

COMPARATIVE MORPHOLOGICAL AND STEM ANATOMICAL STUDIES IN GENUS *TABEBUIA* GOMES EX DC (BIGNONIACEAE) IN KERALA

Botany

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ABSTRACT

A comparative study based on stem anatomical structure was made using light microscopy (LM) techniques on three species of *Tabebuia* Gomes ex DC. (Bignoniaceae) in Kerala. Some characters are found important to distinguish the species within the genera coming under Bignoniaceae were carried out and compared. *Tabebuia rosea alba*, *Tabebuia pentaphylla*, *Tabebuia aurea* recorded from Kerala. After taxonomic confirmation observed stem anatomy of the species of *Tabebuia* as per standard procedures. These species are distinct in their morphology and stem anatomical characters. Diagnostic keys were prepared, which can be used as taxonomic tool for the delimitation of the species coming under genus *Tabebuia*.

KEYWORDS

Tabebuia, Bignoniaceae, Morphology, Anatomy

Introduction

Bignoniaceae are predominantly a neotropical family, members are important components of neotropical forest with lesser contributions to Africa, Malagasy and SE Asian tropical forests. The family include 82 genera and 827 species^[1]. 100 species of *Tabebuia* distributed in Mexico and Cuba. Three species of *Tabebuia* cultivated in Kerala for its grand showy flowers, which offers different shades. The graceful beauty is a treat of eyes but the tree has medicinal value as well^[2]. *Tabebuia* genus have been used empirically as anti-inflammatory, anticancer and antimicrobial agents in rural area^[3]. *Tabebuia aurea* used in treatment of bronchitis, viral disease and anti-inflammatory agent. Recently there is considerable scientific and commercial interest in discovery of anticancer agents from plant products^[4]. Hence the proper identification is inevitable for the safety, efficacy and quality of drug^[5]. Anatomical studies carried on *Tabebuia* species have been shown to be insufficient and limited. The present study describes the morphology and stem anatomical structure of *Tabebuia* species growing in Kerala with the purpose of pointing out stem anatomical characters also useful to distinguish these species.

Materials and methods

Collection and authentication of the plant

Three species of *Tabebuia* were collected from different localities of Kerala for present study. Specimens all species were collected in the flowering stage, studied their morphology, compared with authenticated specimens and determined their taxonomic identity. Voucher specimens were deposited in the herbarium of RHK. Microscopic studies

The materials for anatomical study were fixed in Formaldehyde-Acetic acid Alcohol mixture. Staining was carried out according to standard procedure^[6]. Anatomical microphotographs were transferred using the computer controlled microscopic system and camera. Trinocular 'Leica DM 3000' microscope attached with 'Leica DFC 295' digital camera connected to the computer and Leica Application Suite software was used for the observation and transferring microscopic images of the samples. Images are examined thoroughly and compared the anatomical characteristics.

Observation and results

Tabebuia aurea (Silva Manso) Silver trumpet tree, grows up to 15m tall, has a round crown, with thick and tortuous branches; bark is grey,

thick, corky and fissured. Leaves are palmately compound, with five or seven leaflets, each leaflet 6–18 cm long, green with silvery scales both above and below, elliptical leaflets that are coriaceous, covered with an indumentum of squamose trichomes, lamina obtuse apex, entire margin, and rounded base, petiole is 5–7cm. Inflorescence loose panicle. Flowers are 8cm long, in groups of 40, tubular-campanulate, yellow, and very showy. Calyx cupular shallow lobed, corolla 6 cm long bright yellow, stamens 4. Fruits are capsules, 8–15 by 1.5–2.5cm long and narrowly cylindrical, with a dense indumentum of squamose trichome; Seeds are up to 4cm wide, flat, with two opposite membranous wings on each side.

***Tabebuia rosea alba* (Cham) sudw.** Large evergreen trees; bark is grey thick and fissured, leaves petiolate opposite, simple or digitately 3 foliate, exstipulate, glabrous, leaflets upto 15 cm long, lamina oblong-obovate base rounded, margin entire acute apex; inflorescence terminal panicles; calyx 2-3 labiate, coriaceous, spathaceous, corolla tubular, lobes orbicular, obtuse, crisped, white, throat yellow turning white; stamen didynamous, staminode small; ovary linear, 2 celled, ovules in 2-3 series in each locule; fruit dehiscent capsule, calyx persistent, usually linear, some times ribbed, glabrous; seeds thin with 2 wings hyaline, membranous and sharply demarcated from the seed body

***Tabebuia pentaphylla* (L) Hemsl** pink trumpet tree, up to 15 m; the bole is straight, bark is blackish or greyish brown, rough and narrowly fissured vertically; leaves are decussate, compound, digitate, long petiolate, five leaflets unequal in size; the central leaflet is the larger; Petioles and petiolules are pulvinate, lamina lepidote or glabrous, elliptic-oblong, obovate with acute or acuminate apex, entire margin, and obtuse base; inflorescence terminal; flowers are hermaphrodite; calyx is greenish or greenish brown, tubular, and bilabial; corolla campanulate, penta lobed, membranous, with the limb spreading, it is whitish at base and pink, magenta, or almost white distally, with a yellow throat opening; androecium has four stamens, didynamous, with thecae divaricate, alternating with the corolla lobes and inserted in the corolla tube; staminode present; gynoecium is surrounded by a thick nectar, ovary is linear and bilocular with many ovules, biseriata in each locule, style is long and the stigma, bifid; fruit is a long, slender, linear-cylindrical, brown, bivalve, loculicide capsule, linear or linear-oblong, 18 to 35 cm long, calyx persistent; seeds are whitish, thin, with broad, hyaline-membranaceous wings.

Features	<i>Tabebuia rosea alba</i>	<i>Tabebuia pentaphylla</i>	<i>Tabebuia aurea</i>
cork	15-25 layered barrel shaped cells irregular arrangement	16-25 layered Square shaped Irregular arrangement	10-20 layered Square shaped or irregular
cortex	Wide Outer chlorenchymatous with intercellular spaces tangentially	Many layered Outer cortex lignified	Outer region lignified Majority of cells are filled with prismatic or cluster of calcium oxalate crystals
Pericyclic fibres	elongated pericyclic fibres appeared as broken ring	Pericyclic fibres of varying sizes	Pericyclic fibres arranged in the form of ring
phloem	Wide Compressed cells 2-3 layered of continuous phloem fibres ring	Compressed cells Fibre patches of 3-5 arranged in the form of broken ring	Cells are small and compressed fibre patches in the form of ring

Medullary rays	Unicellular Medullary rays extends to phloem zone		Uni bi seriate medullary rays
xylem	Vesels in the group of 2-6 Varying size	Vessels of varying sizes Fibres occupies the major portion	Vessels of equal sizes Group of 2-4
pith	Parenchymatous Narrow walled	Parenchymatous cells Crystal are present	

in size. Vessels are seen in groups of 2-6. Pith is narrow made up of loosely arranged parenchyma cells.

Tabebuia pentaphylla

TS almost circular in outline. Outer margin is ruptured at places due to the presence of lenticels. Cork is thick walled followed by cortical cells and phloem region cambium is seen in between xylem and phloem. Pith is a wider zone. Cork consists of 16-25 layered thick walled lignified cells. Cells are squarish to rectangular in shape which are irregularly arranged. Cortex region is parenchymatous thin walled with intercellular spaces. Many layered cortical region, outer cortex is lignified, pericyclic fibre patches of varying size are seen in cortical region. Phloem cells are compressed, phloem fibres patches of 3-5 arranged in the form of broken ring. Cambium is present. Xylem elements are lignified. Vessels are round to oval in shape and varying in size. Xylem fibres occupies the major portion. Pith is a wide zone made up of loosely arranged parenchyma cells. All the pith cells are enriched with crystals of calcium oxalate.

Artificial keys

Phloem fibres 2-3layered forms continuous ring, uniseriate medullary rays..... *Tabebuia rosea alba*
 Pith cells are parenchymatous filled with calcium oxalate crystal..... *Tabebuia pentaphylla*
 Cortical cells filled with prismatic calcium oxalate crystals, pith cells consist starch grains and calcium oxalate crystal.....
 *Tabebuia aurea*

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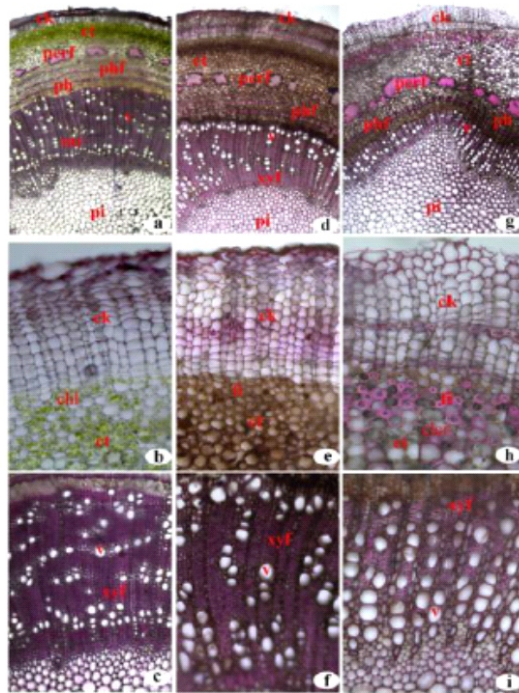
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Tabebuia aurea

TS almost circular in outline. Outer margin is ruptured at places due to the presence of lenticels. Cork is thick walled followed by cortical cells and phloem region cambium is seen in between xylem and phloem. Pith is a wider zone. Fibre patches seen scattered to cortical region. Cork consists of 10-20 layered thick walled lignified cells. Cells are squarish to rectangular in shape which are irregularly arranged. Cortex region made up of round or oval thick walled parenchymatous with intercellular spaces, outer cortex is lignified. Cortical cells filled with prismatic or cluster of calcium oxalate crystals. pericyclic fibre patches of varying size are seen in cortical region, which are arranged in the form of ring. Phloem cells are small, compressed and compactly arranged. Phloem fibres are arranged continuously in the form of rings. Cambium is present. Xylem elements are lignified. Medullary rays are uni or biseriate. Vessels are round to oval in shape and more or less similar in size. Vessels are seen in groups of 2-4. Pith is a wide zone made up of loosely arranged parenchyma cells. All the pith cells are enriched with numerous starch grains and crystals of calcium oxalate.

Tabebuia roseaalba

TS almost circular in outline. Outer margin is ruptured at places due to the presence of lenticels. Cork is thick walled followed by cortical cells and phloem region cambium is seen in between xylem and phloem. Pith is wider zone. Fibre patches seen scattered to cortical region. Cork consists of 15-25 layered thick walled lignified. Cells are barrel in shape, which are irregularly arranged. Cortex region is wide, outer parenchymatous cells with intercellular spaces. Tangentially elongated pericyclic fibre patches of varying size are seen in cortical region, which are arranged as broken ring manner. Phloem cells are compressed 2-3 layered. Phloem fibres are arranged continuously in the form of a ring. Cambium is present. Xylem elements are lignified. Medullary rays are unicellular. Medullary ray cells are extending towards phloem region. Vessels are round to oval in shape and varying



Anatomical comparison of the stems of *Tabebuia* spp. a - c, *T. alba*. d - f, *T. pentaphylla*. g - i, *T. argentea*. chl, chlorenchyma; ck, cork; elcr, calcium oxalate crystals; ct, cortex; fi, fibres; mr, medullary ray; perf, pericyclic fibres; ph, phloem; phf, phloem fibres; pi, pith; v, vessels; xyl, xylem fibres.