

Physicochemical Properties and Phytochemical Investigation of Androecium from *Bombax ceiba* L.

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Abstract

The medicinal plant *Bombax ceiba* L. belongs to the family Malvaceae. This plant is known as Let-Pan in Myanmar. The specimens were collected from Banmaw University Campus, Kachin State, during the flowering and fruiting period, from January to March, 2021. In this research, morphological characters, physicochemical properties and preliminary phytochemical tests were studied. In the morphological study, the plant was a deciduous tree, glabrous leaves and gray or brown bark. In the physicochemical investigation, angiosperms of *Bombax ceiba* L. were found to be significantly soluble in ethyl acetate, which was higher than those of other solvents and the least soluble in petroleum ether. In the phytochemical investigation, the angiosperms contained tannin, α -amino acid, alkaloid, phenolic compound, flavonoid, reducing sugar, saponin and starch.

Keywords: *Bombax ceiba* L. Phytochemical test, Physicochemical test

Introduction

In many parts of the world traditional knowledge and biodiversity still play an important role in health care, culture, religion, food security, the environment, and sustainable development. Moreover, many widely used plant-based medicines are derived from traditional knowledge. Traditional medicine is widely practiced in Myanmar by the majority of the population either as an alternative to or as a supplement to modern medicine. Advances in modern science and technology have contributed to an enormous development in the quality of human life. Plants have served as medicine since time immemorial. Drugs from plant sources are being used by about 80 % of the world population. Herbal medicines have stood the test of time for their safety, efficacy, acceptability and fewer side effects.

The plant *Bombax ceiba* L. belongs to the family Malvaceae. *Bombax ceiba* L. is an important medicinal plant in tropical and subtropical India and also occurs in Sri Lanka, Pakistan, Bangladesh, Myanmar, Malaysia, Java, Sumatra and Northern Austria. The common name of this plant is silk cotton tree. In Myanmar known as Let-Pan and widely distributed. "Bombax" is a Latin word meaning "splendid or marvelous" may be named after its very tall height whereas the species name "ceiba" is a Latinized form of the South American name for Silk Cotton. The flowering season is around January to March. This plant is valued for its medicinal properties and used as traditional medicine such as astringent, cooling, stimulant, diuretic, aphrodisiac, demulcent, dysentery and tonic. It is also beneficial for asthma, expectorant, diarrhea, wounds, leucorrhoea, anemia, splenomegaly and tuberculosis. Parts of the trees are used in traditional Ayurvedic medicine. Barks are astringent and diuretic. Leaves and flowers are used for diabetes. Roots are used as astringents and diuretics; and are considered to have tonic properties Nordal (1963), Pery (1980). In China and Myanmar fallen flowers are gathered and used for tea or soup. The immature calyxes known as Semargulla are consumed as a vegetable in Uttar Pradesh, and addition to the flowers and fleshy calyx. (Donipati *et al.* 2015)

The aim and objectives of the present research were to verify the morphological characteristics of this plant, to examine the physicochemical investigation and the phytochemical constituents.

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Materials and Methods

Botanical Studies

The specimens used in this research were collected widely at Banmaw University Campus, Kachin State. They were collected especially during the flowering and fruiting period from January to March in 2021. The collected fresh specimens of both vegetative and reproductive parts of the plants were identified by using the literature of Lawrences, 1964; Backer, 1965; Hundley and Chit Ko Ko, 1987; Dassanayake, 2000 and Kress et al., 2003. Taxonomic descriptions were accompanied by photographs of natural habitats, L.S of flowers and parts of the plants with measurements.

Chemical Studies

The angiosperms of *Bombax ceiba* L. were collected from the Banmaw University campus, Kachin State. The samples were plucked and dried at room temperature for 2-3 weeks. The dried angiosperms were pulverized by grinding with a blender to get a fine powder and stored in an air tight container. For preliminary phytochemical tests, the air-dried powdered of angiosperms were tested for alkaloids, α -amino acid, reducing sugar, starch, saponin, tannin and phenolic compounds were carried out. The physicochemical properties of solubility of powdered angiosperms were carried out using aqueous soluble matter content and various solvents such as methanol, ethanol, ethyl acetate, chloroform, petroleum ether and acetone.

Physicochemical Investigation of Angiosperms from *Bombax ceiba* L.

Physicochemical investigation was determined according to British Pharmacopoeia (1965) as follows.

Determination of Soluble Matter Content in Different Solvents

Soluble matter content was determined by the method of the British Pharmacopoeia, 1968. Five grams of powder were soaked with 50ml of distilled water in a flask, closed for 72 hrs. The mixture was filtered and evaporated in a weighed beaker then placed in a boiling water bath until it was completely evaporated. The percentage of soluble matter was calculated. Similarly the same procedure was repeated for the determination of aqueous, methanol, ethanol, ethyl acetate, chloroform, petroleum ether and acetone.

Preliminary Phytochemical Test of Angiosperms from *Bombax ceiba* L.

The preliminary phytochemical tests were carried out according to Vogel, 1956; British Pharmacopoeia 1968, Marini Bettolo *et. al.*, 1981; Robinson 1983 and Central Council for Research in Unani Medicine, 1987.

Test for Alkaloid

One gram of powdered sample was boiled for about 20 minutes with 20 ml of 10% HCl and filtered. The filtrate was divided into three portions and tested with Dragendroff's reagent, three Wagener's reagents and Mayer's reagent. The precipitate formed upon the addition of the reagent indicated the presence of an alkaloid (Robinson, 1983).

Test for α -Amino acid

One gram of powdered sample was boiled with 10ml of distilled water for 20 minutes and then filtered. And then, a few drops of each filtrate were spotted on a filter paper using a capillary tube, allowing it to dry and sprayed with ninhydrin reagent. The filter paper was dried at room temperature and then kept at 110°C for a few minutes after which the purple colour appears due to the presence of α -amino acids (Marini Bettolo *et. al.*, 1981).

Test for Reducing Sugar

One gram of powdered sample was boiled with 10ml of distilled water for 20 minutes and filtered. The filtrate was treated with Fehling's solution, then boiled for 20 minutes, it furnished green precipitates, and indication of the presence of a reducing sugar (Vogel, 1956).

Test for Starch

One gram of dried powdered sample was boiled with 10 ml of distilled water for about 20 minutes. It was then filtered and two drops of iodine solution were added to the filtrate. A blue black colour was formed which indicates the presence of starch (Marini Bettolo *et al.*, 1981).

Test for Saponin

One gram of powdered sample was boiled with 10 ml of distilled water for about 20 minutes and filtered. The filtered and the filtrate are shaken vigorously with distilled water for a few minutes. The market fothing which lasted for about half an hour took place, indicating the presence of saponin (Marini Bettolo *et al.*, 1981).

Test for Tannin

One gram of powdered sample was boiled with 10ml of distilled water for about 20 minutes and filtered. The filtrate was treated with a few drops of a 1% ferric chloride solution. A bluish black or yellowish brown colour resulted indicating the presence of tannins (Marini Bettolo *et al.*, 1981).

Test for Phenolic compound

One gram of powdered material was boiled with 10 ml of distilled water for 20 minutes and filtered. The filtrate was treated with a neutral 5% ferric chloride solution. It gave a deep blue colour, indicating the presence of phenol groups (Marini Bettolo *et al.*, 1981)

Results

Morphological Characters of *Bombax ceiba* L.

Scientific name	- <i>Bombax ceiba</i> L.
Myanmar name	- Let-Pan
English name	- Bombax
Family	- Malvaceae
Flowering and fruiting period	- January to March
Parts used	- Angiosperms

The plant is deciduous tree. Stems are cylindrical, woody and greyish brown. The leaves are alternate, palmately compound, petiolate, stipulate; leaflets are 5, oblong-oblong lanceolate, 3.0-4.5, broad cuneate base, margin entire, acuminate apex, glabrous; petioles are cylindrical, 1.0-3.5 cm; 0.1-0.5 cm; stipules are lanceolate about 0.6 × 0.3 cm, caducous. The inflorescences are axillary cyme; peduncles are cylindrical, short, about 1.5-2.5 cm long. The flowers are red about 10.0-13.5 cm in diameter, solitary or 2-5 together, pedicellate, complete, bisexual, regular, zygomorphic; pedicel are cylindrical, about 0.5 × 1.5 cm. The sepals are 3, synsepalous, calyx campanulate, calyx lobes 3-4 × 3 cm, glabrous outside, silky inside. The petals are 5, 10.0-13.5 cm, elliptic-obovate, fleshy. The stamens are (9-15), fuse, polyadelphous, filament about 3.0-4.5 cm, filiform; the anther is ditheous, about 0.2-0.4 cm, extrorse, dorsifixed, longitudinal dehiscence, inferior. The ovary is superior, about 0.2-0.5 cm

in diameter, on the stalk, carpel 5, many ovules in each locule in T.S; style is one, terminal, about 2.8 cm long, red, glabrous; stigma is penta-fid. The fruits are capsule, oblong, 8-10 × 3.0 cm and black. The seeds are numerous, pyriform.



Habit



Leaves branches



Ventral view of leaflets



Dorsal view of leaflets



Flowers



L.S of flower



Sepals



Petals



Penta-adelphous
stamens



Stamens



Stamens



Carpel

Figure (1) Morphological characters of *Bombax ceiba* L.

Physicochemical Investigation of Angiosperm from *Bombax ceiba* L.

The results of the physicochemical investigation, the moisture content were determined and recorded. The solubility of angiosperms powdered in petroleum ether, acetone, ethyl acetate, methanol, distilled water, ethanol and chloroform was carried out to determine the amount of total solids soluble in an individual solvent. Angiosperms of *Bombax ceiba* L. were found to be significantly soluble in ethylacetate, which was higher than those of other solvents and the least soluble in petroleum ether. The results are shown in Table 1.

Table (1) Physicochemical Investigation of Angiosperm from *Bombax ceiba* L.

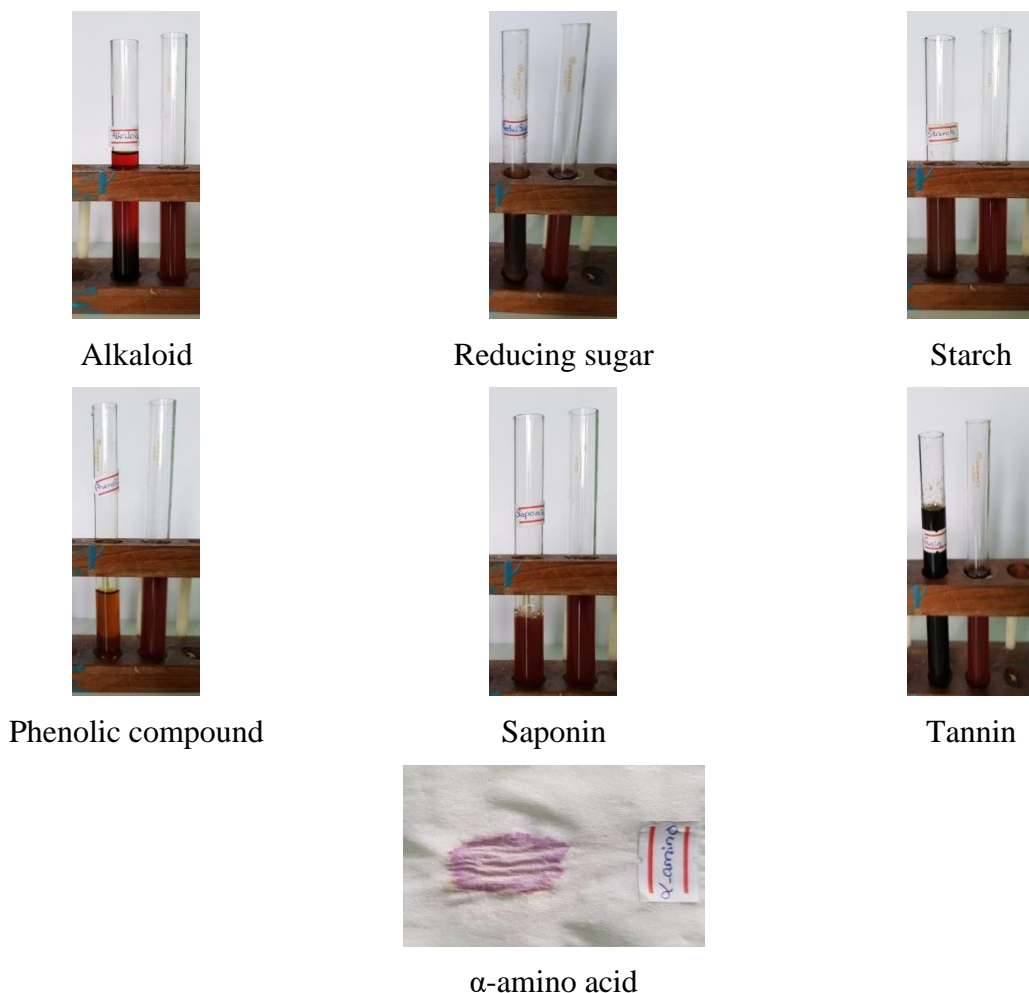
No.	Physicochemical characters	Average (%)
1	Aqueous soluble matter content	0.28
2	Methanol soluble matter content	0.45
3	Ethanol soluble matter content	0.31
4	Ethyl acetate soluble matter content	2.0
5	Chloroform soluble matter content	0.23
6	Acetone soluble matter content	0.09
7	Petroleum ether soluble matter content	0.05

Preliminary Phytochemical Tests of Angiosperm from *Bombax ceiba* L.

The results of a preliminary phytochemical test of air-dried angiosperms powdered from *Bombax ceiba* L. indicated that alkaloids, reducing sugar, α -amino acid, starch, saponin, flavonoids, phenolic compounds and tannin were found to be present. The results are shown in Figure 2-3 and Table 2.



Figure (2) Preliminary Phytochemical Test of Angiosperms from *Bombax ceiba* L.

Figure (3) Preliminary Phytochemical Test of Angiosperms from *Bombax ceiba* L.Table (2) Preliminary Phytochemical Test of Angiosperms from *Bombax ceiba* L.

No.	Test	Extract	Test reagent	Observation	Results
1	Alkaloid	10% HCl	Wagner's reagent	Brown ppt	+
2	α -amino acid	H ₂ O	Ninhydrin reagent	Pink spot	+
3	Reducing sugar	H ₂ O	Fehling's solution	ppt	+
4	Starch	H ₂ O	Iodine solution	Brown ppt	+
5	Saponin	H ₂ O	Distilled water	Foaming	+
6	Phenolic compound	H ₂ O	5% FeCl ₃ solution	Deep blue ppt	+
7	Tannin	H ₂ O	3% Ferric chloride solution	Black ppt	+

Key to the table (+) = present (-) = absent (ppt.) = precipitate

Discussion and Conclusion

Plants play an essential role in the human diet. Additionally, plant species are used for increasing flavor in diets and are recognized for their preservative and medicinal values (DeSouza et al., 2005). Medicinal plants are a main source of a variety of drugs as more than 80% of the world's population uses traditional medicine for their primary healthcare needs (Diallo et al., 1999).

The plant *Bombax ceiba* L. belongs to the family Malvaceae. *Bombax ceiba* L. is an important medicinal plant in tropical and subtropical India and also occurs in Sri Lanka, Pakistan, Bangladesh, Myanmar, Malaysia, Java, Sumatra and Northern Austria. The common names of the plant are silk cotton tree. In Myanmar known as Let-Pan and widely distributed. "Bombax" is a Latin word meaning "splendid or marvelous" may be named after its very tall height whereas the species name "ceiba" is a Latinized form of the South American name for Silk Cotton. The flowering season is from around January to March. This plant is valued for its medicinal properties and is used as traditional medicine such as astringent, cooling, stimulant, diuretic, aphorodisiac, demulcent, dysentery and tonic. It is also beneficial for asthma, expectorant, diarrhea, wounds, leucorrhoea, anemia, splenomegaly and tuberculosis. Parts of the trees are used in traditional Ayurvedic medicine. Barks are astringent and diuretic. Leaves and flowers are used for diabetes. Roots are used as astringents and diuretics and are considered to have tonic properties. Nordal (1963), Pery (1980). In China, fallen flowers are gathered and used for tea or soup. The immature calyxes known as Semargulla are consumed as a vegetable in Uttar Pradesh, and addition to the flowers and fleshy calyx (Donipati et al. 2015).

The flowers are bitter, acrid cooling, dry, astringent to the bowels, remove bile and phlegm, purify the blood, benefit the and are good for leucorrhoea. It is topically applied to skin affections as a cooling and astringent. Ethanolic extract of *Bombax ceiba* L. bark and flower was given for 3 days for various gonorrhoea, leucorrhoea and menstrual disorders in women and to increase sperm count, treat impotency and hydrocele in man (Rani et al., 2016).

In the physicochemical investigation, the moisture content was determined and recorded. The solubility of angiosperms powdered in petroleum ether, acetone, ethyl acetate, methanol, distilled water, ethanol and chloroform was carried out to determine the amount of total solids soluble in an individual solvent. Angiosperms of *Bombax ceiba* L. were found to be significantly soluble in ethyl acetate was higher than that of other solvents and the least soluble in petroleum ether.

The results of a preliminary phytochemical test of air-dried angiosperms powdered from *Bombax ceiba* L. indicated that alkaloids, reducing sugar, α -amino acids, starch, saponin, flavonoids, phenolic compounds and tannin were found to be present. Among them, the amount of precipitate from tannin was higher than in the other tests. This data was agreed with alkaloids, phenolics, tannins, α -amino acids in the methanolic extract of flowers reported by Rathore et al., 2019.

Therefore, the present study focused on chemical composition by using preliminary phytochemical tests and physicochemical investigation of this plant which could be assumed to be beneficial for human health. In this regard, further studies need to be carried out to explore *B. ceiba* L. for its potential in preventing and treating diseases.

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