Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
Impact Factor (RJIF): 6.35
www.phytojournal.com
JPP 2025; 14(5): 466-472
Received: 04-09-2025
Accepted: 03-10-2025

Dr. K Babu
Ph.D., Senior Research Scientist R & D Centre, Cholayil Private Limited, SIDCO Industrial Estate North, Ambattur, Chennai, Tamil Nadu, India

DK Srinivasaprabhu
R & D Centre, Cholayil Private Limited, Ambattur, Chennai, Tamil Nadu, India

Corresponding Author:
Dr. K Babu
Ph.D., Senior Research Scientist R & D Centre, Cholayil Private Limited, SIDCO Industrial Estate North, Ambattur, Chennai, Tamil Nadu, India

Pharmacognostic studies of *Tabebuia rosea* (Bertol.) DC.

K Babu and DK Srinivasaprabhu

DOI: https://www.doi.org/10.22271/phyto.2025.v14.i5f.15607

Abstract
Pharmacognostic studies of *Tabebuia rosea* (Bertol.) DC. has been carried out to determine the requisite anatomical features of leaf and stem-bark. This investigation provides referential anatomical and phytochemical information for correct identification of this plant.

Keywords: *Tabebuia rosea*, Pink trumpet tree, Pharmacognosy, leaf, stem-bark, thin-layer chromatography

Introduction
Medicinal plants are potential source of bioactive compounds and several researchers are exploring their various pharmacological activities worldwide, which are utilized in the traditional or alternative systems of medicine. The extraction, isolation and characterization of secondary metabolites from different parts of medicinal plants are still an area of great relevance and interest to identify molecules with potential biological activities such as antimicrobial, antioxidant, anti-inflammatory, and antitumor [1-5].

Tabebuia rosea (Bertol.) DC. is one of the important medicinal plant belongs to the family Bignoniaceae, commonly known as a pink trumpet tree, grown as an ornamental for its pink or purple flowers. The aerial parts of the tree were used for the treatment of malaria and uterine cancer traditionally. A decoction of the cortex of the tree is utilized for anemia and constipation. The flowers, leaves, and roots were also used to reduce fever, pain, sweating, tonsil inflammation, and many other disorders. A secondary metabolite Lapachol isolated from tree is considered as an anticancer drug [6]. Tea made from the leaves and bark is known to have a fever-reducing effect. The flowers, leaves, and roots were also used to reduce fever, pain, sweating, tonsil inflammation, and many other disorders [7]. In Guatemala, Costa Rica and Colombia, traditionally this plant used as an antipyretic, antimalarial and treatment for eyes infections, rabies, fever, colds, headache, snake bites, throat ailments, fever, astringent, antimicrobial, anti-inflammatory, diuretic, laxative, uterine cancer, anaemia and tonsillitis [8-17]. Recent findings showed that anti-inflammatory and anti-obesity activities of bark extract [18-19], anticancer, antimicrobial and *in vitro* antioxidant activities of flower extract [20-22], anticancer activity of leaves extract [23]. However, there is lack of pharmacognostical studies on leaf and stem-bark. Hence, the present study has been carried out to standardize the anatomical features of leaf and stem-bark, physico-chemical analysis, extraction yield and thin-layer chromatographic finger-print profile to serve as a possible tool for suitable identification.

Materials and Methods
Anatomical studies: Leaves and stem-bark (from 6 years old tree) were collected from R&D Centre, Cholayil Pvt Ltd, Ambattur, Chennai and Tamil Nadu and authenticated using regional flora [24]. Fresh leaves (rachis, petiole, and lamina) and stem-bark were cut in to small pieces and fixed immediately in FAA for 24hr, embedded in paraffin wax after dehydration and infiltration using standard procedure. Sections were taken using rotary microtome to the thickness of 8-12 µm [25], stained with toluidine blue [26]. Leaf epidermal peeling stained with Safranin and photographed.

Physico-chemical properties evaluation: For the analysis of water soluble extractives (WSE), alcohol soluble extractives (ASE), Total ash (TA) and Acid insoluble ash (AIA) methods adopted from the Ayurvedic Pharmacopoeia of India [27].

The leaves and stem-bark were shade dried separately for a week and powdered. Extraction yield analysis was carried out using soxhlet apparatus. Each 10 g of samples were extracted using *n*-hexane, chloroform and methanol separately for 5 hr, then filtered, evaporated on water-bath and the residues were weighed.

Thin-Layer Chromatographic (TLC) analysis

For the TLC analysis, 2 g of samples was extracted under reflux with 20 ml of methanol (3 times) in a water-bath, then filtered, concentrated and dried. The residue was re-dissolved in methanol and used for the TLC spotting. For stationary phase precoated Silica Gel F^{254} (Merck) plate and for mobile phase Toluene: Ethyl acetate (3:1) was used. After the plate development, dried and observed under UV-254 & 366 nm, then dipped in 1% Vanillin H_2SO_4 and heated at 105°C for colour development and the all the spots Rf values are recorded.

Results

Macroscopic characters of the leaf (Figure 2:1-2)

Leaves palmately compound, typically with five leaflets arranged on long rachis. Rachis up to 20 cm long, 5 mm thick. Leaflets varies in size, terminal leaflet large, each leaflet petiolate; lamina elliptic to oblong, 10-20 × 5-10 cm, dorsal side dark green, glabrous; ventral side light green and scabrous; margin entire, apex acuminate, base acute and veins prominent.

Microscopic characters of the leaf (Figure 2 & 3)

Rachis (Figure 2:3-5)

The transverse section of rachis about 5 mm thickness shows circular in outline with two distinct angular edges on adaxial surface. The epidermis is single layer, composed of cuboid cells with thick cuticle. Hypodermis consist two to three layers of collenchymatous cells and four to five layers of parenchymatous cells. Vascular bundle is circular with distinct xylem and phloem. Xylem consist numerous vessel elements which are large, circular or oval in shape. Xylem surrounded by the phloem and scattered sclerenchyma bundles capped the phloem. A large parenchymatous ground tissue occupied in the centre region. Scattered prismatic calcium oxalate crystals are found in parenchymatous cells of hypodermis (Figure 2:5).

***Petiole* (Figure 3:1-3)**

The anatomical features of petiole shows exactly similar to rachis except its size which is about 1.5-2.0 mm thickness. Due to the same similarity of rachis further details are not described here.

***Lamina* (Figure 3:4-7)**

The midrib is cup shaped and convex in adaxial surface with single layer epidermis consist cuboid cells. Three to four layers of collenchyma cells followed by epidermis. Vascular bundle arranged in a ring and continuous; xylem surrounded by the phloem. Xylem comprises large, circular or oval shaped vessels elements. Scattered sclerenchyma bundles are surrounded the phloem. Ground tissue consist large parenchymatous cells. In lamina, the upper epidermis made up of large, cuboid or rectangular cells and the lower epidermis comparatively small cuboid cells. The internal mesophyll composed of narrowly cylindrical shaped palisade parenchyma and followed by spherical shaped spongy parenchyma. Vascular bundles are distinct and collateral. Stomatal apparatus anomocytic type and hypostomatic (Figure 3:6). Peltate type of trichomes present in the lower epidermis (Figure 3:7). Calcium oxalate crystals are absent.

***Macroscopic characters of stem-bark* (Figure 4)**

The bark is about 10 mm thickness; external surface pale brown with irregular, soft, thin flakes; inner surface pale white to light brown, smooth, fibrous with no characteristic odour and taste.

***Microscopic characters of stem-bark* (Figure 5:1-3)**

Stem-bark is distinctly differentiated into outer periderm, middle cortex and inner secondary phloem. Periderm consist phellem, phellogen and phelloderm. The outer phellem layers are fissured, collapsed and broken into thin tangential membranous layers (Figure 5:1). The middle phellogen is four to five layers of cells and clearly evident. The phelloderm zone is broad, consist thin walled compactly arranged cells. Secondary phloem consist radial files of sieve tubes, axial parenchyma and group of fibres. Phloem fibres are found as scattered in cortex region and horizontal layers in secondary phloem region (Figure 5:1-2). Phloem rays are uni- to multiseriate and homocellular (Figure 5:2-3). Calcium oxalate crystals and any other cell inclusion not found.

Phytochemical analysis

The results of physico-chemical analysis, extraction yield of various solvents and TLC fingerprint profiles are presented in Table 1, 2 & 3 and Figure 6.

Table 1: Physico-chemical analysis

	Leaves	Bark
Parameters	**Values (%)**	**Values (%)**
Water soluble extractives	21.55±0.24	37.89±027
Alcohol soluble extractives	13.07±0.16	19.1±1.5
Total Ash	7.75±0.03	2.71±0.02
Acid insoluble ash	4.17±0.12	0.52±0.09

Value from triplicate (Mean ± SD)

Table 2: Extraction Yield of various solvents

	Leaves	Bark
Parameters	**Values (%)**	**Values (%)**
Hexane	2.57±0.13	1.44 0.11
Chloroform	8.98±0.15	1.59 0.13
Methanol	23.76±0.17	42.43 0.14

Value from triplicate (Mean ± SD)

Table 3: TLC profile Rf values (Visible Light After Spray)

1. Stem-Bark	2. Leaves
0.25 (Light pink) 0.35 (Blue) 0.41 (Violet) 0.55 (Light pink) 0.87 (Violet)	0.12 (Violet) 0.18 (Blue) 0.26 (Green) 0.31 (Blue) 0.35 (Violet) 0.41 (Violet) 0.55 (Light pink) 0.62 (Blue) 0.72 (Blue) 0.86 (Violet) 0.87 (Violet)

Discussion and Conclusion

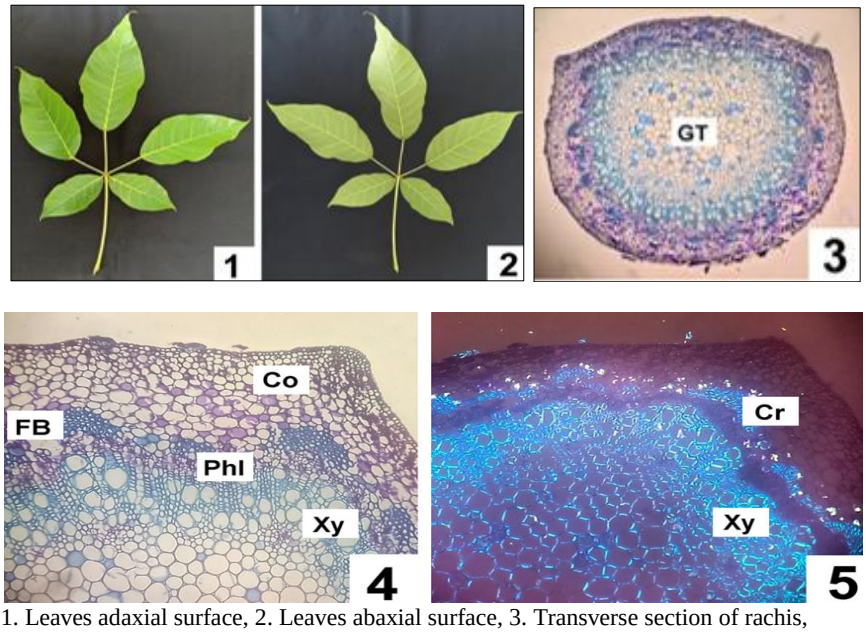
The growing interest in herbal medicines for health care remedy, beauty improvement, and prevention of disease has led to the renewed demand for nutraceuticals. While the pharmaceutical industry is now moving towards phyto-

pharmaceuticals to meet this increasing demand to have assurance of the quality, safety and effectiveness of herbal medicines [28]. In this respect, the identification and standardization of herbal drug has become an essential process ensuring that herbal drugs satisfy. For herbal drug identifications, macroscopic evaluation includes morphology and organoleptic characters like taste, odor, color, size, shape and texture, whereas, the microscopic evaluation involves anatomical characters identification and the comparison of different entities [29]. In the present study, we have investigated the detailed anatomical features, physico-chemical properties, extraction yield and thin-layer chromatographic fingerprint profile of leaf and stem-bark of *T. rosea* and provided the following key diagnostic features to identify the drugs.

- **Leaf rachis & petiole:** Circular in outline with two distinct angular edges on adaxial surface. Vascular bundle circular with distinct xylem and phloem. Vessel elements numerous, large, circular or oval in shape. Scattered prismatic calcium oxalate crystals found in parenchymatous cells of hypodermis.
- **Lamina:** Midrib cup shaped and convex in adaxial surface. Vascular bundle arranged in a ring and continuous. In lamina, upper epidermis made up of large, cuboid or rectangular cells and the lower epidermis comparatively small cuboid cells. Stomatal apparatus anomocytic type and hypostomatic. Peltate type of trichomes present in lower epidermis.
- **Stem-bark:** Distinctly differentiated into periderm, cortex secondary phloem. Phellem layers fissured, collapsed and broken into thin tangential membranous layers. Phellogen four to five layers and clearly evident. Phelloderm is broad, consist thin walled compactly arranged cells. Phloem fibres found scattered in cortex region and horizontal layers in secondary phloem. Phloem rays uni- to multiseriate and homocellular.
- **TLC:** Leaf and stem-bark TLC fingerprint profile shows specific spots and colours with Rf values as in Table 3; Figure 6.

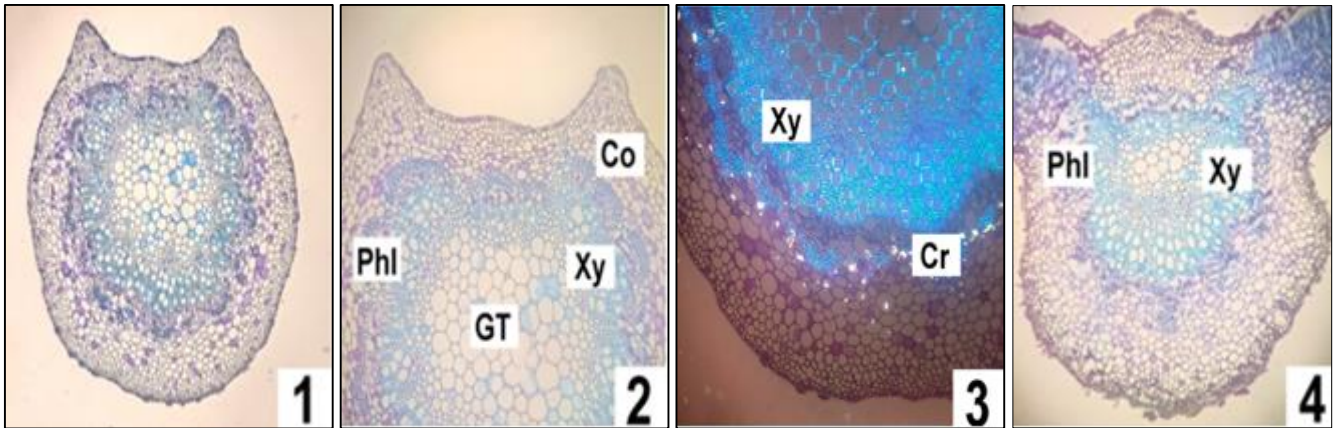
Legend to the pictures

Fig 1: *Tabebuia rosea* (Bertol.) DC. Flowering stage

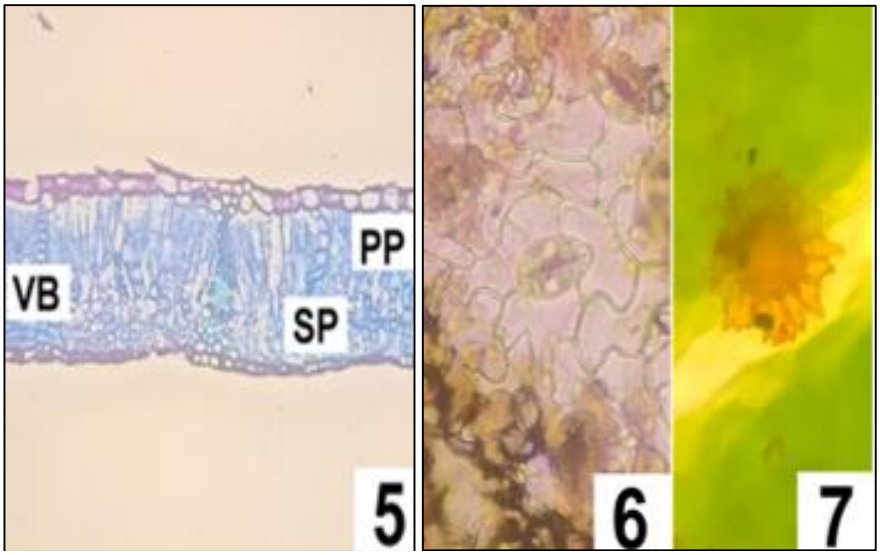


1. Leaves adaxial surface, 2. Leaves abaxial surface, 3. Transverse section of rachis, 4. Rachis portion enlarged, 5. Rachis portion enlarged (under polarized light)

Fig 2: Morphology of leaf and anatomy of rachis



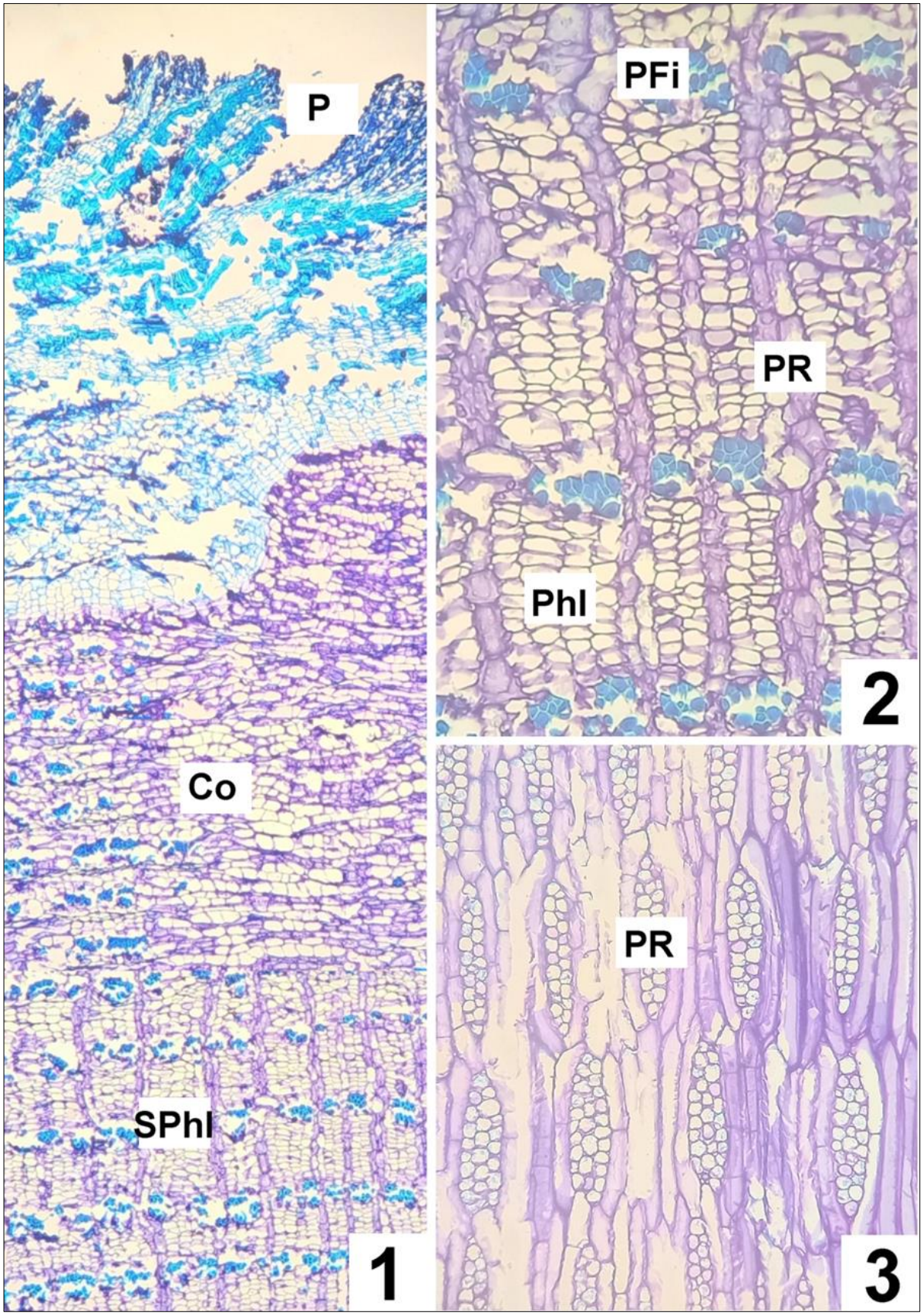
Transverse section of petiole Petiole portion enlarged Petiole portion enlarged (under polarized light) Transverse section of leaf midrib



Transverse section of lamina Stomata Peltate trichome

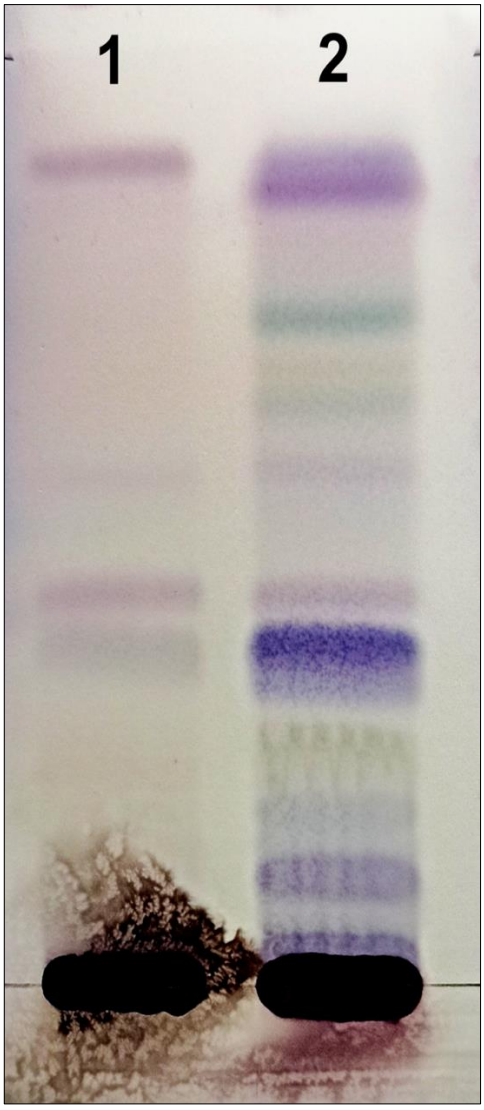
Fig 3: Anatomy of petiole and leaf

Fig 4: External morphology of stem-bark



Transverse section of bark | Secondary phloem portion enlarged | TLS of secondary phloem

Fig 5: Anatomy of stem-bark



(Co-Cortex; Cr-Crystals; FB-Fibre; GT-Ground tissue; P-Periderm; Phl-Phloem; PF-Phloem fibres; PP-Palisade parenchyma; PR-Phloem rays; SP-Spongy parenchyma; SPhl-Secondary phloem; VB-Vascular bundle; Xy-Xylem)

Fig 6: TLC fingerprint profile-Track-1, Bark; Track-2, Leaves

Acknowledgement
The authors are thankful to Mr. Pradeep Cholayil (Chairman & Managing Director), Mrs. Jayadevi Pradeep Cholayil (Directress) and Anupam Katheriya (CEO)-Cholayil Private Limited for their constant support and encouragement.

References

1. Gyawali R, Ibrahim SA. Natural products as antimicrobial agents. Food Control. 2014;46:412-429.
2. Embuscado ME. Spices and herbs: Natural sources of antioxidants-A mini review. J Funct Foods. 2015;18:811-9.
3. Gomez Estrada HA, Gonzalez Ruiz KN, Medina JD. Anti-inflammatory activity of natural products. Bol Latinoam Caribe Plant Med Aromat. 2011;10:182-217.
4. Rocha DAB, Lopes RM, Schwartsmann G. Natural products in anticancer therapy. Curr Opin Pharmacol. 2001;1:364-369.
5. Sathiya M, Muthuchelian K. Antitumor potential of total alkaloid extract from *Tabebuia rosea* (Bertol.) DC. leaves on MOLT-4 cells *in vitro*. Nat Sci. 2010;8:7.
6. Madhumitha G, Divya K, Fowsiya J. A study on phytochemical analysis, antioxidant and larvicidal activity of dried flowers of *Tabebuia rosea*. J Chem Pharm Res. 2015;7(10):693-698.
7. Solomon S, Senthamilselvi MM, Muruganantham N. Anti-oxidant and anti-inflammatory activity of *Tabebuia rosea* (flowers). J Biosci Appl Res. 2016;2(9):621-625. DOI: 10.21608/jbaar.2016.109003
8. García Barriga H. Flora Medicinal de Colombia. Instituto de Ciencias: Naturales, Bogota; 1975, Vol. 3.
9. Morton JF. Atlas of Medicinal Plants of Middle America. In: Charles C, Thomas, editors. Springfield, IL; 1981. p. 827-829.
10. Arenas P. Medicine and magic among the Maka Indians of the Paraguayan Chaco. J Ethnopharmacol. 1987;21:279-295.
11. Almeida DER, Filho DSAA, Santos DER, Lopes CA. Anti-inflammatory action of lapachol. J Ethnopharmacol. 1990;29:239-241.
12. Gentry AH. A synopsis of *Bignoniaceae ethnobotany* and economic botany. Ann Missouri Bot Gard. 1992;79:53-64.
13. Binutu OA, Lajubutu BA. Antimicrobial potentials of some plant species of the Bignoniaceae family. Afr J Med Med Sci. 1994;23:269-273.
14. Lewis WH, Okunade AL, Elvin-Lewis MP. Pau d'Arco or Lapacho (Tabebuia). Encyclopedia Dietary Suppl. 2005:527-535.

15. Ramalakshmi S, Muthuchelian K. Analysis of bioactive constituents from the ethanolic leaf extract of *Tabebuia rosea* (Bertol.) DC. by gas chromatography-mass spectrometry. Int J Chem Tech Res. 2011;3:1054-1059.
16. Sichaem J, Kaennakam S, Siripong P, Pyang TS. Tabebuialdehydes A-C, cyclopentene dialdehyde derivatives from the roots of *Tabebuia rosea*. Fitoterapia. 2012;83(8):1456-1459.
17. Seham S, El-Hawary, Taher MA, Elham A, Zid FAS, Mohammed R. Genus Tabebuia: A comprehensive review journey from past achievements to future perspectives. Arabian J Chem. 2021;14:103046.
18. Straffon PEC, González MCE, Pérez CDA, Garrido CJ, Marchat LA, Cardoza BCG, *et al*. *Tabebuia rosea* (Bertol.) DC. Ethanol extract attenuates body weight gain by activation of molecular mediators associated with browning. J Funct Foods. 2021;86:104740.
19. Nolasco BA, López DA, García MA, Garrido CJ, Flores JME. Anti-inflammatory effect of ethanolic extract from *Tabebuia rosea* (Bertol.) DC., Quercetin, and anti-obesity drugs in adipose tissue in Wistar rats with diet-induced obesity. Molecules. 2023;28:3801.
20. Solomon S, Muruganantham N, Senthamilselvi MM. Antimicrobial activity of *Tabebuia rosea* (flowers). Int J Res Dev Pharm L Sci. 2016;5(2):2018-2022.
21. Solomon S, Muruganantham N, Senthamilselvi MM. Anti-cancer activity of *Tabebuia rosea* (flowers) against human liver cancer. Int J Pharm Biol Sci. 2015;5:171-174.
22. Sobiyana P, Anburaj G, Manikandan R. Comparative analysis of the *in vitro* antioxidant activity of *Tabebuia rosea* and *Tabebuia argentea*. J Pharmacog Phytochem. 2019;8(1):2673-2677.
23. Hemamalini K, Soujanya GL, Bhargav A, Vasireddy U. In-vivo anticancer activity of *Tabebuia rosea* (Bertol) DC. leaves on Dalton's Ascitic Lymphoma in mice. Int J Pharm Sci Res. 2012;3(11):4496-4502.
24. Livingstone C, Henry A. The flowering plants of Madras city and its immediate neighbourhood by P.V Mayuranathan. The Commissioner of Museums, Govt. of Tamil Nadu, India; 1994.
25. Johansen DA. Plant Microtechnique. New York: McGraw Hill Book Company; 1940.
26. O'Brien TP, Feder N, McCully ME. Polychromatic staining of plant cell walls by toluidine blue O. Protoplasma. 1964;59:367-373.
27. The Ayurvedic Pharmacopoeia of India. Vol. 6. New Delhi: Govt. of India, Ministry of Health and Family Welfare, Dept. of ISM & H; 2008.
28. Zuberi SA, Tasleem F, Malik N, Jaffar F, Aamir N. Drug standardization and its applications to herbal/skin care formulations: A review. J Population Ther Clin Pharm. 2024;31(9):3976-3983.
29. Patel PM, Patel NM, Goyal RK. Evaluation of marketed polyherbal antidiabetic formulation using biomarker Charantin. Pharma Rev. 2006;22:113-114.