

Study on Morphology, Anatomy and Phytochemical Test of *Terminalia Catappa* L. Leaves

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Abstract

Terminalia catappa L. belongs to family Combretaceae and is popularly known as “badam”, for its nutritional fruit and possesses medicinal benefits as well. The plant specimen was collected from North Dagon Township, Yangon Region, during flowering to fruiting period, 2019. The collected specimen was studied on the morphological characters of vegetative and reproductive parts for the correct identification by available literature. The morphological and anatomical characters of leaves were described with relevant photographs and scientific name, Myanmar name, English name and family name were also mentioned in this paper. The fresh specimens were cut by free hand sections and examined under microscope. The phytochemical investigation revealed the presence of active constituents such as alkaloids carbohydrate, starch, reducing sugar, phenolic compound, tannin, steroid and glycoside. Alkaloids (Wagner’s), α -amino acid, saponin and flavonoid are absent.

Keywords : Morphology, Anatomy and Phytochemical test

Introduction

Terminalia catappa L. is a large tropical tree in the family Combretaceae that is native to tropical regions of Asia, Africa and Australia. Combretaceae is a family of flowering plants comprising 14 genera and about 500 species. *Terminalia* includes 190 species some of them with economic importance as ornamentals and timbers yielding plant.(Lawrence,1951).

T. catappa L. is commonly called tropical almond or India almond is medium to large deciduous tropical tree. The leaves are long, smooth, shiny and turn red then fall off twice a years. In Taiwan, fall leaves are used as a herb to treat liver diseases. Greenish white flowers are in a spike at the end of branches. It is known for nutritional fruit and possess medicinal benefits as well. This is a comprehensive review of the phytoconstituents and pharmacological benefits.(Ramachandra *et al.*, 2007).

The WHO has indicated that as many as 80% of all people living in the world’s make use herbal medicine as their main source of healthcare. It is no wonder that the world’s one-fourth population i.e 1.42 billion people are dependent on traditional medicines for treatment of various ailments (Gomathi *et al*, 2016).

The ripe fruits are relished by children and young adults, while the fruit nuts can be roasted or eaten raw. Leaves are used to treat dysentery, asthma and malaria fever in different parts of the country. The edible fruits are fibrous with a tender skin. (Yada and Munin, 2011).

The anatomical features of leaves are dorsiventral with an anomocytic stoma in lower surface. In upper surface stomata absent, the epidermal cells are wavy. The

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palisade mesophyll cell is one layer, cylindrical, elongated, closely arranged. The spongy mesophyll cells are largely irregular shaped, parenchymatous cells with intercellular space. The midrib is slightly convex covered with smooth cuticle. The upper epidermal cells are barrel-shaped. Vascular bundle is crescent shaped and collateral in petiole. Simple unicellular trichome is present. (Metcalf and Chalk, 1950).

The leaves of *T. caappa* L. contains alkaloid, carbohydrate, starch, reducing sugar, phenolic compound, tannin, steroid, glycoside and α -amino acid, saponin, flavonoid are absent. The usage of herbs to treat a variety of different ailments is universal, and exists in every human culture on Earth. There is a need for documentation research work carried out on traditional medicines (Gomathi *et al*, 2016).

In this paper, the morphology, the taxonomy of vegetative and reproductive parts, the anatomy of leaves and preliminary phytochemical test of *Termanilia catappa* L. has been studied. The main objectives of this paper are to study the morphological characters of vegetative and reproductive parts of *Termanilia catappa* L., to know the anatomical characters of leaves, to determine the phytochemical constituents from the leaves and to study the medicinal value and uses of the *Terminalia catappa* L.

Materials And Methods

Collection and identification of *Terminalia catappa* L.

The specimens of *Terminalia catappa* L. were collected from North Dagon Township, Yangon Region from June to July in 2019. The collected specimens were identified by Hundley & Chit Ko Ko, 1987. Fresh specimens of vegetative and reproductive parts were used to study its morphology by the help of Backer (1963); Hooker (1879) and Dassanayake (1991).

For the anatomical studies, the fresh leaves were sliced into fine cuttings by free hand section with razor blade. The cut specimens were cleared by using chloral hydrate solution as a clearing agent. The specimens were examined under light microscopes and were recorded with photographs.

For chemical studies, the leaves were thoroughly washed with water and then dried about four weeks in room temperature. When completely dried, the specimens were homogenized by blender to get powdered and stored in air tight containers for phytochemical studies.

Phytochemical investigation of *Terminalia catappa* L. was determined the presence or absence of chemical constituents from powdered sample was tested according to British Pharmacopeia, (1965), Central council for Research in Unani Medicine (1987) and Trease and Evans (2002).

Results

Morphological Characters of *Terminalia catappa* L.

Scientific Name - *Terminalia catappa* L.

Myanmar name - Ban-da

English name - Almond

Family - Combretaceae

The tree grows to about 35m tall, with an upright, symmetrical crown and horizontal branches. Its branches are characteristically arranged in tiers. The **leaves** are large, 15-25cm long and 10-14cm broad, spirally arranged whorled, simple, petiolate, exstipulate, lamina obovate, glossy dark green and leathery, leaf margin entire, upper surface smooth, lower surface of hair present. **Inflorescence** axillary, spikes. The trees are monoecious with distinct male and female flowers on the same tree. **Male flowers** towards apex and bisexual ones towards base, Male flower-creamy, about 0.6 cm in diameter, ebracteate, ebracteolate, sessile, incomplete, unisexual, regular, actinomorphic, pentamerous, epigynous. **Sepals-5**, aposepalous, campanulate, valvate, deciduous, petaloid (cream color) superior. **Petal-absent**. **Stamens 5+5**, exserted, the upper 5stamens alternate with calyx lobes, the lower 5 stamens opposite with calyx lobes, disc is present at the base of the stamen, the filaments are curved inward in bud, the anther ditheous, yellow, introrse, dorsifixed, longitudinal dehiscence, superior. Ovary absent. **Bisexual flowers**, creamy or white to greenish, about 0.6 cm in diameter, ebracteate, ebracteolate, sessile, incomplete, bisexual, regular, actinomorphic, pentamerous, epigynous. **Sepals (5)**, synsepalous, campanulate, valvate, petaloid (cream), superior. **Petal-absent**. **Stamens 10**, apostemonous, the filament length unequal, about 0.3-0.4 cm long, the anther ditheous, introrse, dorsifixed, longitudinal dehiscence, superior. **Ovary** ovoid about 0.5 cm in diameter, carpel one, monocarpellary, unilocular, the style long, filiform bearing a pointed, the stigma simple, inferior. The **fruit** is a drupr 5-7 cm long and 3-5.5 cm broad, green at first, then yellow and finally red when ripe. Containing spindle shaped, a single seed.

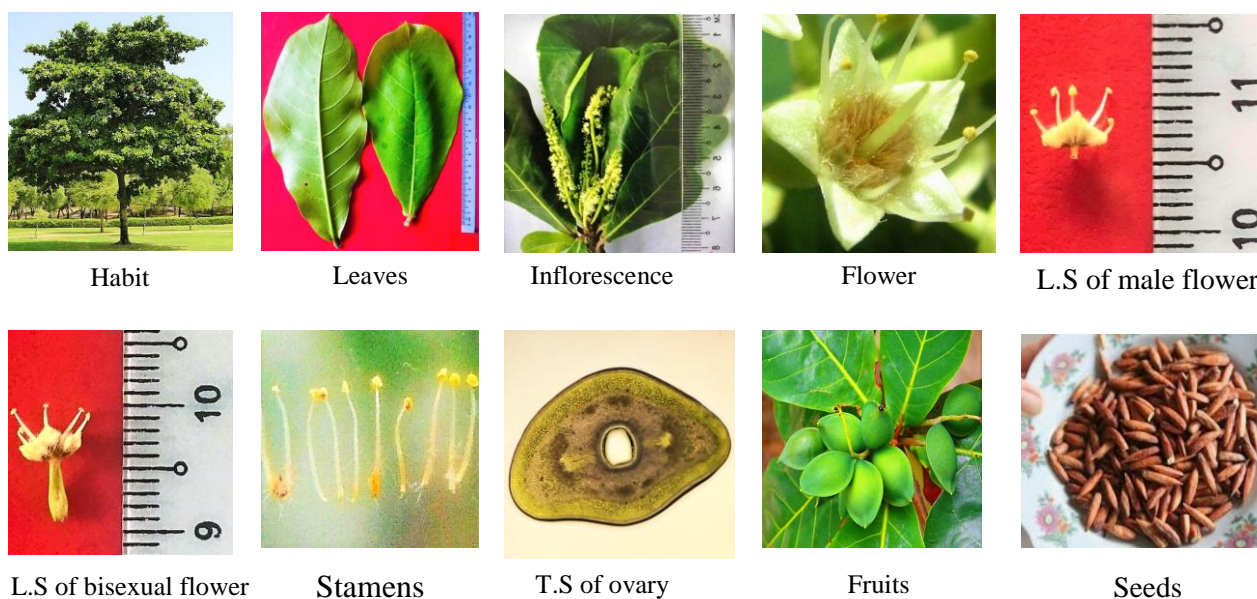


Figure 1. Morphological characters of *Terminalia catappa* L.

Anatomical Characters of *Terminalia catappa* L.

Lamina

In surface view, the epidermal cells of both surfaces are smooth in cuticle and anticlinal walls and wavy. Stomata are absent on upper surface and lower surface present. Anomocytic type of stomata were found in lower surface.

In transverse section, the leaves are dorsiventral. The upper epidermal cells are barrel-shaped, single layered. The palisade mesophyll is one layered cylindrical, elongated, closely arranged with a lot of chloroplasts. The spongy mesophyll cells are largely irregular shaped, 3-4 layers thin walled parenchymatous cells with intercellular spaces, unicellular trichome is present.

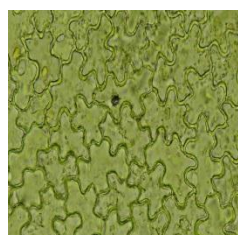
Midrib

In surface view, the epidermal cells are rectangular shaped, elongated, compactly arranged, oil cells present among the cells. The midrib is slightly convex covered with smooth cuticle. The upper epidermal cells are barrel-shaped, compactly arranged, 3-4 layers of collenchyma above the vascular bundle and 5-6 layers of rounded parenchyma cells below the vascular bundle. Parenchyma cells are large and with intercellular space. Vascular bundle is crescent shaped and collateral. Unicellular trichome is present.

Petiole

In surface view, the epidermal cells are rectangular shaped and elongated, Parenchyma cells are compactly arranged, oil cells abundant. The epidermal cells are parenchymatous, compactly arranged, oval to barrel-shaped 2-4 layers of collenchyma, above the vascular bundle 5-6 layers cells of collenchyma and 9-11 layers of polygonal parenchyma cells below the vascular bundle is crescent shaped and collateral. Simple unicellular trichome is present.

Lamina



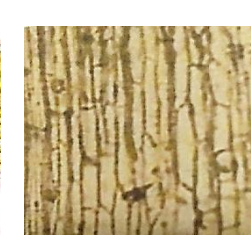
Upper surface



Lower surface view with stomata



T.S of Lamina



Surface view of midrib



T.S of midrib

Midrib

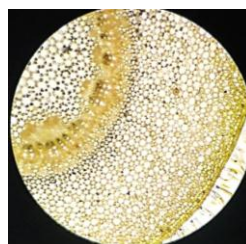
Petiole



Surface view of petiole



T.S of petiole



Close up view of petiole

Figure 2. Anatomical Characters of *Terminalia catappa* L.

Preliminary phytochemical test of *Terminalia catappa* L.

The dried powdered of the leaves were examined by using various chemical reagents for the presence or absence of the chemical constituents. It was determined by observation of the resulting color or precipitation were as shown in Table 1.

According to observation of the present of alkaloids, carbohydrate, starch, reducing sugar, phenolic compound, tannin, steroid, glycoside. The test has shown that alkaloid (Wagner's), flavonoid, saponins and α -amino acids were absent. The results are shown in Table 1 and Figures.

Table1. Preliminary phytochemical test of leaves of *Terminalia catappa* L.

No.	Test	Extract	Test Reagent	Observation	Result
1	Alkaloid	HCl	Mayer's reagent	Cream Color	+
			Dragendroff's reagent	Orange ppt	+
			Wagner's Reagent	No change	-
2	α -Amino acid	H ₂ O	Ninhydrin solution	No change	-
3	Carbohydrate	H ₂ O	10% α -naphthol +conc: H ₂ SO ₄	Red ring	+
4	Starch	H ₂ O	I ₂ KI solution	Bluish black ppt	+
5	Reducing sugar	H ₂ O	Benedict's solution	Deep green ppt	+
6	Phenolic compound	H ₂ O	10% FeCl ₃ solution	Deep blue color	+
7	Saponin	H ₂ O	Distilled water	No change	-
8	Tanin	H ₂ O	Ferric chloride solution	Blue black	+
9	Steroid	Pet-ether	Acetic anhydride + Conc: H ₂ SO ₄	Green	-
10	Flavonoid	Methanol	(1) Mg turning (2) Conc: HCl acid	Green	-
11.	Glycoside	H ₂ O	10% lead acetate solution	White	+

(+) = Present

(-) = Absent

(ppt.) = precipitate

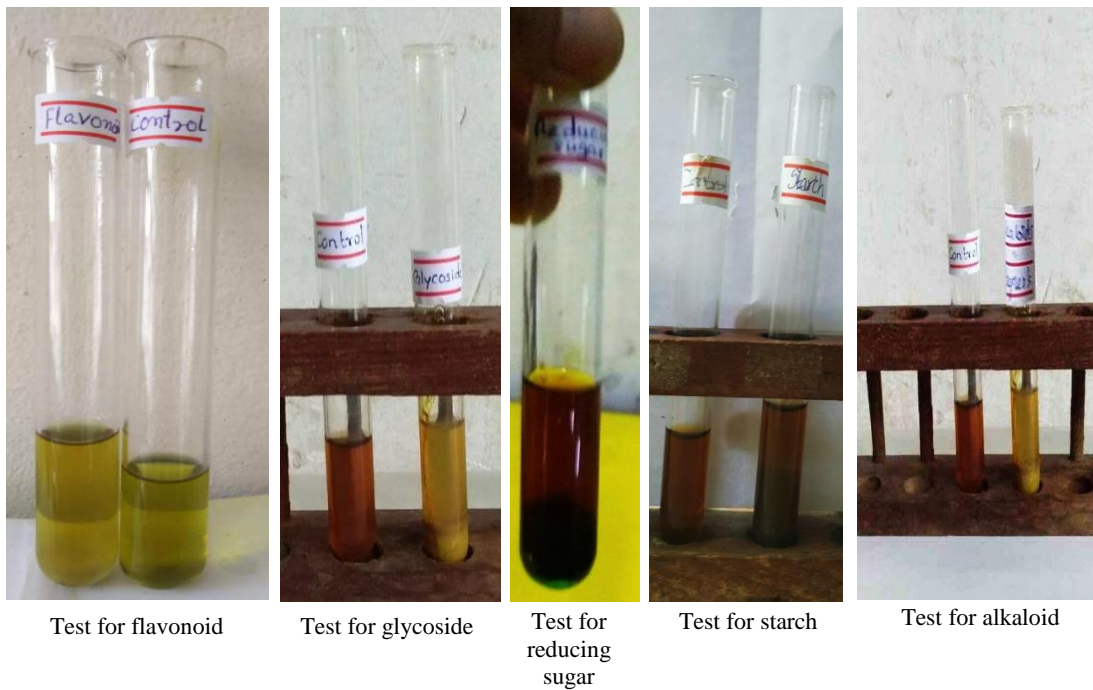


Figure 3. Preliminary phytochemical test on the leaves of *Terminalia catappa* L.

DISCUSSION AND CONCLUSION

In this research work, morphological, anatomical characters of *Terminalia Catappa* L. have been investigated. Preliminary phytochemical test of the specimens were also described.

T. catappa L. is commonly called tropical almond belong to the family Combretaceae. The plant is deciduous perennial with an upright, symmetrical crown and horizontal branches, the trees are monoecious. The leaves are long, short petiole, cluster at the branched tip, ovoid, glossy dark green and leathery. The flowers are grouped in axillary spike, male or hermaphrodite. The male flowers are usually at the upper part and hermaphrodite ones on the lower part, the calyx is cream coloured. Corolla is absent. The androecium is composed of 10-stamens, apostemonous, anther ditheous, dorsifixed. Carpel 1-monocarpellary, Unilocular, ovary inferior, Fruit-drupe, ellipsoidal. Seed yellow brown, spindle-shaped, 1-seeded. These characters were agreement with those mentioned by Backer, (1963) and Dassanayake, (1991).

In anatomical characters, stomata are anomocytic type in lower surface, stomata absent in upper surface epidermal cells are wavy. In transverse section of the lamina, the leaves are dorsiventral. The upper epidermal cells are barrel-shaped. The palisade mesophyll is one layered, elongated, the spongy mesophyll cells are largely irregular shaped, then parenchymatous cells with intercellular spaces the midrib is convex covered with smooth cuticle, the upper epidermal cells are barrel-shaped, compactly arranged 3-4 layers of collenchymas above the vascular bundle, parenchyma cells are large and with intercellular space, vascular bundle is crescent shaped and collateral; unicellular trichome is present. In the petiole; polygonal parenchyma cells below the vascular bundle, simple unicellular trichomes are present. These characters were in agreement with those reported by Metcalfe and Chalk (1950).

The preliminary phytochemical test were determined the presence of alkaloids, carbohydrate, starch, reducing sugar, phenolic compound, tannin, steroid, glycoside. The absent of α -amino acid, saponin, flavonoid. These characters were agreement with British pharmacopeia (1965), Central council for Research in Unani Medicine (1987) and Trease and Evans (2002). According to the literature, the ripe fruits are relished by children and young adults while the fruit nuts can be roasted or eaten raw, leaves are used to treat dysentery, asthma and malaria fever in different part of the country. Almond tree is an important species providing nut for consumption, local medicine, used as ornamental and serve as excellent central of strong winds. These facts were described by Yada and Munin, (2011).

In conclusion, the pharmacological investigations carried out on *T. catappa* L. validate the immense numerous diseases. Additional research and clinical treats are needed for the product development to strengthen the use of *T. catappa* L. for the future generations

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