Morphological and Histological Characters of Leaves of *Luffa Aegyptiaca* Mill.

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Abstract

The study of traditional medicinal plants and their usage in therapy played a very important role in Myanmar. *Luffa aegyptiaca* Mill. was a member of angiosperm belonging to the Cucurbitaceae. It was commonly called sponge gourd and locally known as Tha-but-kha in Myanmar. The specimens were collected from Dagon University Campus, East Dagon Township, Yangon Region, in February to June, 2022. In this paper, the morphological and microscopical characters of fresh leaves were studied at the Department of Botany, Dagon University. In morphological study, the plant was herbaceous, leaves simple and alternate. Inflorescence were racemose for male flowers with about 5–20 flower buds and solitary for female. The flowers were showy, unisexual, regular and prominent with five petals. In microscopically study, in transverse section of petiole, the vascular bundles were arranged in a ring and bicollateral type. In surface view of lamina, trichomes were present on both surfaces of the leaves. Stomata were present on both surfaces and anomocytic type. Stomata were rarely present on upper surface and were abundantly present on lower surface. In transverse setion of midrib, the collenchyma was angular and the vascular bundle was crescent shape, bicollateral and opened type. Glandular trichomes and non-glandular trichomes were present on leaves. In addition, the diagnostic characters of powdered leaves were also investigated for their standardization used in medicine. The plant had been used for the treatment of flu, anthelmintic, stomachic and an antipyretic phytochemical drug.

Key words: *Luffa aegyptiaca* Mill., Morphological and Histological Characters of Leaves

Introduction

Luffa aegyptiaca Mill. locally known as Tha-but-kha in Myanmar and commonly called sponge guard. The Cucurbitaceae is botanically highly specialized family of mainly climbing plants. A family Cucurbitaceae are represented by about 100 genera and 850 species, primarily in tropic and subtropical distributions between the old and new world (Lawrence, 1964).

The Cucurbitaceae of dicotyledons including 90 genera and about 750 species, was found in the temperate and warmer parts of the earth but especially developed in the tropics. In North America the family is represented by a few genera comprising about 40 species, which occur chiefly in the southern parts of the United States and Mexico (Encyclopaedia, 1768). About 100 genera, mainly in tropical and subtropical regions and two species cultivated in China, also in Hong Kong. Some species are of economic importance, and such as the cucumber, marrow and pumpkin are cultivated worldwide. The family is represented in Ceylon by about 36 species, most of which occur in a wild state throughout the island (Dassanayake, 1997 and Qi-ming, *et al.,* 2007).

A family of about 110 genera and 640 species; tropical; mostly herbs climbing by tendrils. The fruit is fleshy. Most members have bicollateral vascular bundles. The vascular network of the pericarp of *Luffa* is used in Ayurvedic medicine. The cucurbitacins are triterpenoids bitter principles named A to Q, cucurbitacins-E (Mohammad, 2011).

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Luffa aegyptiaca Mill. also has an amphistomatic leaf blade, with anomocytic stomata. The vascular system is composed of bicollateral vascular bundles, forming a ring (Vieira, *et al.,* 2019). Loofah are used anticancer, antileukemic, antimelanomic, antiribosomal, antiseptic, aperitif, bitter, carminative, demulcent, diuretic, emetic, expectorant, hemolytic, lactagogue, laxative, pectoral, pesticide, tonic, vermifuge. Extracts are antimelanomic, and inactivate ribosomes. Aqueous seed extract is active against leukemia at 4-8 mg/ kg (Duke, 2002). Leaves are used to treat cough. Seeds treat cough, kill worm. Roots treat rhinitis, sinusitis (Kribb, 2013).

Metchalfe and Chalk (1950) stated that the anatomical features of the family Cucurbitaceae. Glandular hairs with multiseriate stalks are very characteristics, but simple unicellular or uniseriate types as well as spiny trichomes also occur. The stomata, which occur on both sides of the leaf or are confined to the lower surface, are ranunculaceous. The petiole, in transverse sections through the distal end, exhibits a crescent or circle of vascular bundles of which the larger ones are bicollateral. Glandular hairs with uniseriate stalks of variable length and spherical or disk-shaped heads in species of *Luffa*.

A small genus of herbaceous climbers are mainly individuals to the tropics of the old World. Four or five species are found wild in India. Some are grown for edible fruits while a few are of medicinal value; yields the well-known Loofah Sponge. Sponge gourd is said to be indigenous to India. Young leaves of the plants are used as pot-herb in Africa. A clear liquid, useful in respiratory complaints, is extracted in Japan from the stem by making incisions above the ground. Mature seeds are bitter, emetic and cathartic. The seed oil may be used as a substitute for olive oil; it is said to be useful for skin affections. The bitter seed cake may be used as manure
(Wealth of India, 1962).

Many cucurbits' fruits have been an ingredient for the culinary and are eaten when immature or mature. Besides being food, some species are often used in popular medicine throughout the world. The principal parts of the plant used to treat gastric diseases, diabetes, lung diseases, fever, cancer, inflammation, skin infections, pain, among others, are roots, leaves, fruits and seeds (Vieira, *et al.,* 2019).

The plants cultivated throughout the greater part of India, as well as in Africa and America. The fruit is oleaginous, laxative; useful in leprosy. The seeds are emetic and cathartic. In Indo China, the fruit is prescribed as a lactagogue. In Cambodia it is mostly used as a diuretic. In Guiana, the young fruit is applied to tumours as a poultice. The seeds yield an oil which has been examined chemically (Kirtikar and Basu, 1935).

In this research, morphological characters and microscopical characters of fresh leaves of *Luffa aegyptiaca* Mill. were carried out. The objectives are to identify the morphological and microscopical characters of leaves.

Materials and Methods

Morphological characters of *Luffa aegyptiaca* Mill.

The plant specimens of *Luffa aegyptiaca* Mill. were collected from Dagon University Campus, East Dagon Township, Yangon Region during the flowering and fruiting periods from February to June, 2022. *Luffa aegyptiaca* Mill. The plant of all the vegetative and reproductive parts of the fresh specimens were used. The selected plant of the habit, leaves, inflorescences and flowers were recorded by photographed. These specimens were identified with the help of available literatures such as Backer (1963); Lawrence (1964); Subrahmanyam (1995); Dassanayake (1997) and Qi-ming, *et al.,* (2007).

Histological characters of *Luffa aegyptiaca* Mill.

For histological studies, the samples of *Luffa aegyptiaca* Mill. were thoroughly washed with water. The petiole, lamina, midrib were cut by free hand section to examine under the electron microscope (BioBlue Lab. and Olympus) at the Department of Botany, Dagon University. The powder were cleared in chloral hydrate solution on a glass slide and discovered under the electron microscope and were also photographed and solution of phloroglucinol with concentrated hydrochloric acid was tested for lignin. The samples of fresh specimens were examined according to the method Metcalfe and Chalk (1950); Esau (1953); Pandey (2002) and Tandon Neeraj (2011).

Results

Morphological characters of *Luffa aegyptiaca* Mill.

Scientific name	-	*Luffa aegyptiaca* Mill.
Myanmar name	-	Tha-but-kha
English name	-	Sponge gourd
Family	-	Cucurbitaceae
Flowering period	-	August-March
Part used	-	Leaves and fruits

Annual, monoecious or dioecious, climbers; stems and branches 5-angled, green, pubescent; tendrils trifid. Leaves simple, alternate, exstipulate, petiolate; leaf blade orbicular to reniform, 5-lobed, cordate at the base, shallowly dentate along the margin, acute at the apex, densely shortly hispid-scabrid above, finely pubescent hispid beneath. Inflorescence staminate flowers in axillary racemes, clusters on the top of peduncles, the pistillate flowers in axillary solitary. Flower unisexual, actinomorphic, pentamerous, epigynous, yellow; bracteates; pedicels short. Sepals (5), synsepalous, campanulate, petaloid yellowish green. Petals (5), synpetalous, campanulate, petaloid yellow. Stamens 5, inserted at the mouth of the calyx tube; filaments short, free, anther dithecous, basifixed, longitudinal dehiscence. Carpels 3, united, ovary inferior, cylindrical, unilocular with many ovules on the three parietal placentae; style short; stigma 3-lobed. Fruit large, ovoid-oblong, smooth with dark green longitudinal lines, fibrous within. Seeds many, ovate, compressed, non-endospermic.

Fig. (1) Habit

Fig. (2) Leaves

Fig. (3) Male inflorescence

Fig. (4) Female inflorescence

Fig. (5) Male flower

Fig. (6) Female flower

Fig. (7) L.S of male flower

Fig. (8) L.S of female flower

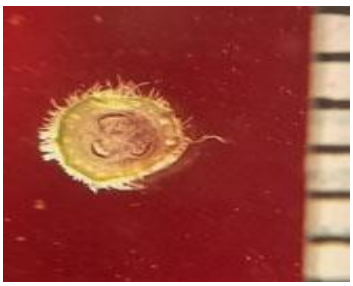

Fig. (9) T.S of ovary

Morphological characters of *Luffa aegyptiaca* Mill.

Microscopical characters of leaves of *Luffa aegyptiaca* Mill.

Petiole

In transverse section, the petiole has a rounded outline, with two prominences on the adaxial face. It was distinguished into dermal, ground and vascular tissue system.

Dermal Tissue System

In surface view, the epidermal cells were parenchymatous thin-walled and mostly polygonal shaped and elongated along the length of the petiole. Stomata were absent. Unicellular trichomes were present. In transverse section, the cuticle layer was thin. The upper epidermal cells were rounded to oval in shape and lower epidermal cells were rounded to oval in shape. Non-glandular trichome were present on the epidermis.

Ground Tissue System

Below the epidermis, the cortex was made up of two different types of tissues, outer collenchymatous and inner parenchymatous tissues. The outer collenchymatous

cells below the epidermis consisted of 3 to 6 layers thinness on the upper surface and 2 to 3 layers' thinness on the lower surface. The parenchymatous tissues composed of 2 to 3 layers in thickness above the vascular bundles and 4 to 5 layers' thickness below the vascular bundles. Pith parenchymatous cells were present.

Vascular Tissue System

Vascular bundle ring in shape in outline and embedded in the parenchymatous tissue. Vascular bundle was bicollateral and opened type. The phloem cells were thin walled and consisted of sieve tubes and companion cells. The xylem composed of vessels, tracheids, xylem fiber and xylem parenchymatous cells.

Lamina

The lamina of *Luffa aegyptiaca* Mill. was typically dorsiventral. In transverse section was distinguished into dermal, ground and vascular tissue systems.

Dermal Tissue System

In surface view, the upper and lower epidermal cells were parenchymatous, polygonal in shape, thin-walled and completely arranged. The upper epidermal cells were polygonal in shape. Stomata were rarely present on upper surface. The lower epidermal cells were polygonal in shape and stomata were abundantly present on lower surface. The type of stomata was anomocytic. Stomata polygonal in shape, guard cells were reniform shape with chloroplast. Trichomes were present on lower surface. In transverse section, thin cuticle smooth was present on both surfaces. The upper epidermal cells were made up of one layer parenchymatous cells and polygonal in shape. The lower epidermal cells were made up of one layer parenchymatous cells and polygonal in shape, glandular and non-glandular trichomes were present.

Ground Tissue System

The mesophyll layer consisted of palisade and spongy parenchyma. Palisade parenchyma cells are found on upper side and two-layered, the cells vertically erect, compact, chloroplast abundant. The spongy mesophyll consisted of 3-6 layers of cells, irregular to isodiametric shape and loosely arranged. These characters were the same in apical regions, central regions and basal regions but different in sizes.

Vascular Tissue System

The vascular bundles of lateral veins were embedded in mesophyll cells and oval in shape. The phloem cells were very small. The xylem tissues composed of vessel, tracheids, xylem fibers and xylem parenchyma cells. The phloem tissues consisted of sieve tube, companion cells, phloem fiber and phloem parenchyma cells. The xylem always toward the inner side and phloem always towards the outer.

Midrib

In transverse section, the midrib has a biconvex shape, both surfaces were covered with thick cuticle. It was distinguished into dermal, ground and vascular tissue system.

Dermal Tissue System

In surface view, cuticle was smooth on both surfaces. The epidermal cells of both surfaces were made up of thin walled parenchymatous cells. They were rectangular in shape, elongated along the length of the midrib. Trichomes were present. Stomata were not observed.

Ground Tissue System

In transverse section, the cuticle was thin. The epidermal cells were only one layered, rounded to oval shaped and compactly arranged. The upper epidermal cells were similar to these the lower cells. Below the epidermis the cortex was differentiated into collenchyma and thick-walled parenchyma cells. The collenchymatous cells were 3-4 layers in thinness towards the upper surface and 3-5 layers in thinness towards the lower surface. They were rounded to isodiametric in shape. The parenchymatous cells were 3-5 layers in thickness above the vascular bundle and 4-6 layers in thickness below the vascular bundle. They were thin-walled and irregular rounded or oval in shape. Glandular and non-glandular trichomes were present.

Vascular Tissue System

The vascular bundles were crescent shape in outline and embedded in the cortex. The vascular bundles were bicollateral and opened type. The phloem cells were consisted of sieved tube elements and companion cells. Xylem cells were composed of vessel, tracheid, xylem fibers and xylem parenchyma.

Table (1).

No.	Sensory characters	Sample leaves
1.	Colour	Yellowish green
2.	Odour	Aromatic
3.	Taste	Little bitter
4.	Texture	Fibrous

Diagnostic characters of powdered leaves of *Luffa aegyptiaca* Mill.

Fig. (10) Surface view of petiole (X 400)

Fig. (11) Surface view of petiole showing non-glandular trichomes (X400)

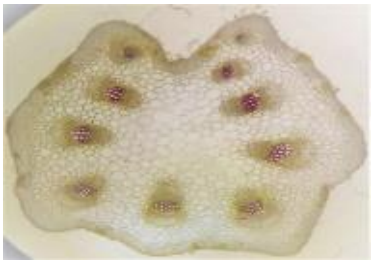

Fig. (12) T.S of petiole (X 40)

Fig. (13) T.S of petiole showing non-glandular trichomes (X 400)

Fig. (14) T.S of petiole showing collenchyma (X 400)

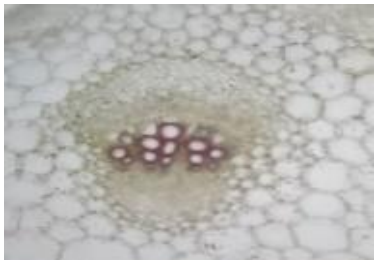

Fig. (15) T.S of petiole close up view of vascular bundle (X 400)

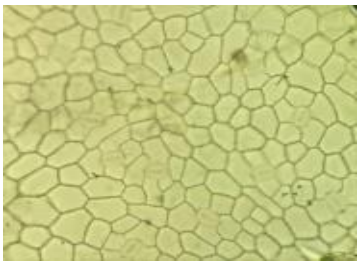

Fig. (16) Surface view of lamina of upper epidermal cells (X 400)

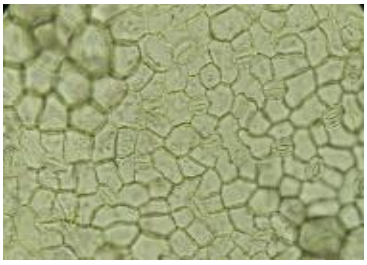

Fig. (17) Surface view of lamina of lower epidermal cells (X 400)

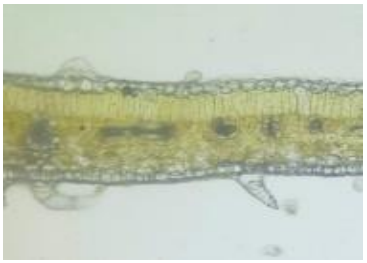

Fig. (18) T.S of lamina (X 100)

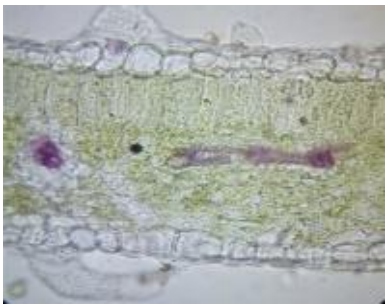

Fig. (19) T.S of lamina showing close up view of vascular bundle (X 400)

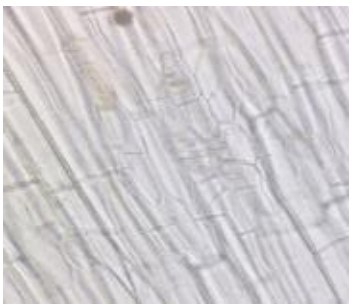

Fig. (20) Surface view midrib (X 400)

Fig. (21) T.S of midrib (X 40)

Fig. (22) T.S of midrib showing non-glandular trichomes (X 400)

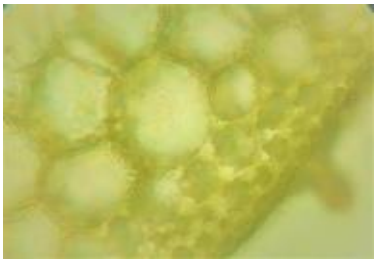

Fig. (23) T.S of midrib showing glandular trichome (X 400)

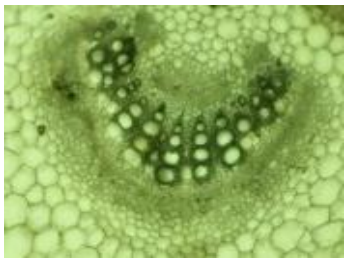

Fig. (24) T.S of midrib showing close up view of vascular bundle (X 100)

Microscopical characters of *Luffa aegyptiaca* Mill.

Fig. (25) Spiral vessel element

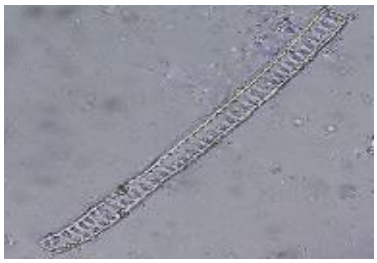

Fig. **(**26) Scalariform vessel element

Fig. (27) Annular vessel element

Fig. (28) Pitted vessel element

Fig. (29) Tracheid element

Fig. (30) Fiber-tracheid

Fig. (31) Fiber

Fig. (32) Uniseriate trichome

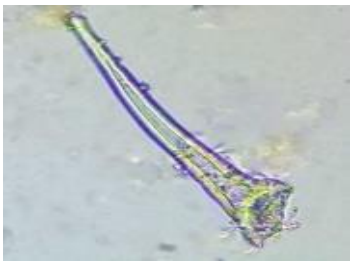

Fig. (33) Unicellular trichome

Diagnostic characters of powdered leaves of *Luffa aegyptiaca* Mill.

Discussion and Conclusion

The specimens of *Luffa aegyptiaca* Mill. belonging to the family Cucurbitaceae, is climbing herbaceous and collected from Dagon University Campus, East Dagon Township, Yangon Region during the flowering and fruiting periods from February to June, 2022. The morphological studies on both vegetative and reproductive parts of the plants, the microscopical characters of leaves have been studied and described in this study.

In this paper, the morphological, microscopical characters of leaves of *Luffa aegyptiaca* Mill. had been undertaken. The plant of *Luffa aegyptiaca* Mill. was herbaceous and leaves were simple and alternate. Inflorescences were racemose for male flowers and solitary cymose for female flower. The male and female flowers were unisexual, yellow colour, unisexual, actinomorphic, epigynous flowers, anthers monothecous, and inferior ovary with parietal placenta. These characters were in agreements with those reported by Kirtikar and Basu (1935); Backer (1963); Lawrence (1964); Cronquist (1981); Subrahmanyam (1995); Dassanayake (1997) and Qi-ming, *et al.*, (2007).

In the microscopical study, in transverse section of petiole, the vascular bundles were arranged in a ring and bicollateral type. In surface view of lamina, trichomes were present on both surfaces of the leaves. Stomata were present on both surfaces and anomocytic type. Stomata were rarely present on upper surface and were abundantly present on lower surface. In transverse section of midrib, the collenchyma was angular and the vascular bundle was crescent shape, bicollateral and opened type. Glandular hairs were unicellular and uniseriate. The sensory characters of the powdered leaves of *Luffa aegyptiaca* Mill. showed yellowish green in color, aromatic in odour, little bitter in taste and fibrous in texture. These characters were in agreements with those stated by Metchalfe and Chalk, (1950); Pandey (2002) and Vieira, *et al.*, (2019).

It is concluded that the water extracts of *Luffa aegyptiaca* Mill. samples showed good availability of biologically active components which could be a good source for pharmaceutical utilization. Therefore, it is sincerely hoped that this present study can be beneficial for the further researches.

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