

Phytochemical Investigation on the Fruits of *Abelmoschus Esculentus* (L.) Moench

THAN THAN YEE¹, KYI WAR YI LWIN²

¹ Lecturer, Department of Botany, Kyaukse University

² Assistant Lecturer, Department of Botany, Pakokku University

Abstract- *Abelmoschus esculentus* (L.) Moench belongs to the family Malvaceae. It is known as *Yone pa dae* in Myanmar. It was collected from Sintgaing Township, Kyaukse District, Mandalay Region. Morphological and histological studies were carried out at Department of Botany, Kyaukse University. Phytochemical studies of *Abelmoschus esculentus* (L.) Moench was carried out at Department of chemistry, Mandalay University. Stem are cylindrical, solid, covered with hairs. Leaf blade are palmately, pubescent, bracteoles of epicalyx, 5 to 12, linear segments. Flowers are large, yellow and showy. Ovary is superior, multilocular and axil placentation. Fruits are long, long pod ribbed, 5 angles, cylindrical to conical capsule. In histological studies, anomocytic type of stomata are present on both surfaces. Trichomes are present on both surfaces. Mucilaginous are present on both surfaces and calcium oxalate crystals present. Phytochemical studies on the whole plant of *Abelmoschus esculentus* (L.) Moench showed the presence of glycosides, phenolic compounds, polyphenols, saponins, and steroids. However, alkaloids, flavonoids, terpene and tannins are not found in this plant.

Indexed Terms- Malvaceae, Trichomes, chemical constituents, part uses, medicinal uses

I. INTRODUCTION

The family Malvaceae is one of the most important families consisting of 82 genera and 1500 species. The family is worldwide in distribution but is mostly represented in the tropical and subtropical region. *Abelmoschus esculentus* (L.) Moench is also known by the synonym *Hibiscus esculentus* and the common name lady's fingers (Patrisha 2016).

Abelmoschus esculentus (L.) Moench cultivated as a vegetable and its fruits pods are consumed as vegetables. The Malvaceae plant family, which contains many economically important plants. *Hibiscus* originated in Africa, is widespread in cultivation in tropical, subtropics and warmer temperate zones. *Hibiscus* is native to the West Africa and become in new World tropical area, Portuguese, Spanish, French, Middle East, Iran, North America and Russia (Awurum 2007).

Abelmoschus esculentus (L.) Moench is a widely used medicine and functional food. The consumption of fruits are now widely associated with prevention of diseases like cancer, cardiovascular and diabetes. The flowers, fruits, seeds and roots are used by the Chinese as a diuretic and to treat sores. The Malays use the fruits to treat painful and the roots for syphilis. In the Philippines, the fruits are used to treat sore throat (Olotuash 2002).

The edible part is the seed pod, it is actually a capsule. It contains smooth seeds. Immature fruits have long been used in the East relieve pain, skin, treat urinary disorders.

Flavonoids belong to a group of polyphenolic compounds found in fruits and vegetables. The species of *Abelmoschus* are very economically important vegetable crop grown in tropical and subtropical parts of the world. This crop is suitable for cultivation as garden crop as well as on large commercial farms. It is grown commercially and widely cultivated ornamental (Guanghou 2004).

Abelmoschus esculentus (L.) Moench is annual, herbaceous with mucilage. Leaves are simple alternate, stipulate, petiolate, palmatifid. Inflorescence is solitary as in cymes through occasionally they are in panicle raceme, regular,

bisexual, hypogynous, conspicuously mucilaginous, with a whole of bracteoles known as epicalyx (Dassanayake 1987).

Herbs and shrub, widely distributed throughout the world. The stellate hairs are especially characteristics but simple unicellular or uniseriate and glandular or non-glandular trichomes also occur. Mucilages are very common in parenchymatous cells. The cells of the epidermis especially in the leaf, sometimes have mucilaginous. Stomata are present on both surfaces (Metcalf and Chalk 1954).

Abelmoschus esculentus (L.) Moench is an herbaceous plant grown for the fruits which are eaten as a vegetable. Leaves are palmately lobed on a long stalk. Flowers are solitary, large and showy, white to yellow, purple or red at the base. Fruits are long and 5 angles. Leaves are cordate, simple usually 3-7 lobed. The flowers are large yellow petals with a red or purple spot at the base of each petal. The flowers are almost always bisexual and actinomorphic. The fruits is an elongated, conical capsule, five cavities containing ovules. The fruits is actually long pod is generally ribbed. The pods are the edible portion (Andras 2005).

II. MATERIALS AND METHODS

A. Collection, identification and preparation of *Abelmoschus esculentus* (L.) Moench

The specimens of *Abelmoschus esculentus* (L.) Moench were collected from Sintgaing Township, Kyaukse District, Mandalay Region. The collected plants were taxonomically identified with the help of references such as Hooker 1885, Heywood 1978 and Dassanayake 1987. The fresh specimens were pressed, dried and preserved for morphological studies. Herbarium specimens were prepared and kept in the Herbarium of Botany Department, Kyaukse University.

B. Histological studies of *Abelmoschus esculentus* (L.) Moench

The fresh specimens were examined by preparing free hand sections and studied under microscope. The histological characters of fresh specimens of leaves and bulbs were prepared by the literature of Metcalfe and Chalk 1957, Esau 1965. The following reagents

were used to examine the section.

1. Chloral hydrate solution for clearing agents
2. Hydrochloric acid for testing lignin.
3. Concentrated sulfuric acid for testing calcium oxalate crystals.

C. Preliminary phytochemical characterization of *Abelmoschus esculentus* (L.) Moench

Preliminary phytochemical investigation was performed at Department of Chemistry, Mandalay University, according to Harbone 1984. It was carried out for the whole plant of *Abelmoschus esculentus* (L.) Moench with a view to determine the constituents such as glycosides, phenolic compounds, polyphenols, saponins, steroids, alkaloids, flavonoids, tannin and terpene.

III. RESULTS

a. Morphological Studies of *Abelmoschus esculentus* (L.) Moench

Scientific name- *Abelmoschus esculentus* (L.) Moench
 Family- Malvaceae
 English name- Lady's finger
 Local name- Yone pa dae

Annual erect, herbaceous, Stem cylindrical, solid, covered with hairs. Leaves simple, alternate, stipulate, leafblade palmately, 3 to 5 lobed, lobes triangular, coarsely serrate, pubescent, more or less deeply, broadly ovate, base cordate, apex pointed, bracteoles of epicalyx, 5 to 12, linear segments. Inflorescences solitary, axillary terminal cymes. Flowers large, showy, bisexual, regular, actinomorphic, hypogynous, yellow. Sepals 5, synsepalous, lanceolate, valvate, pale yellow. Petals 5, apopetalous, obovate, twisted, yellow with a purple center, coloring red in afternoon. Stamens on a stamina tube, monadelphous; anther monothecous, dorsifixed; filament short. Ovary superior, multilocular, axil placentation. Style united; stigma free. Fruits long, long pod ribbed, 5 angles, cylindrical to conical capsule, greenish when young, brownish when mature. Seeds many, globose, white.

Specimens examined:

IV. Histological studies of *Abelmoschus esculentus* (L.) Moench

a. Lamina

In surface view of lamina, the upper epidermal cells and lower epidermal cells are covered with thin cuticle. The upper epidermal cells are parenchymatous, thin walled wavy, polygonal in shape, 30-60 μm long and 26-50 μm wide. The lower epidermal cells are parenchymatous, thin walled wavy, polygonal in shape, 35-68 μm long and 25-40 μm wide. Anomocytic type of stomata are present on both surfaces, numerous on lower surface than on the upper surface. Trichomes are present, non-glandular trichomes and unicellular with cuticular striation on both surfaces. Mucilaginous are present on both surfaces.

In transverse section of lamina, mesophyll cells are composed of palisade and spongy parenchyma. Palisade parenchyma consists of a single layer, vertically elongated in shape, compact, thin walled, the cells 40-60 μm long and 15-25 μm wide and spongy parenchyma Calcium oxalate crystals are present.

Vascular bundles are embedded in the mesophyll cells, bundles collateral type. Xylem composed of spirally thickened vessel, xylem fiber and xylem parenchyma cells. Phloem consists of sieve-tube, phloem fiber and phloem parenchyma cell.

b. Midrib

In surface view of midrib, the epidermal cells are thin walled, parenchymatous, compactly arranged, rectangular in shaped, the cells 36-48 μm long and 28-34 μm wide. It bears trichomes. Anomocytic type of stomata are present. It contains calcium oxalate crystals.

In transverse section of midrib, cortex consists of epidermis, collenchyma and parenchyma. Epidermis is a single layer. Collenchyma are 3 to 5 layers, the cells oval or rounded in shape, 20-30 μm long, 12-38 μm wide. Parenchyma are 4 to 6 layers, the cells oval or rounded in shape, 45-65 μm long, 32-48 μm wide.

Vascular bundles are arranged in a crescent shape,

collateral type. Phloem are 3 to 5 layers, the cells 9-15 μm in vertical diameter and 12-20 μm in horizontal diameter, consists of sieve tube, phloem fiber and phloem parenchyma. Xylem lies in the middle ground tissue. Xylem are arranged in radial row of 4 to 6 layers, it consists of vessels, xylem fiber and xylem parenchyma.

c. Petiole

In surface view of petiole, the epidermal cells are thin walled, parenchymatous, irregular in shaped, the cells 30-42 μm long and 28-34 μm wide with cuticle. It bears unicostate trichomes. Mucilaginous are present.

In transverse section of petiole, cortex consists of epidermis, collenchyma and parenchyma. Epidermis is a single layer, the cells barrel in shape. Collenchyma are 2 to 4 layers, the cells oval or rounded in shape, 20-35 μm long, 12-36 μm wide. Parenchyma are 3 to 5 layers, the cells oval or rounded in shape, 45-65 μm long, 30-48 μm wide. It contains calcium oxalate crystals.

Vascular bundles are arranged in a crescent shape, collateral type, lies in the middle of the ground tissues. Phloem are 4 to 6 layers, the cells 9-15 μm in vertical diameter and 12-20 μm in horizontal diameter, consists of sieve tube, companion cell, phloem fiber and phloem parenchyma. The xylem form a closed ring round by phloem. Xylem are 3 to 5 layers. It consists of vessels, xylem fiber and xylem parenchyma.

d. Stem

In surface view of stem, the epidermal cells are thin walled, parenchymatous, irregular in shaped with thin cuticle, the cells 50-68 μm long and 25-40 μm wide. It contains calcium oxalate crystals. Mucilaginous are present

In transverse section of stem, cortex consists of epidermis, collenchyma and parenchyma. Epidermis is a single layer, the cells barrel in shape. Collenchyma are 4 to 5 layers, the cells 30-46 μm long, 28-37 μm wide. Parenchyma are 5 to 7 layers, the cells oval or rounded in shape, 60-82 μm long, 34-46 μm wide.

Vascular bundles are arranged in a ring, collateral type. Phloem are 4 to 6 layers, the cells 7-13 μm in vertical diameter and 10-20 μm in horizontal diameter, consists of sieve tube, phloem fiber and phloem parenchyma. Xylem are two to three layers. It consists of vessels, tracheids and xylem parenchyma.

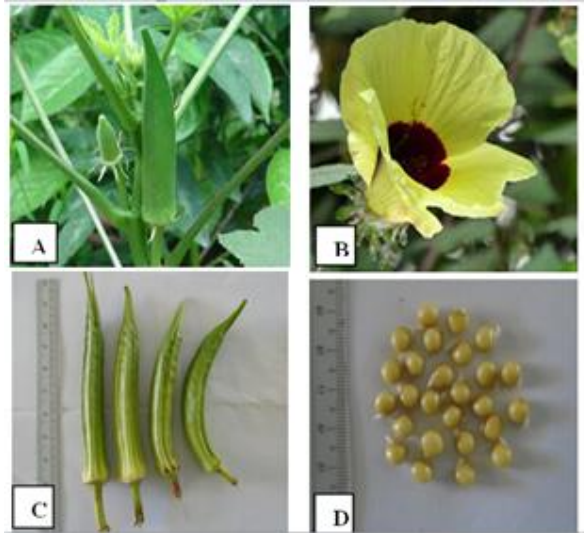


Figure 1. Morphological characters of *Abelmoschus esculentus* (L.) Moench
A. Habit B. Flower C. Fruits D. Seeds

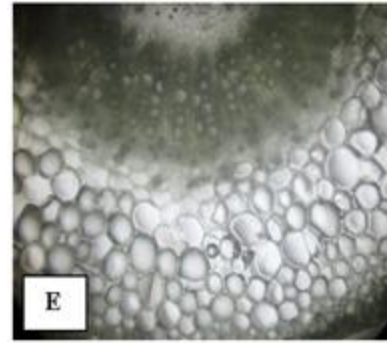
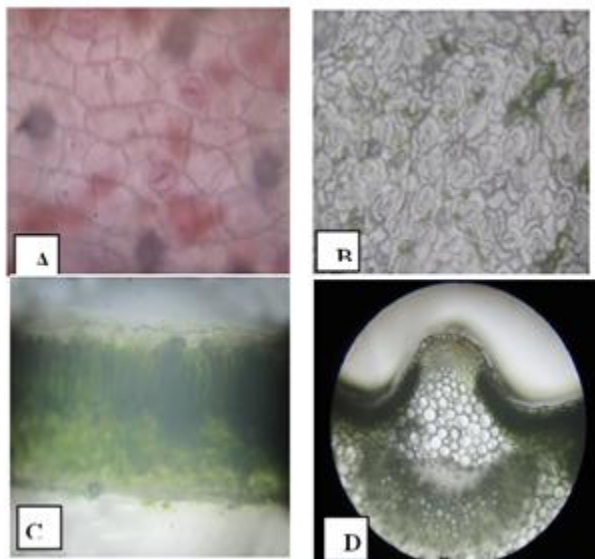


Figure 2. Histological studies of lamina and midrib
A. Upper surface view of lamina, B. Lower surface view of lamina, C. Transverse section of lamina, D. Transverse section of midrib, E. Close up view of vascular bundle

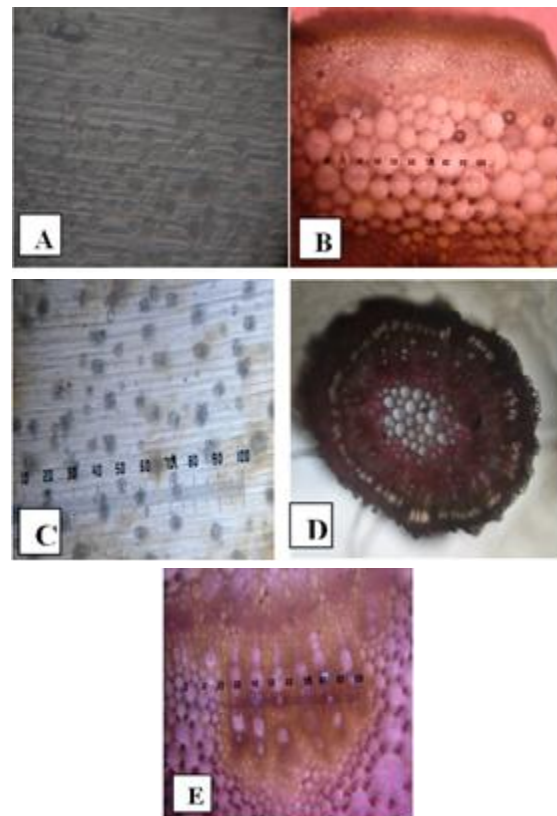


Figure 3. Histological studies of petiole and stem
A. Surface view of petiole, B. Transverse section of petiole C. Surface view of stem, D. Transverse section of stem, E. Closed up view of vascular bundle

V. PRELIMINARY PHYTOCHEMICAL INVESTIGATION

Phytochemical screening were determined at Department of Chemistry, Mandalay University, according to Harbone 1984.

Table 1. Preliminary phytochemical investigations of *Abelmoschus esculentus* (L.) Moench

No	Constituents	Extract	Test Reagent	Observation	Result
1	Alkaloids	1% HCl	Dragendroff's reagent	Brown color solution	-
2	Glycosides	Water	10% (CH ₃ CO) ₂ Pb	white ppt	+
3	Flavonoids	Ethanol	Conc. HCl, Mg	Pale green color solution	-
4	Phenolic compounds	Water	10% FeCl ₃	Blue black color solution	+
5	Polyphenols	Ethanol	1% FeCl ₃ , K ₃ F e(CN) ₆	Greenish blue color solution	+
6	Saponins	Water	Shake	Froth	+
7	Tannins	Pet.ether	FeCl ₃ , Conc. H ₂ SO ₄	Pale green color solution	-
8	Terpene	Pet.ether	(CH ₃ CO) ₂ O, CHCl ₃ , Conc. CuSO ₄	Pale green color solution	-
9	Steroids	Pet.ether	CHCl ₃ , Conc. CuSO ₄	Deep green color solution	+

(+) = present (-) = absence

Preliminary phytochemical investigations were carried out for the *Abelmoschus esculentus* (L.) Moench with a view to determine the constituents such as glycosides, phenolic compounds, polyphenols, saponins, steroids, alkaloids, flavonoids, terpene and tannins. The results were presented in Table 1.

VI. DISCUSSION AND CONCLUSION

In the present work, the morphological, histological and phytochemical characters of *Abelmoschus esculentus* (L.) Moench were presented.

In morphological studies, *Abelmoschus esculentus* (L.) Moench are widely through the tropical region of Myanmar. It is one of the species in Malvaceae family. Annual erect, herbaceous, Stem are cylindrical, solid, covered with hairs. Leaf blade are palmately, 3 to 5 lobed, lobes triangular, coarsely serrate, pubescent, more or less deeply, broadly ovate, base cordate, apex pointed, bracteoles of epicalyx, 5 to 12, linear segments. These characters are similar to those given by Dassanayake 1987.

Flowers are large, yellow and showy. Sepals are 5, synsepalous, lanceolate, valvate, pale yellow. Petals are 5, apopetalous, obovate, twisted, yellow with a purple center, coloring red in afternoon. Ovary is superior, multilocular, axil placentation. Fruits are long, long pod ribbed, 5 angles, cylindrical to conical capsule, greenish when young, brownish when mature. These characters are agreed with those given by Dassanayake (1987).

In the histological studies, anomocytic type of stomata are present on both surfaces, numerous on lower surface than on the upper surface. Trichomes are present, non glandular trichomes and unicellular with cuticular striation on both surfaces. Mucilaginous are present on both surfaces and calcium oxalate crystals present. These characters are in agreement with those stated by Metcalfe and Chalk (1957).

In the midrib, the epidermal cells are thin walled, parenchymatous, compactly arranged, rectangular in shaped. Cortex consists of epidermis, collenchyma and parenchyma. Vascular bundles are arranged in a crescent shape and collateral type. These characters are agreed with those mentioned by Metcalfe and Chalk (1975).

In the petiole, cortex consists of epidermis, collenchyma and parenchyma. Epidermis is a single layer, the cells barrel in shape. Mucilaginous are present. Vascular bundles are arranged in a crescent

shape and collateral type, lies in the middle of the ground tissues. These characters are agreed with those stated by Metcalfe and Chalk (1975).

In the stem, the epidermal cells are thin walled, parenchymatous, irregular in shaped with thin cuticle. It contains calcium oxalate crystals and mucilaginous present. Vascular bundles are arranged in a ring, collateral type. These characters are similar to those given by Esau (1965).

According to the results, phytochemical studies on the whole plant of *Abelmoschus esculentus* (L.) Moench showed the presence of a wide range of secondary metabolites such as glycosides, phenolic compounds, polyphenols, saponins, and steroids. However, alkaloids, flavonoids, terpene and tannins are not found in this plant.

In Myanmar, *Abelmoschus esculentus* (L.) Moench is a widely used medicine and functional food. The consumption of fruits are now widely associated with prevention of diseases like cancer, cardiovascular and diabetes.

VII. ACKNOWLEDGEMENT

My sincere thanks are due to Dr Aye Aye Than, Professor and Head, Kyuakse University for her kind suggestion, constant encouragements and for providing the facilities during my research work.

REFERENCES

- [1] Andras D. C., Simandi. B., and Domokos. J. 2005. Supercritical carbondioxide extraction of *Abelmoschus esculentus* (L.) Moench Seeds. Department of Chemical engineering. Hungary.
- [2] Awurum A.N., D. E. Okwu, and J.I. Okoronkwo. 2007. Phytochemical composition and in vitro antifungal activity screening of extracts from *Abelmoschus esculentus*.
- [3] Dassanayake, M.D. and F.R. Fosbers, 1987. Flora of Ceylon. Vol(X). Amerind publishing Co. Pvt. Ltd. New Delhi.
- [4] Easu K. 1965, Plant Anatomy.2nd Ed Japan Co.,ltd. Tokyo Japan.
- [5] Guanghou S. and Peng L. L.2004. An improved method for the analysis of major antioxidants of *Abelmoschus esculentus* L. Department of Chemistry, Singapore.
- [6] Harbone, J. B., 1984. Phytochemical Methods.2nded. Published in USA by Champman and Hall. London, New York.
- [7] Heywood, V.H. 1978. Flowering Plants of the world. Oxford University Press, London.
- [8] Hooker, J.D 1885. The Flora of British India. Vol (VI).L. Reeve & Co., ltd. London.
- [9] Metcalfe C.R & L. Chalk, 1957. Monocotyledons Vol (I). Oxford University Press.
- [10] Olotuah. O. F. 2002. Anatomy of leaf epidermis and petiole of two selected species of *Abelmoschus esculentus*. Department of plant science and biotechnology. Nigeria.
- [11] Patrisha J. P. and Pham L. J. 2016. *Abelmoschus esculentus* seed oil, characterization and potential use for high value products. Institute of Chemistry. Philippines.