

MORPHOLOGICAL AND HISTOLOGICAL STUDIES OF *ARTOCARPUS LAMELLOSUS* BLANCO (LEAVES)

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Abstract

The plant *Artocarpus lamellosus* Blanco belongs to the family Moraceae. It is collected from University of Yangon Campus, Kamayut Township during flowering and fruiting period in 2022. This plant is an unrecorded species in Myanmar. It possesses high medicinal value especially in the treatment of inflammation, malarial fever, ulcers, diarrhea, obesity and diabetes. Thus, this plant was selected for further investigation. The collected plants were classified and identified according to standard procedures. In this paper, morphological and histological characters of leaves were investigated. In morphological study, this plant was a monoecious tree with simple leaves, stipulate. Inflorescences (also called syncarp) were axillary and terminal, capitate. Flowers were yellow, unisexual. The fruits were syncarp (aggregate fruit). In histological study, epidermal cells of both surfaces were polygonal in shape with slightly wavy anticlinal walls. Stomata were found only the lower surface and anomocytic type. Cystoliths were present in epidermal cells of lamina and laticiferous were present on the surface view and transverse sections of midrib, petiole and stems. Unicellular and glandular trichomes were present on the surface of petiole and stem but midrib was present only one type unicellular trichomes. In addition, the powdered sample of leaves were investigated and presented as diagnostic characters for medicinal purposes.

Keyword: *Artocarpus lamellosus* Blanco morphological and histological characters

Introduction

The plant *Artocarpus lamellosus* Blanco belongs to the family Moraceae. It is widely distributed in Philippines. This family consists of 60 genera comprising 14,000 species distributed in the tropical and subtropical regions of Asia with all parts contain white latex. The plant is occurring in Southern China, Myanmar, Thailand, Indo-China, Malaysia. (Cronquist. 1981)

The plant *Artocarpus lamellosus* Blanco has also been used as traditional folk medicine in South-East Asia for the treatment of inflammation, malarial fever and treat the ulcers, abscess and diarrhea. The leaves and stem barks have been used to treat anemia, asthma, dermatitis, diarrhea, cough and as an expectorant. The latex mixed with vinegar promotes healing of abscesses, snakebite and glandular swellings. *Artocarpus* species are rich in phenolic compounds including flavonoids, stilbenoids, arylbenzofurans present in all plant parts and jacalin, a lectin present in seeds of certain *Artocarpus* species (Somashekhar, *et al.* 2013). Several pharmacological studies of the natural products from *Artocarpus* have conclusively established their mode of action in the treatment of various diseases. *Artocarpus lamellosus* Blanco extract is as a pancreatic lipase inhibitor, and has antiobesity action, can be used for diseases such as prevention or treatment of obesity. (CN,2009)

The objectives of this paper are to botanical identification and histological characters of fresh specimen of *Artocarpus lamellosus* Blanco (leaves).

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Materials and Methods

Collection and Identification of Plant

Artocarpus lamellosus Blanco was collected from University of Yangon campus, Kamayut Township. The collection was done during the flowering period (January to March). Botanical identification of *Artocarpus lamellosus* Blanco was performed by verifying the references of Conquist (1981), Gardner, et al (2020) and Dassanayake (1981) in Department of Botany, University of Yangon.

Preparation of *Artocarpus lamellosus* Blanco leaf powder

The collected leaves were washed and dried in shade for one week. The dried leaves were ground to get powder and stored in air tight containers. The sensory and diagnostic characters of powdered leaves were studied.

Histological Study of *Artocarpus lamellosus* Blanco

The microscopical characters of fresh specimens were examined by freehand sections and under microscope. The microchemical tests for the presence of lignin, tannin were made according to the methods and reagents given in Metcalfe and Chalk (1965), Esau (1953), Trease and Evans (2002) at the department of botany, University of Yangon. The following reagents were used to examine the free hands sections and powdered samples.

1. Chloral hydrate solution as the clearing reagent.
2. Phloroglucinol solution for testing the lignin.
3. Iodine solution for testing starch.
4. Ferric chloride testing secretory cells.
5. Sudan III for testing oil cells.
6. Acetic acid and 80% sulphuric acid for testing calcium carbonate crystals.

Diagnostic Characters of Powdered Leaves of *Artocarpus lamellosus* Blanco

Microscopical characters and sensory characters of powdered leaves were studied.

Results

Key to the taxa comprising *Artocarpus lamellosus* Blanco

1. Adjacent pistillate flowers proximally free 2
1. Adjacent pistillate flowers completely fused 6
 2. Syncarp subglabrous; nigrescent when dry *A. griffithii*
 2. Syncarp pubescent; not nigrescent when dry 3
3. Syncarp pubescence dark red-brown *A. borneensis*
3. Syncarp pubescence otherwise 4
 4. Syncarps up to 5 cm across, velutinous, flesh bright pink ripening orange- pink; leaf apices rather blunt *A. parvus*

4. Syncarps seldom exceeding 3 cm, short-pubescent, flesh otherwise; leaves acuminate 5
5. Syncarps seldom deeply lobed; leaf acumen up to 3 cm, lateral veins markedly ascending, usually drying brown, attachment cuneate..... *A. humilis*
5. Syncarps usually deeply lobed; leaves shortly acuminate, without markedly ascending lateral veins, often drying blue-grey above, attachment often rounded to subcordate..... *A. lamellosus*

Scientific Classification

Family	: Moraceae
Tribe	: Artocarpeae
Genus	: Artocarpus
Sub-genus	: <i>A. subg. Pseudojaca</i>
Species	: <i>Artocarpus lamellosus</i> Blanco
Synonyms	: <i>Artocarpus lamellosus</i> Trecul <i>Artocarpus nitidus</i> Trecul <i>Saccus lanceolatus</i> (Trecul) Kuntze <i>Saccus nitidus</i> (Trecul) Kuntze

Morphological Characters

Scientific Name	- <i>Artocarpus lamellosus</i> Blanco
Myanmar Name	- Unknown
Common Name	- Butong (Tag)
Family	- Moraceae

Trees up to 17m tall, evergreen, with latex; monoecious, straight. Bark black to brown, longitudinally fissured. Branchlets cylindric, wrinkled, 2-3 mm thick. Leaf simple, alternate, stipules lanceolate, caduceus. Petiole 0.5-2 cm; leaf blade oblong to orbicular or ovate, 7-15 x 3-7 cm, lathery to thinly lathery, glabrous, abaxially pale green, adaxially dark green. Young leaves with both surface black, when dry base cuneate, margin entire or irregularly shallowly veins 6-10 on each side of midvein, adaxially prominent. Male inflorescences capitate, obovoid or oblong 2.5-12 x 2.7-7 mm. Male flowers calyx lobes 2-4, basally connate for 0.5-0.7 mm. Female inflorescences capitate or globose; peduncle 1.5-8 mm. Female flowers calyx tubular, style exerted. Fruiting syncarp red, reddish orange or yellow, brown when dry, globose, 1.5-5 cm in diam, fleshy, glabrous or sparsely covered with coarse pubescence, peduncle to 5 mm; bracts persistent. The results were shown in figure 1 to 7.

Flowering and fruiting period – January to March.



Figure 1. Habit



Figure 2. Arrangement of leaves



Figure 3. Lower and upper view of leaf



Figure 4. Staminate inflorescence



Figure 5. Pistillate inflorescence



Figure 6. Syncarp (aggregate fruit)



Figure 7. Longitudinal Section of Syncarp (aggregate fruit)

Histological Study of *Artocarpus lamellosus* Blanco

Lamina

In surface view, the cuticle is striated on upper surface. The epidermal cells were thin-walled, polygonal in shaped. Stomata were occurred only on lower surface. Anomocytic types stomata with wavy anticlinal walls and two reniform-shaped guard cells. Cystolith of calcium carbonate crystals were present in the epidermal cells. Trichomes were absent on both surfaces.

In transverse section, the epidermis was covered with thin cutical on upper surface. Upper epidermis and lower epidermis were one-layered thick and bulliform- shaped cells. Mesophyll was differentiated into 1-2 layered palisade and 3-4 layered spongy region. The palisade mesophyll was composed of elongated and compactly arranged parenchyma cells. The spongy cells were arranged with air spaces and mostly rounded to oval- shaped parenchyma cells.

The vascular bundles embedded in mesophyll region. Bundles were collateral types. Xylem lies toward the upper epidermis and composed of reticulate and pitted vessels, tracheids, fibers and xylem parenchyma cells. Phloem lies toward the lower epidermis consists of sieve tubes, companion cells and phloem parenchyma cells. The results were shown in figures 8 to 10.



Figure 8. Upper surface view of lamina showing epidermal cells (x400)



Figure 9. Lower surface view of lamina showing epidermal cells with anomocytic stomata and cystolith (x400)



Figure 10. T.S of lamina showing epidermis and mesophyll cells (x100)

Midrib

In surface view, the epidermal cells were thin-walled, rectangular to polygonal in shaped and elongated along the axis. Trichomes were mainly of unicellular type and glandular trichomes were very rare. In transverse section, a single layered epidermis was covered with unicellular trichome and followed by cortex. Cortex region consisted of 3 to 4 layered collenchyma cells and 7 to 10 layered of parenchyma cells. Latex tubes and crystal glands were more on the apical region

than the middle and basal regions of midrib. Collenchyma was occurred in ground tissue of upper midrib. The vascular bundle was semicircular shaped and closed collateral type. Xylem was endarch and surrounded by phloem. The xylem cells were hexagonal and arranged in radial rows, composed of vessel, tracheids, fibers and xylem parenchyma cells. The phloem cells were thin-walled and occurred outside of the xylem tissue, mainly composed of sieve tubes, companion cells and phloem parenchyma cells. The vascular bundle was surrounded by pericycle fiber. The results were shown in figure 11 to 16.



Figure 11. Upper surface view of midrib showing epidermal cells with unicellular and glandular trichomes (x400)

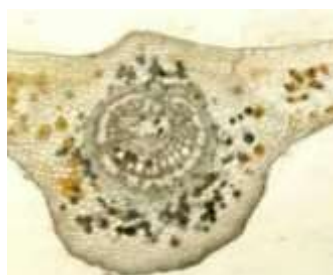


Figure 12. T.S of apical region of midrib (x100)



Figure 13. T.S of middle region of midrib (x100)



Figure 14. T.S of basal region of midrib (x100)



Figure 15. T.S of Midrib showing the parenchymatous cells (x400)



Figure 16. T.S of midrib showing the vascular bundles (x400)

Petiole

In surface view, the epidermal cells were thin-walled, rectangular to polygonal-shaped parenchymatous cells. Crystal glands were present in parenchymatous cells. Trichomes were present unicellular and glandular type.

In transverse section, the petiole was oval in outline. The epidermal cells were barrel-shaped, compactly arranged and one-layered thick. There were 2 to 3 layered collenchymatous cells under the epidermis. The parenchymatous cells were 8 to 10 layered thick. The parenchymatous cells were thin-walled and oval to rounded in shape.

The vascular bundles were circular in outline, collateral and closed type. Xylem vessels were endarch. Xylem lies toward the inside and composed of vessels, trachids, fibers and xylem parenchyma cells and phloem lie toward the outside and composed of sieve tubes, companion cells and phloem parenchyma cells. There were 2 to 5 layered phloem cells. Both xylem and phloem were surrounded by pericycle fiber as patches and composed of sclerenchymatous cells. Pith occupied at the center. The results were shown in figure 17 to 20.



Figure 17. Upper surface view of petiole showing epidermal cells (x400)



Figure 18. Upper surface view of petiole showing epidermal cells with unicellular and glandular trichomes (x400)

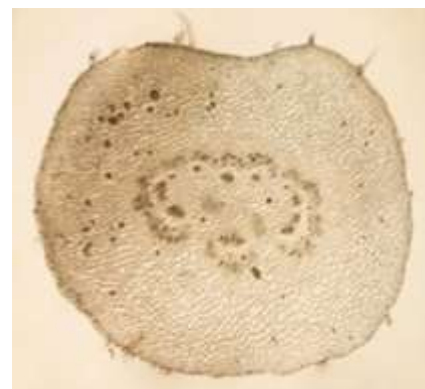


Figure 19. T.S of petiole showing parenchymatous cells and trichomes (x100)

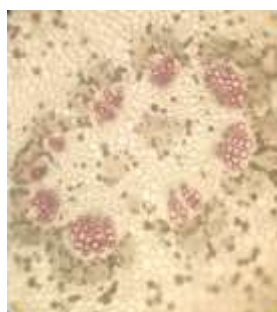


Figure 20. T.S of petiole showing the close-up view of vascular bundles (x400)

Stem

In surface view, the epidermal cells were thin-walled parenchymatous cells and polygonal-shaped. Trichomes were present unicellular and glandular type.

In trasverse section, the stem was semi-circular in outline. The epidermals cell was one-layered thick and covered with unicellular and glandular trichomes. Cork layer was present under the epidermis. There were 3 to 4 layered collenchymatous cells under the epidermis. The parenchymatous cells were 15 to 18 layered thick. The collenchymatous cells were isodiametric in shaped and parenchymatous cells were thin-walled and oval to polygonal in shaped. Latex tubes, unicellular and glandular trichomes were present. Pericycle present as patches and compose of sclerenchymatous cells.

The vascular bundles were collateral and closed type. Xylem vessels were endarch. Xylem lies toward the inside and composed of vessels, trachids, fibers and xylem parenchyma cells and phloem lie toward the outside and composed of sieve tubes, companion cells and phloem parenchyma cells. There were 5 to 7 layered phloem cells. Pith was present. The results were shown in figure 21 to 23.

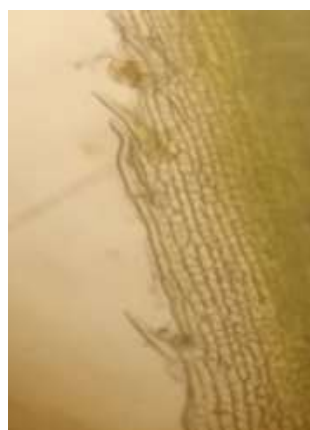


Figure 21. Upper surface view of stem showing epidermal cells with unicellular and glandular trichomes (x400)

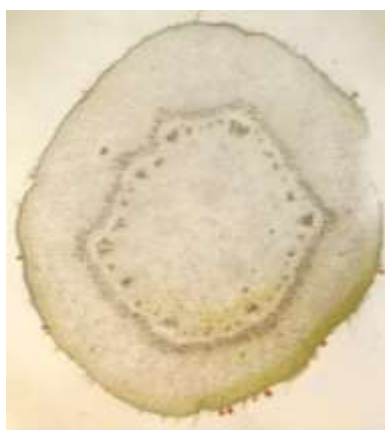


Figure 22. T.S of stem showing parenchymatous cells(x100)



Figure 23. T.S of stem showing the close-up view of vascular bundles (x400)

Diagnostic Characters of Powdered Leaves of *Artocarpus lamellosus* Blanco

Microscopical Characters of Powered Leaves of *Artocarpus lamellosus* Blanco

The microscopical characters of powered leaves contained fragment of epidermal cells, tracheid, fibre, pitted and annual vessels, anomocytic stomata, cystolith, cystal and unicellular trichome. The color of powdered leaves was brown. The results were shown in figure 24 to 38.

Sensory Characters of Powered Leaves of *Artocarpus lamellosus* Blanco

The powder of *Artocarpus lamellosus* Blanco was brown color and non-odour. The taste was astringency and granular. The results were shown in table 1 to 34.

Table 1. Sensory Characters of Powered Leaves *Artocarpus lamellosus* Blanco

Characters	Colour	Odour	Taste	Texture
Leaves	Brown	Non	stringency	Granular



Figure 24. Powder of Leaf



Figure 25. Fragment of Epidermal Cells



Figure 26. Showing Stomata



Figure 27. Unicellular trichomes



Figure 28. Phloem Fiber



Figure 29. Fiber



Figure 30. Tracheids



Figure 31. Annual Vessel



Figure 32. Pitted Vessel



Figure 33. Starch grains



Figure 34. Crystals

Discussion and Conclusion

In the present research, the morphological characters on the vegetative and reproductive parts of the plant and histological study of leaves have been undertaken. Trees are evergreen, with latex; monoecious, straight. Leaves simple, alternate, stipules lanceolate, caduceous; petiolate; leaf blade oblong or ovate. Inflorescences capitate, obovoid or oblong or globose. Fruiting syncarp red, reddish orange or yellow, brown when dry. These characters were in agreement with those given by Gardner, *et al* (2020), Cronquist (1981).

According to the results of histological characters of *Artocarpus lamellosus* Blanco, in the surface view of lamina, the epidermal cells were thin-walled, polygonal in shaped. Anomotic types of stomata were occurred only on lower surface. In transverse sections of midrib, petiole and stem, the epidermal cells were thin-walled, rectangular to polygonal in shaped. The vascular bundle was semicircular in shaped, closed and collateral type. Xylem vessels were endarch. The vascular bundles were surrounded by pericycle fiber as composed of sclerenchymatous cells. In midrib, trichomes were mainly of unicellular type and glandular trichomes were very rare. In transverse sections of midrib, petiole and stem, latex tubes, unicellular and glandular trichomes were present

and containing chambered crystals. These finding were in agreement with those of Metcalfe and Chalk (1950), Esau (1965) and Wallis (1967).

In powdered sample of leaves of *Artocarpus lamellosus* Blanco fragment of epidermal cells, tracheid, fiber, pitted and annual vessels, anomocytic stomata, cystals and unicellular trichome were found. These characters are similar to these mentioned by Treas and Evans, (2002).

In surface view of lamina, trichomes were absent on both surfaces, Cystolith of calcium carbonate crystals were present in the epidermal cells. In transverse section of midrib, latex tubes were more on the apical region than the middle and basal regions of midrib. These finding were carried out from this research.

In conclusion, morphological and histological characters of *Artocarpus lamellosus* Blanco were carried out. This genus, *Artocarpus* is a tree in the family Moraceae and a wild species of the breadfruit/ jackfruit genus. Detailed morphological identification of *Artocarpus lamellosus* Blanco collected in the University of Yangon campus revealed that was an unrecorded species in Myanmar. According to the above data, it is proved that the both morphological and histological characters of the specimen studied are useful for identification standardization of drugs. For further study, the other pharmacological effects of *Artocarpus lamellosus* Blanco such as antidiabetes activity, antimalarial activity and antioxidant activity should be carried out.

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