



PHARMACOGNOSTIC EVALUATION OF *ALTERNANTHERA BRASILIANA* (L.) KUNTZE: LEAF

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ABSTRACT

Alternanthera brasiliana belonging to the family Amaranthaceae is well known for its analgesic and anti-inflammatory properties in traditional medicine. This study basically deals with the pharmacognostical evaluation of the leaves of *Alternanthera brasiliana*. Pharmacognostical parameters such as macroscopy, microscopy and physicochemical properties and phytochemical constituents are also investigated. The transverse section of leaf showed the presence of non- glandular trichomes, xylem, phloem, cambium, and medullary rays. Physicochemical constants showed the values of total ash (10.35%), acid insoluble ash (1.27%), water soluble ash (0.51%), sulphated ash (6.5%), nitrated ash (4.45%), water soluble extractive (11.47%), ethanol soluble extractive (10.11%), ether soluble extractive (3.5%), loss on drying (8%), swelling index (1), foaming index (0) and mucilage content (23%). The preliminary phytochemical screening of the ethanolic extract showed presents of alkaloids, phenolic compounds, tannins, mucilage, carbohydrates and flavonoids. The study aims to develop standard parameters of the plant which would indeed help in identification and authentication of the plant.

KEYWORDS: *Alternanthera brasiliana*, Pharmacognostical, Phytochemical, Leaf.

INTRODUCTION

Plants have been employed for medicinal purposes since ancient times, and their role in the treatment of human ailments is irrefutable. Due to their complex molecular structures and ability to interact with mammalian target cells, plants have been utilised for the development of new drugs. Moreover, synthetic drugs are very expensive to develop since for the successful introduction of a new product approximately 3000-4000 compounds are to be synthesized, screened and tested, the cost of which ranges from 0.5 to 5 million dollars.^[1] The use of herbal medicinal products and supplements has increased tremendously over the past three decades with not less than 80% of people worldwide relying on them for some part of primary healthcare.^[2] A medicinal plant is factually any plant which in one or more of its parts contains substances that can be used for therapeutic purposes or which are precursors for the synthesis of direct therapeutic agents.^[3]

Alternanthera brasiliana (L.) Kuntze belonging to the family Amaranthaceae is a herbaceous plant commonly known as Brazilian joy weed, grows with ease on poor and deforested soil. It is used therapeutically against inflammation, cough and diarrhoea in Brazilian popular medicine.^[4] The extract of *A. brasiliana* leaves has antinociceptive effect, anti-microbial effect and antiviral

activity against herpes simplex virus. Aqueous and ethanol extract of *A. brasiliana* leaves are able to block human mitogen induced lymphocyte proliferation without any toxic effect.^[5,6] Even though traditional healers have ethnomedicinal knowledge on the properties of *A. brasiliana*, scientific validation of the medicinal values and the mechanisms of its diverse pharmacological actions has not been carried out to a greater extend.

MATERIALS AND METHODS

Collection and authentication of plant

Leaves of *Alternanthera brasiliana* (L.) Kuntze was collected from Pariyaram, Kannur District, Kerala in December, 2020. *Alternanthera brasiliana* (L.) Kuntze were authenticated by Mr. Muhammed Haneef K.A Assistant Professor, Dept of Botany, Govt Brennan College, Thalassery. The specimen bearing voucher has been deposited in the department of Pharmacognosy, College of Pharmaceutical Sciences, Government Medical College, Kannur, Kerala state.

Pharmacognostical studies

• Macroscopic and Microscopic Analysis

Morphology of fresh leaves of *Alternanthera brasiliana* (L.) Kuntze was studied. Free hand transverse sections of leaves were taken using phloroglucinol and hydrochloric

acid (1:1) as staining agent.^[7] Microphotographs of the sections and powder microscopy were taken using microscope at different magnifications (4x, 10x and 40x) with inbuilt analogue camera. Images were captured using a computer software.

• Quantitative microscopy

The quantitative examinations such as vein-islet number, vein-termination number, palisade ratio, stomatal number and stomatal index were studied using standard methods.^[8]

Physicochemical Parameters

Various physicochemical properties such as moisture content, total ash, sulphated ash, nitrated ash, water soluble ash, acid insoluble ash, alcohol, water, ether soluble extractive values, foaming index, swelling index, mucilage content of *Alternanthera brasiliana* (L.) Kuntze were determined.^[9,10,11]

Phytochemical screening

Extraction was done by using 35g of coarse dried powder with 150 ml of 70% ethanol at 76°C until solvent became colourless. Various phytoconstituents present in the leaves was detected by their respective chemical tests using ethanolic extract.^[12]

RESULTS AND DISCUSSION

Pharmacognostical studies

Alternanthera brasiliana (L.) Kuntze, is a perennial, prostrate and branchy herb, 7.5- 45.0 cm in length. Branches are 7.5- 45.0 cm long and glabrous, nodes are villous in nature, leaves are opposite and attach to swollen nodes and long internodes. Leaves are 2.5-7.5 cm long even longer if grown in watery places, rather fleshy, sometime obscurely denticulate. Flowers are inconspicuous, white, in colour appear as clusters. Seeds 1.25-1.5mm in diameter are sub- orbicular. The inflorescence occurs in cymes and are composed of hermaphrodite, actinomorphic and monocyclic flowers.

Plant profile



Fig.1: *Alternanthera brasiliana* (L.) Kuntze.

Kingdom	-	Plantae
Subkingdom	-	Tracheobionta
Super division	-	Spermatophyte
Division	-	Magnoliophyta
Class	-	Magnoliopsida
Order	-	Caryophyllales
Family	-	Amaranthaceae
Genus	-	Alternanthera
Species	-	brasiliana

A) Macroscopy

Characters:	Leaf
Shape	- Oval-Lanceolate
Size	- 2.5-7.5 cm
Colour	- Purple green on adaxial side & purple on abaxial side
Odour	- No characteristic odour
Taste	- Slightly bitter
Apex	- Acute acuminate
Base	- Cuneate
Phyllotaxy	- Decussate
Margin	- Slightly wavy
Surface	- Membranous and hairy

B) Microscopy

Leaf

In transection, the epidermis is uniseriate and is covered by cuticle. Anomocytic and diacytic stomata are seen on both abaxial face and adaxial surface. Stomata appears to be even with the other epidermal cells or slightly raised above the surface. Numerous pluricellular, non-glandular trichomes, consisting of three to five cells in a series occur on adaxial and abaxial surfaces but prominent in the abaxial face. The trichome basal cells are nearly isodiametric, the other cells of the series are long coated with papillose cuticle

Mesophyll

The mesophyll is in dorsiventral organisation, consisting of one layer of palisade parenchyma and four layers of spongy parenchyma, the latter occupying majority of the mesophyll. The chlorenchyma cell walls are coated by phenolic compounds and the parenchymatic cells contain amiloplasts. Idioblasts are predominantly seen in the palisade parenchyma. Minor collateral vascular bundles are seen in the mesophyll and are enclosed by a sheath of parenchymatic cells

Midrib

The transverse section of midrib is biconvex in shape. The epidermis has same features of the blade and angular collenchyma is seen beneath it which is formed by five layers on the adaxial side and two layers on the opposite side. Collateral vascular bundles are embedded in the ground parenchyma. A narrow cambial zone can be identified.

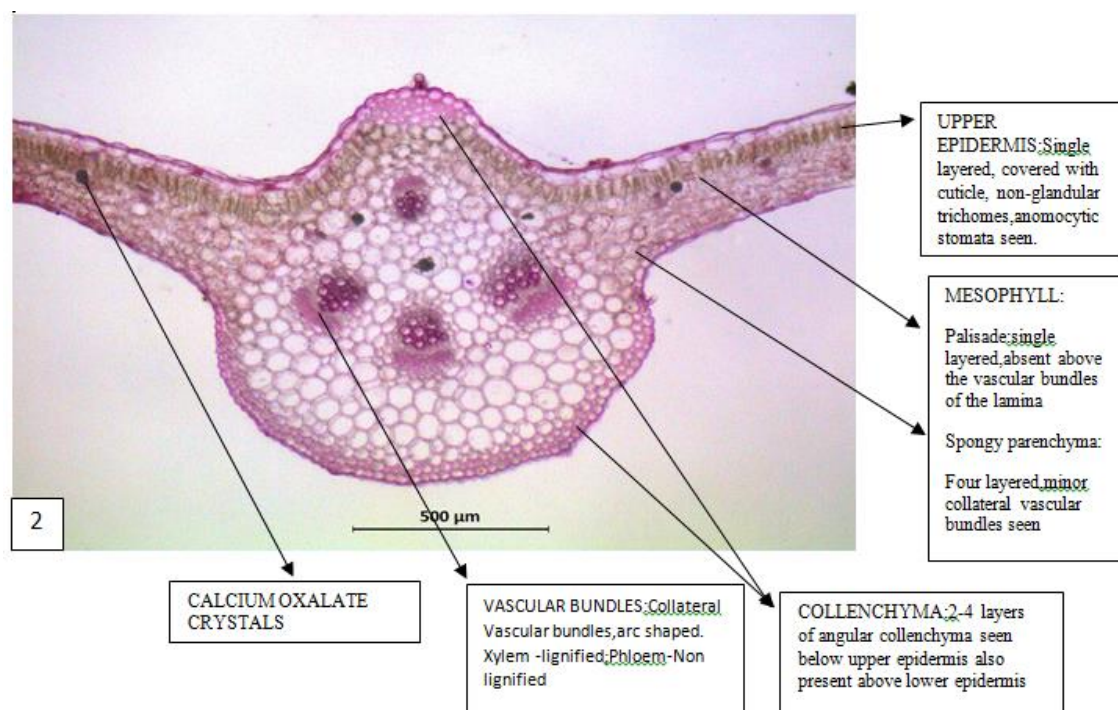


Figure 2: *Alternanthera brasiliana* midrib.

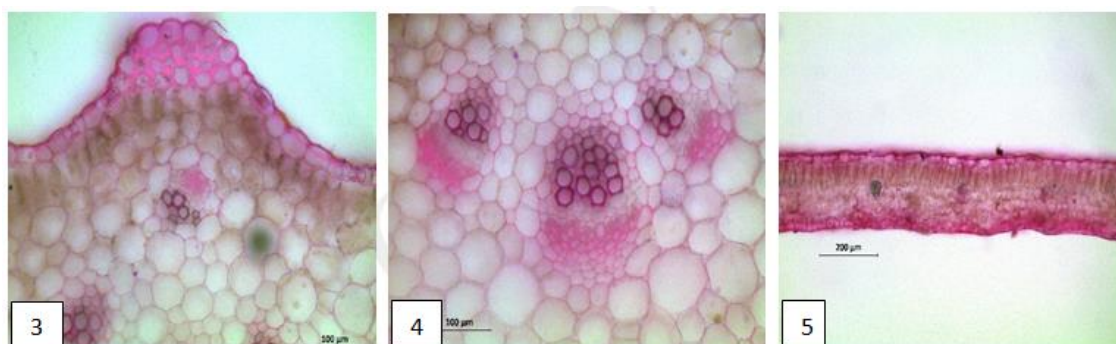


Fig. 3: Collenchyma layer below epidermis-4) Transverse section exhibiting variable number of vascular bundles-5) Palisade parenchyma.

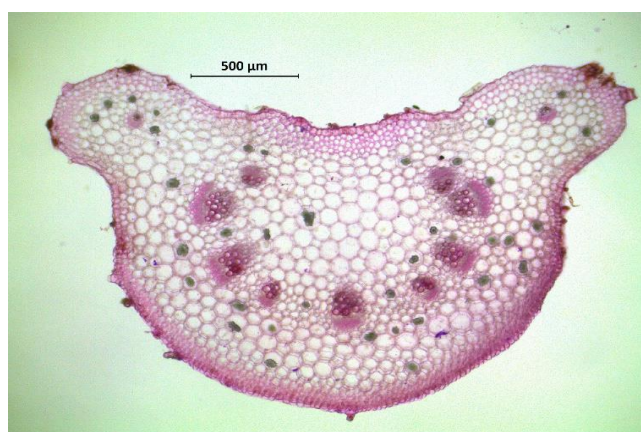


Figure 6: Transverse section of petiole.

Petiole

The transverse section of petiole, has plain-convex contour. Epidermis is uniseriate and consists of polygonal cells, few stomata and several non-glandular

trichomes similar to the leaf. Two or three rows of non-continuous ring of angular collenchyma is also present. Collateral vascular bundles varying from four to eight, are seen in the ground parenchyma, having caps of non-

lignified and thick-walled cells next to the phloem. A cambial zone is seen between the phloem and the xylem.

Idioblasts along with druses and phloem cell walls saturated with phenolic compounds are also seen.

C) Quantitative Microscopy

LEAF CONSTANT PARAMETERS	RANGE*
Stomatal Number	5 per sq.mm
Stomatal Index	21%
Palisade ratio	2.2
Vein Islet Number	8 per sq.mm
Vein termination Number*	3 per sq.mm

*Values are a mean of four measurements

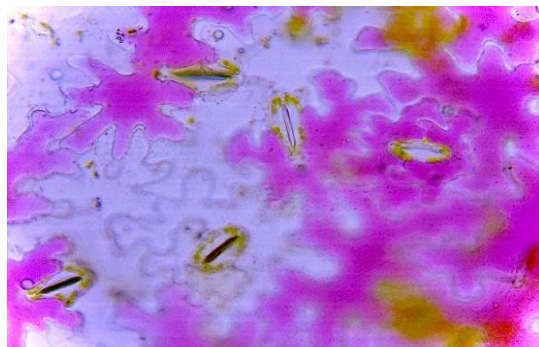


Figure 7: Stomata.

Powder Microscopy

Powder of the leaf along with petiole showed fragments of vascular strands, trichomes, palisade and spongy

parenchyma cell, calcium oxalate crystals, collenchyma cells, epidermal cells and stomata.

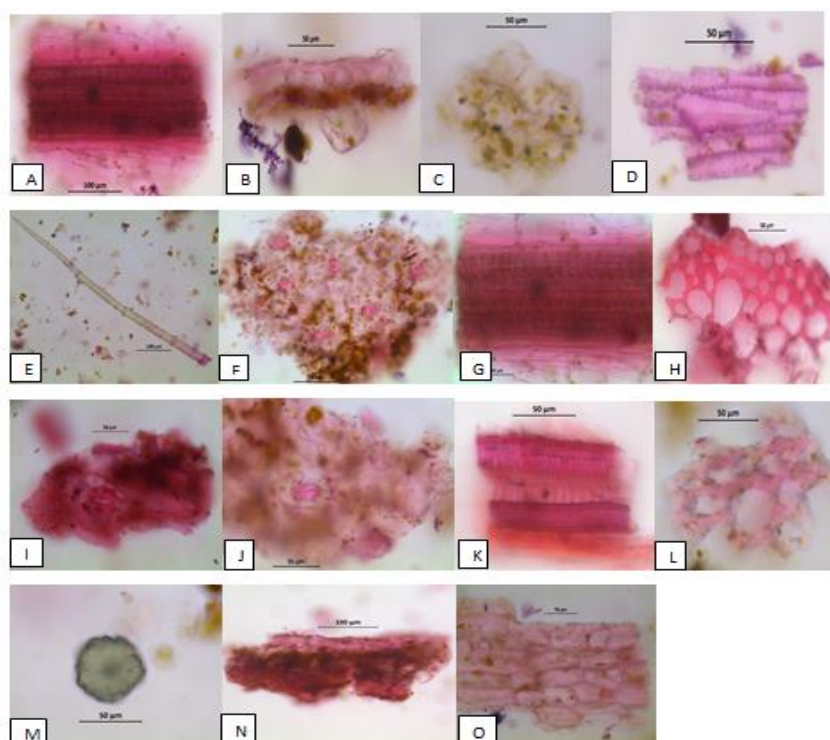


Figure:9-A- Fragments of vascular strands from lamina; B-Epidermis of leaf from midrib region C-Spongy parenchyma with chlorophyll; D-Spiral vessel fragments; Figure: E- Multicellular trichome; F- Lower epidermal cells with stomata; G- Fragments of xylem vessels; H- Fragments of collenchyma from the midrib; I-Upper epidermis of the leaf with stomata; J-Lower epidermis of the leaf with stomata; K-Fragments of tracheids and vessels; L-Fragments of collenchyma; M-Rosette crystals of calcium oxalate; N-Transversely cut fragment of leaf lamina; O-Epidermal cells from petiole.

Physicochemical Parameters

Physicochemical parameters are essential parameters in detecting adulteration and are adopted to confirm the purity and quality of drug.

Physicochemical Parameters	Results
Ash value	(Percentage w/w)
(a) Total ash	10.35
(b) Acid insoluble ash	1.27
(c) Water soluble ash	0.51
(d) Sulphated ash	6.5
(e) Nitrated ash	4.45
Extractive Values	(Percentage w/w)
(a) Water soluble extractive	11.47
(b) Ethanol soluble extractive	10.11
(c) Ether soluble extractive	3.5
Loss on drying	8%
Foaming index	Nil
Swelling Index	1%
Mucilage content	23%

Phytochemical studies

Phytochemical screening showed the presence of flavonoids, tannins, mucilage, phenolic compounds, carbohydrates and alkaloids.

Tests for constituents	Ethanol extract
Carbohydrates	+
Mucilage	+
Proteins	+
Amino acid	+
Fats and Oils	-
Steroids	+
Saponins	-
Phenolic compounds	+
Terpenoids	+
Flavonoids	+
Alkaloids	+
Tannins	+

DISCUSSION

The current work deals with the pharmacognostical, physicochemical and phytochemical study of the leaves of *Alternanthera brasiliana* (L.) Kuntze.

The salient diagnostic characteristic of leaf is pluricellular, non-glandular trichomes which is present on the epidermis, diacytic and anomocytic stomata and collateral vascular bundles. Ash values indicates the presence of various impurities like carbonates, oxalates, and silicates. The low acid insoluble ash value indicates presence of negligible amount of siliceous matter. The extractive values help to evaluate the chemical constituents present in crude drug and in the estimation of specific constituents soluble in a particular solvent. Phytochemical analysis showed the presence of important classes of phytoconstituents like flavanoids, phenolic compounds and tannins which in turn indicates that the leaves can be useful for treating different

diseases as the therapeutic activity of a plant is due to the presence of particular class of compounds.

CONCLUSION

It is concluded that the above parameters are very useful for the identification and authentication of the species. The results of the present study will also be helpful in preparation of monograph.

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