fibres. The pith composed of parenchyma cells and are deposited with small prismatic crystals (Plate-4).

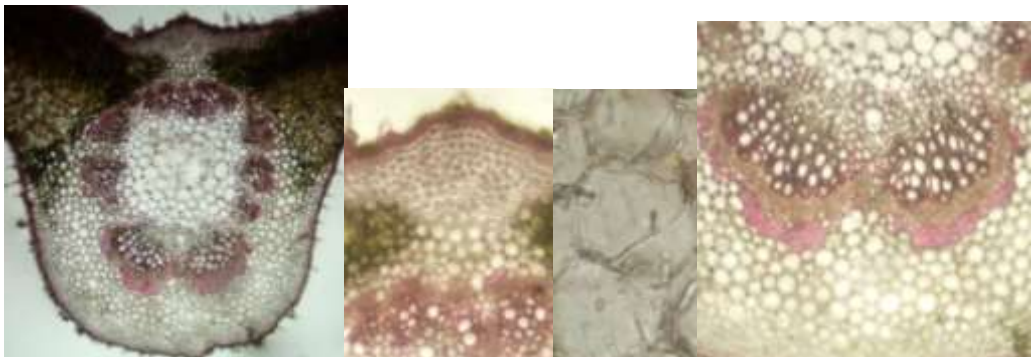

Plate4:- Cross section of leaf midrib of *Clerodendrum quadriloculare*(Blanco) Merr.

Anatomy of Petiole.

The petiole showed thick-walled epidermis deposited with cuticle and it possess numerous glandular trichomes.The hypodermis consists of multilayered collenchyma. The outer cortex showed pigmented cells and are dilated up to epidermis and inner with parenchyma cells. The vascular region become circular in appearance and it consists of numerous small vascular bundles. The outer edge of each bundle having brachysclereids as bundle cap. The inter-fascicular region become prosenchymatous. The pith composed of both parenchymatous and prosenchymatous tissues (Plate-5).

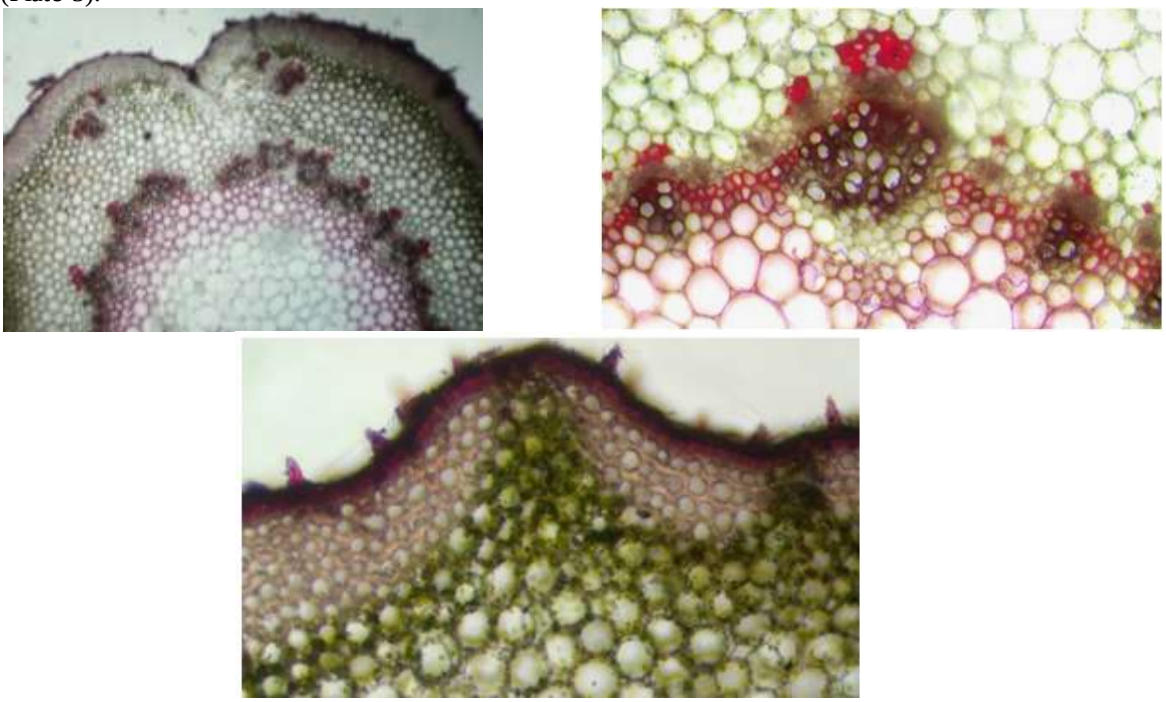

Plate5:- Cross section of petiole of *Clerodendrum quadriloculare*(Blanco) Merr.

Anatomy of Stem.

The transverse section of stem showed an outer periderm and lenticels. The stele composed of both phloem and xylem elements. The cortex become highly reduced and the endodermis is well differentiated. The outer edge of secondary phloem consists of fibres. The secondary xylem is well developed and very wide in nature. The xylem vessels are linear in arrangement and are uni-bi seriate, and xylem parenchyma and fibres were present. The pith is highly thick walled and the primary bundles were intruded in to the pith (Plate-6).

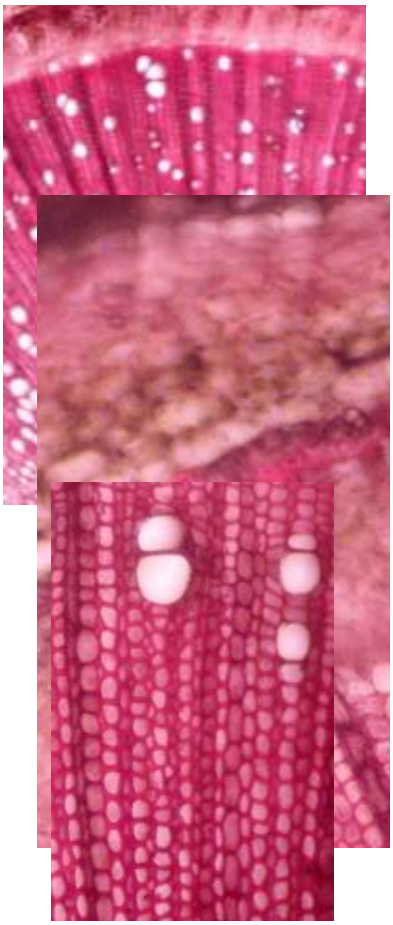

Plate6:- Cross section of stem of *Clerodendrum quadriloculare*(Blanco) Merr.

Wood Anatomy.

The radial longitudinal section (RLS) of wood showed tracheids and large vessel elements. The lateral wall of vessels with bordered pits and each vessel with end-plate. It also showed large xylem parenchyma cells. The transverse longitudinal section (TLS) showed large parenchyma cells and ray cells. The ray cells are well deposited with starch granules (Plate-7).

R.L.S.

T.L.S.

Plate7:- Characteristics of wood (R. L. S. & T. L. S.) of *Clerodendrum quadriloculare*(Blanco) Merr.

Discussion:-

Anatomical Characters of Leaf.

Stomata is ranunculaceous and hypostomatic. The epidermal cells arefimbriate in nature.The epidermis become slightly wavy in nature. The spongy parenchyma was deposited with starch grains. The epidermal peel showed numerous gland dots.The midrib having glandular hairs. The hypodermis consists of multilayered collenchymatous layer. The outer region of phloem having bands of fibres. The pith with small prismatic crystals.For the identification of plant, primarily the organoleptic evaluation was done as an easiest and fastest way (Sumitra, 2014).Microscopic investigations might be used to examine leaf epidermal characteristics such as the type and

distribution of trichomes and stomata, as well as the epidermal cell shape and non-living depositions, reported by Vigi and Hari (2021).The presence of prismatic crystals in the leaf midrib was also reported by Sa, etal. (2017).

Anatomical Characters of Petiole.

The petiole possesses numerous glandular trichomes. The outer edge of each bundle having brachysclereids as bundle cap. The inter-fascicular region become prosenchymatous. The pith composed of both parenchymatous and prosenchymatous tissues.Shaheen (2006), found to be different in the amount of secondary vascular zone in the petiole of various Mimosoid species, which are utilized to differentiate the taxa.

Anatomical Characters of Stem/Wood.

The stem showed an outer periderm and lenticels. The outer edge of secondary phloem consists of fibres. The secondary xylem is well developed and very wide in nature. The xylem vessels are linear in arrangement and are uni-bi seriate, and xylem parenchyma and fibres were present. The ray cells are well deposited with starch granules. The pith is highly thick walled and the primary bundles were intruded in to the pith.According to Ayensu (1970), the differences in location rays, as well as size ofpore and number, increase the trustworthiness of anatomical characteristics in systematic botany.Anatomy was considered as a systematically relevant characteristics as it is less liable to the environmental variation (Metcalfe and Chalk, 1950).

Conclusion:-

In conclusion, anatomical study inC. quadriloculare provides a comprehensive understanding of its internal structure, contributing to the scientific validation of its traditional medicinal uses. The findings highlight the plant's complex histological features, which are essential for its identification, potential medicinal applications, and conservation. This research underscores the importance of anatomical profiling in authenticating traditional knowledge and protecting valuable plant species from adulteration and misidentification.This study also reveals the potentialities of stem, petiole and leaf anatomy that can be used as an aid for taxonomical identification of Clerodendrum quadriloculare species.

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