Study on Morphology and Flower Anatomy of *Plumeria alba* L.

Pyae Sandi Win[1], Sann Sann Oo[2], Ohnmar Ye Win[3]

Abstract

Plumeria alba L. belongs to the family Apocynaceae. *Plumeria alba* L. is locally known as Tayoke-Sagar-Phyu. This plant was collected from Loikaw Township, Kayah State. The natural habit of this plant including leaves, inflorescences and flowers have been recorded by photograph. According to the morphological characters presented in the vegetative parts of the plant and anatomical characters of the flower of this plant has been identified by using available literature. In morphological study, the plant is small tree with milky latex; bark rough; leaves simple, opposite, exstipulate, blade elliptic to lanceolate, apex acute, margin entire; inflorescence terminal or axillary cyme; flowers are borne in clusters that form at the ends of the branches on a long thick stalk, bisexual, actinomorphic, hypogynous, cyclic; sepal (5), fused, imbricate; corolla large, white, fleshy, petals (5), fused, funnel-shaped, tube narrow, hairy inside, lobe longer than the tube, twisted; stamen 5, stamens inserted on the inside of the corolla tube, anther sagittate, dithecous, filament very short, basifixed; carpel 2, bilocular, ovule numerous, style short, stigma bifid, ovary superior; axile placentation. In anatomical study, the stomata on calyx are present only on lower surface and of paracytic type, 16 small vascular bundles in calyx were collateral and closed type. The stomata on corolla are present only on upper surface and of paracytic type. The vascular bundles were embedded in mesophyll cells, collateral and of closed type. The upper epidermal cells of pedicels were polygonal-shaped and lower epidermal cells of pedicels were angular-shaped. The vascular bundles were oval-shaped and embedded in the cortex, collateral and of closed type. This study will give the useful information and standardization of plants for other researchers with pharmaceutical industry in traditional medicine. In this paper, identification and microscopical studies were carried out at the Botany Department, Loikaw University.

Keywords: *Plumeria alba L.,* Apocynaceae., Morphological and Anatomical Characters

Introduction

The family Apocynaceae consists of about 200 genera and 2000 species, widespread in tropical and subtropical regions with relatively few genera and species in temperate climate (Cronquist, 1981).

Plumeria is a genus which contains 7 to 8 species which grow in tropical and subtropical America. This genus comprises of mainly deciduous trees and shrubs. *Plumeria* currently popularly used as an ornamental outdoor plant was only as a plant graveyard (Depok, Jawa Barot, 2011).

The flowers are native to Central America, Mexico, the Caribbean and South America as far South as Brazil but can be grown in tropical and subtropical regions (Jagdish Sura., *et al*., 2016).

Plumeria blooms may be used raw in salads, fried or as an ingredient in making candies, jellies and omelets. Frangipani is a common ingredient in many fragranced soaps, candles, massage and oils. The flowers of the plant are also considered sacred in certain tropical nations such as Bali and India, where they are used in religious ceremonies.

The frangipani flowers can also be made into tea after being sun-dried, which is normally called the frangipani tea and the tea has effects of curing fever, wiping out diarrhea, cleaning the lungs and detoxification.

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Plumeria alba L. is a small lactiferous tree or shrub is a native of tropical America, commonly known as White Champa leaf and stem were evaluated for its phytoconstitutes, which is used in several traditional medicines to cure various diseases. *Plumeria alba* L. known to passes analgesic, antitumor, antimalarial activity (Abhijit Dey and Anuradha Mulcheriee, 2015).

The leaves and dry stem were extracted with organic solvents and concentrated to obtain residue. *Plumeria alba* L. is 4.5m high, occasionally grown in the gardens. The plant is mainly grown for its ornamental fragrant flowers are also known for their medicinal importance. Leaves edible. Their medicinal properties are often due to their latex which is frequently drastic and corrosive. Latex is applied to ulcers, herpes and scabies. Moreover, its bark is bruised and applied as plaster over hard tumours. Whereas the others find use as purgative, cardiotonic, diuretic and hypotensive (Monika Gupta; *et al*., 2016).

This paper includes morphological study of the whole plant and microscopical study of the flower of *Plumeria alba* L.

Materials and Methods

The collection and idntification of *Plumeria alba* L.

The plant specimens were collected from Loikaw Township, Kayah State during the flowering periods. *Plumeria alba* L. blooms from March to October. After the collection, all the vegetative and repeoductive parts of the fresh specimens were studied, measured in detail and recorded.

The collected specimens were identified with the help of available literature of (Backer, 1963; Cronquist, 1981; Hundley and Chit Ko Ko, 1961; Dassanayake, 1983; Qi-ming, 2009).

The vegetative and reproductive parts of the fresh specimens were pressed, preserved and then mounted to be out in herbarium of the department of Loikaw University. The flower was used to study its morphological and microscopical characters of the plant.

Microscopical Character of *Plumeria alba* L.

Microscopical characters of flower was examined by preparing freehand sections from the fresh flower and cleaned with chloral hydrate solution, stained with safranin solution and temporary mounts were prepared by applying glycerine. The microscopical studies of flower was done according to Cronquit, 1981; Esau, 1965; Metcalfe and Chalk, 1950).

Results

Morphological Characters of *Plumeria alba* L.

Scientific name - *Plumeria alba* L.

Myanmar name - Tayoke-Sagar-Phyu

English name - White Frangipani

Family name - Apocynaceae

Flower Period - March to October

Taxonomic Description

Small tree with milky latex; bark rough. Stem solid; branches swollen leafy at the tip; leaves simple, opposite, exstipulate, blade elliptic to lanceolate, apex acute, margin entire, deciduous, petiole glabrous; the leaves are dark and leathery and tend to be shiny on the upper surface; inflorescences terminal or axillary cyme; flowers are borne in clusters that form at the ends of the branches on a long thick stalk, bract deciduous, bisexual, actinomorphic, hypogynous, cyclic, pentamerous; sepal (5), fused, calyx-lobe minute, truncate or very broadly tri-angular, imbricate; corolla large, white, fleshy, petals (5), fused, funnel-shaped, tube narrow, hairy inside, lobe longer than the tube, twisted; stamen 5, stamens inserted on the inside of the corolla tube, anther sagittate, dithecous, filament very short, basifixed; carpel 2, bilocular, ovule numerous, style short, stigma bifid, ovary superior; axile placentation.

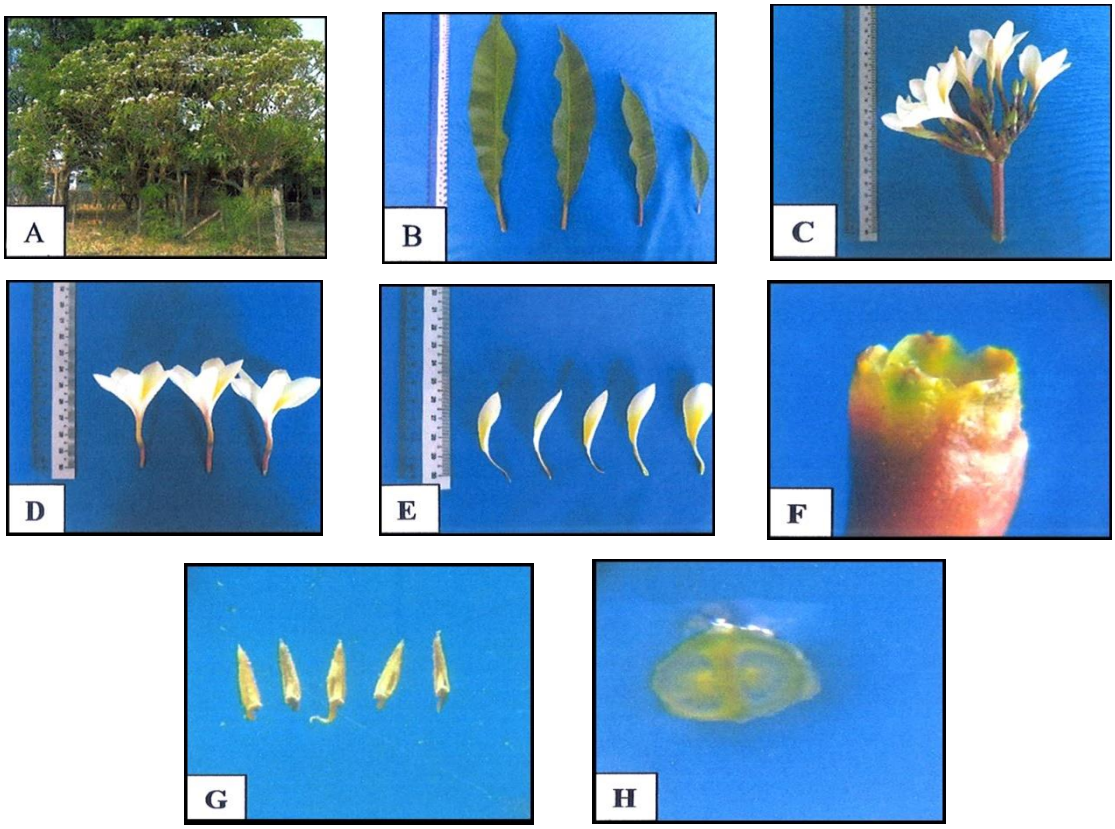

Figure 1. Morphological Characters of Tayoke-Sagar-Phyu

A. Habit
B. Leaves
C. Inflorescence
D. Flower
E. Corolla
F. Calyx
G. Stamens
H. T.S of Ovary

Microscopical Character of *Plumeria alba* L.

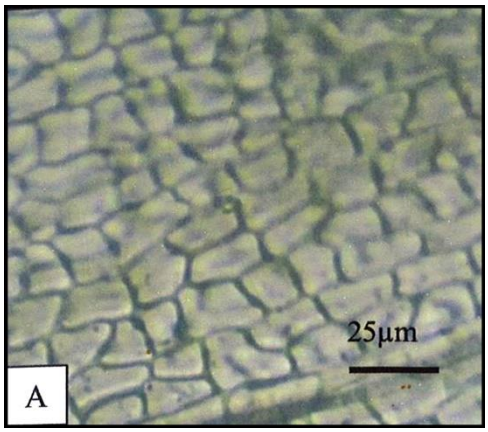

Figure 2. Upper Surface of Calyx

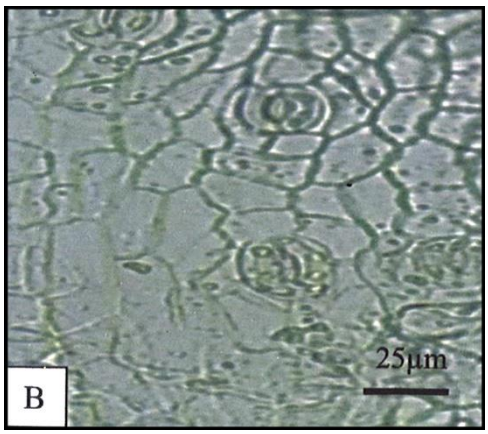

Figure 3. Lower Surface of Calyx

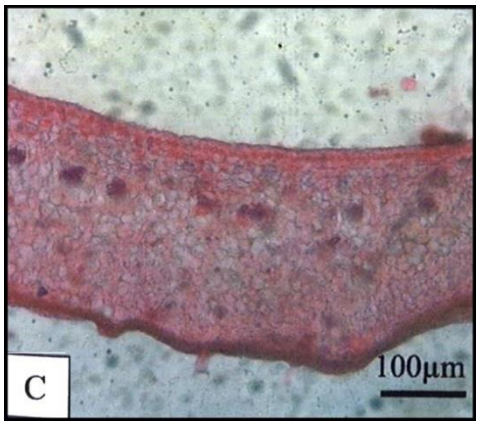

Figure 4. T.S of Calyx

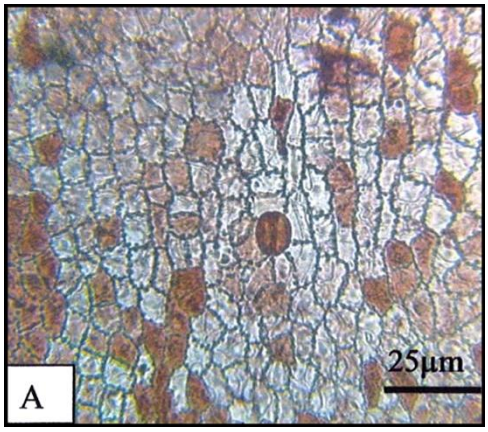

Figure 5. Upper Surface of Corolla

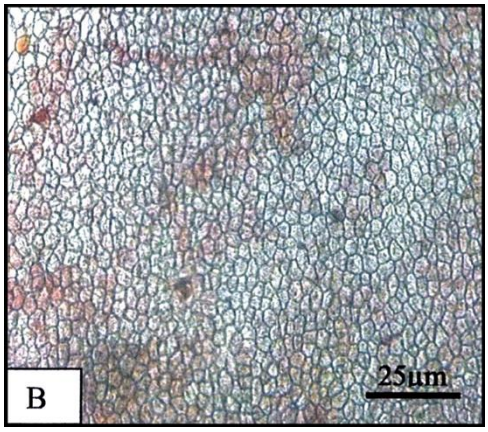

Figure 6. Lower Surface of Corolla

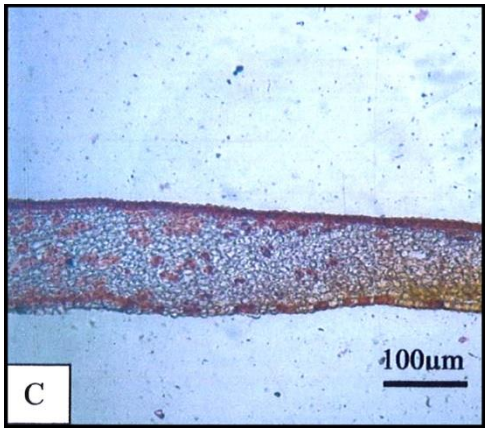

Figure 7. T.S of Corolla

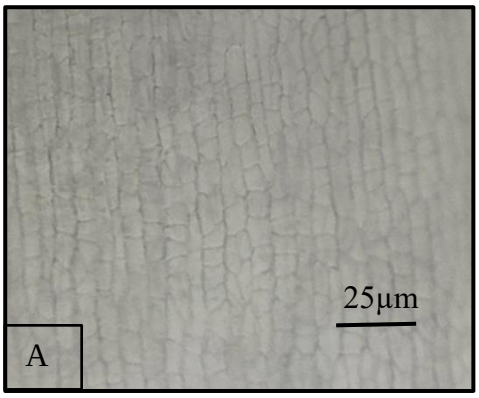

Figure 8. Upper Surface of Pedicel

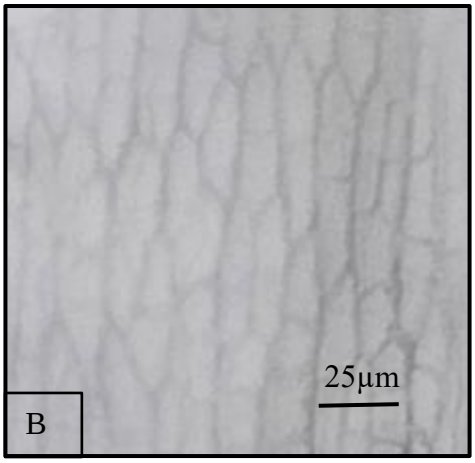

Figure 9. Lower Surface of Pedicel

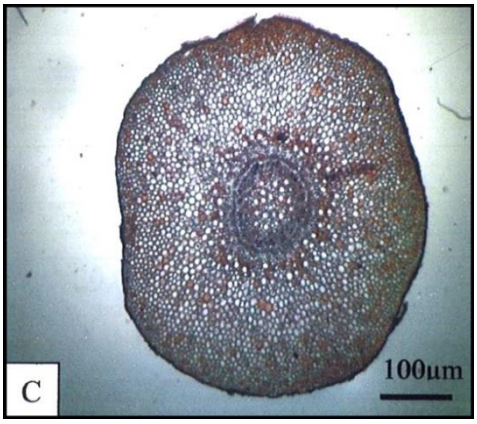

Figure 10. T.S of Pedicel

Microscopical Characters of *Plumeria alba* L.

Calyx

In surface view, polygonal parenchymatous cells were both surfaces. Stoma are present only on lower surface and of paracytic type.

In transverse section, crescent shaped in outline, calyx lobes 5 in number, distinguishable into dermal, ground and vascular tissue.

Dermal tissue system: In transverse section, epidermal cells one-layered on both surfaces, rectangular or barrel-shaped, outer cell walls of epidermis concave, inner cell walls of epidermis convex, lower cuticle thicker than the upper ones.

Ground tissue system: In transverse section, composed of 10-15 layered parenchymatous cells, polygonal or irregular in shape.

Vascular tissue system: In transverse section of calyx, 16 small vascular bundles were embedded in the ground tissue, surrounded by parenchymatous sheath, oval in shape, collateral and closed type, 3 to 4 layers of parenchymatous cells above the vascular bundles and 4 to 7 layers of parenchymatous cells below the vascular bundles. The phloem cells were very small. The xylem tissue composed of vessel, tracheids, xylem fiber and xylem parenchymatous cells. The phloem tissues consisted of sieve tube, companion cells, phloem fiber and phloem parenchyma cells.

Characters	Length (µ)	Width (µ)
Upper Surface	2.0-8.0-10.0	0.2-5.0-8.0
Lower Surface	5.0-15.0-30.0	0.3-10.0-12.0
Stomata	15.0-20.0-25.0	0.2-0.5-0.7
Guard Cell	20.0-25.0-35.0	5.0-10.0-15.0
T.S of Upper	8.0-15.0-20.0	0.2-0.4-0.5
T.S of Lower	10.0-15.0-20.0	0.5-0.7-10.0
Cuticle Upper	3.0	-
Cuticle Lower	0.5	-
Vascular Bundle	25.0-50.0-100	15.0-25.0-35.0

Corolla

In surface view, the upper epidermal cells were polygonal in shape and lower epidermal cells were elongated in shape. Stomata are present only on upper surface and of paracytic type. The anticlinal wall of lower surface wavier than that of upper surface.

In transverse section, straight in outline, corolla lobes 5 in number, distinguishable into dermal, ground and vascular tissue system.

Dermal tissue system: The epidermal cells of both surfaces were parenchymatous, polygonal in shape, thin-walled and compactly arranged. The cuticle layers were presented on both surfaces. The upper epidermal cells were polygonal in shape with few stomata. The cell wall of lower surface wavier than that of upper

surface. In transverse section of corolla lobe, abaxial and adaxial epidermis one-layered, cells oval, cuticle thin on both surfaces.

Ground tissue system: In transverse section, composed of parenchymatous cells, 12-layered.

Vascular tissue system: In transverse section of corolla lobes, the vascular bundles were embedded in mesophyll cells and oval in shape. The vascular bundle was surrounded by parenchymatous bundle sheath. The vascular bundles were collateral and of closed type. The phloem cells were very small. The xylem tissue composed of vessel, tracheids, xylem fiber and xylem parenchymatous cells. The phloem tissues consisted of sieve tube, companion cells, phloem fiber and phloem parenchyma cells.

Characters	Length (µ)	Width (µ)
Upper Surface	10.0-20.0-30.0	5.0-10.0-15.0
Lower Surface	10.0-15.0-20.0	5.0-8.0-10.0
Stomata	20.0	5.0
Guard Cell	40.0	15.0
T.S of Upper	5.0-8.0-10.0	10.0-15.0-20.0
T.S of Lower	15.0-20.0-25.0	10.0-15.0-20.0
Cuticle Upper	0.3	-
Cuticle Lower	0.3	-
Vascular Bundle	30.0-40.0-50.0	20.0-25.0-30.0

Pedicel

In surface view, the upper epidermal cells of pedicels were polygonal-shaped and lower epidermal cells of pedicels were angular-shaped.

In transverse section, the pedicel studied is oval shaped.

Dermal tissue system: The epidermal cells of pedicel were parenchymatous, thin walled, barrel-shaped and compactly arranged. The cuticle layer was thick.

Ground tissue system: The cortex was made up of 2 different types of tissues below the epidermis. The inner collenchymatous cells below the epidermis consisted of 22-layered. The outer collenchymatous cells below the epidermis consisted of 24-layered. The collenchymatous tissues were found towards the peripheral region and thin-walled parenchymatous cells towards the inner region.

Vascular tissue system: The vascular bundles were oval-shaped and embedded in the cortex. The vascular bundles were collateral and closed. The xylem tissue composed of vessel, tracheids, xylem fiber and xylem parenchyma cells. The phloem tissues consisted of sieve tube, companion cells, phloem fiber and phloem parenchyma cells.

Characters	Length (µ)	Width (µ)
Upper Surface	20.0-25.0-30.0	10.0-15.0-20.0
Lower Surface	25.0-30.0-45.0	25.0-20.0-25.0
T.S of Upper	5.0-10.0-15.0	2.0-3.0-5.0
T.S of Lower	3.0-5.0-7.0	1.0-2.0-3.0
Cuticle Upper	1	-
Cuticle Lower	1	-
Vascular Bundle	300.0	200.0

Discussion and Conclusion

In this research, the morphological and anatomical characters of *Plumeria alba* L. is presented. These characters have not been reported in the previous literature of Myanmar. The plant *Plumeria alba* L. belongs to the family Apocynaceae. *Plumeria alba* L. is native to Central America, Mexico, the Caribbean and South America as far South as Brazil but can be grown in tropical and subtropical regions (Jagdish Sura., *et al*., 2016).

In morphological study, *Plumeria alba* L. is small tree with milky latex, stem solid, branches swollen leafy at the tip. The leaves are simple, opposite, exstipulate, blade elliptic to lanceolate, apex acute, margin entire. Inflorescences are axillary or terminal and cymose. Flowers large and showy, fragrant, pedicel long. Stamens inserted on the inside of the corolla tube, anther sagittate, filament very short, basifixed, carpel 2, bilocular, ovule numerous, ovary superior, axile placentation. Fruit of paired follicles. Seeds numerous, winged, without a tuft of hairs. The morphological characters given in this presentation are in accordance with the characters given by Backer (1963), Cronquist (1981), Dassanayake (1983), Jagdish Sura., *et al*., (2016), Qi-ming (2009).

In anatomical study, the surface view of upper and lower epidermal cells were parenchymatous rectangular and polygonal-shaped. *Plumeria alba* L., stomata present only the lower surface of calyx and upper surface of corolla.

Plumeria alba L. striated cuticles are distinct and cell walls are bladed and waxy. The vascular bundle of calyx, corolla and pedicels are oval in shape. The bundles are collateral and closed type. These are in agreement of those of Cronquit (1981), Esau (1965), Metcalfe and Chalk (1950).

This study will give the useful information and standardization of plants for other researchers with pharmaceutical industry in traditional medicine. Moreover, it will be useful to be effective utilization and be isolated the right plant species for people.

Acknowledgement

I would like to acknowledge to Rector Dr. Aung Khin Myint, Dr. Thida (Prorector), Loikaw University, for permitting me to write this paper.

I would like to express our deep thanks Dr. Sann Sann Oo, Professor and Head of the Department of Botany, Kyaukse University for her invaluable suggestions.

I also wish to extend our gratitude to Professor Dr. Ohnmar Ye Win, Head of the Department of Botany, Loikaw University for invaluable advice and encouragement during this research work.

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