

HISTOLOGICAL CHARACTERS AND ITS ANTIMICROBIAL ACTIVITIES FROM LEAVES OF *PLUMERIA RUBRA* L.

Aye Aye Thant¹

Abstract

The plant *Plumeria rubra* L.(Tayok-saga-ani) belongs to the Family Apocynaceae. They were collected from North Dagon Township in Yangon Region during the flowering periods. Then the collected plants were studied of classified, identified and histological characters were examined by the literature. In histological study of leaves, paracytic type of stomata were present on both surface. Multicellular trichomes, laticiferous canals and calcium oxalate crystals were also present. Various solvent extracts of leaves were tested against the various microorganisms for antimicrobial activity by using agar-well diffusion method. It was found that acetone extracts of leaves showed more significant antimicrobial activity than different solvent extracts. This paper had recorded for standardization of drugs.

Keywords : *Plumeria rubra* L., antimicrobial activity, histological studies, leaves

Introduction

Plumeria rubra L. belongs to the family Apocynaceae, which is known as temple tree or pagoda tree in English and the plant is known as Tayok-saga-ani in Myanmar. These plants cultivated as an ornamental plant throughout in India and Myanmar. These plants are widely cultivated in the tropical and subtropical regions throughout the world. This family Apocynaceae included about 900 species (Hooker, 1882), 130 genera and 1000 species (Bailey, 1939) and 300 genera and 1300 species (Lawrence, 1969), 300 genera and 1400 species (Dassanayake, 1983).

In deciduous types, the leaves fall during winter-time and new leaves emerge during the spring flowering period. The flowers are tubular, expanding into a 'pinwheel' of five petals. Flowers are bloom from March to October. Maturation of the seed pods are usually in early spring from a previous season's pollination (Richard, 1998).

The Indian population has depended mainly upon plant based crude drugs for a variety of ailments *Plumeria* species are widely used as purgative, remedy for diarrhoea, cure of itch, bronchitis, cough, asthma, fever, bleeding piles, dysentery and tumors etc.

The medicinal plants have been used in traditional medicine for hundreds of years with reputation as efficacious remedies. These plants are rich sources of bioactive compounds and thus serve as therapeutic agents and raw materials for the manufacture of traditional and modern medicine.

This plant is famous for their attractiveness and fragrant flowers. The whole plants are used in cholera and indigestion. The flowers are used for perfumery and pectoral syrups. The latex are useful in rubefacient, drastic, purgative, cathartic, corrosive, abortifacient, itch, rheumatism and soothe irritation. The leaves are used to treat ulcers, leprosy, inflammation, rubefacient, rheumatism, bronchitis, cholera, cough, antipyretic, antifungal, stimulant, asthma, fever, bleeding piles, dysentery, blood disorders and tumors. The fruits are reported to be used as abortifacient. The barks are used in asthma, ease constipation, menstruation and reduce fever, bitter, pungent heating, carminative, laxative, leprosy, ulcers, gonorrhoea, purgative, emmenagogue, febrifuge, malaria, antiseptic, antiseptic, venereal sores, diarrhoea. The roots are

¹ Dr, Lecturer, Botany Department ,University of Yangon

used in carminative, thermogenic, laxative, leprosy, astringent, ulcers and gastropath (Kirtikar, K.R and Basu, 1984, Khare, C.P, 2007).

In Myanmar, the leaves are used in abdominal tumors, inflammation, rheumatism and the latex are used in purgative, gastropath as traditional medicine. The flowers are used in carminative, diuretic, malaria, pruritis. It is also eaten as salad with other ingredients. The decoction of barks are used in leprosy, pruritis, heal boils, carbuncles, analgesic, febrifuge for prolong fevers, inflammation and ascites.(U San Hla, 1960; U Mya Win, 1966; Burmese Medicinal Plants, 1998 and KyawSoe& Tin MyoNgwe, 2002).

The antimicrobial activity was tested to know whether it possesses any medicinal values. Antimicrobial drugs must have a selective action against microorganisms. Today, antimicrobial drugs used as antibiotics specific antimicrobial therapy may be instituted if the species of infecting microorganism is one whose drug-resistant variants are known not to assume clinical importance and antimicrobial drugs in general use is of advantage

Aims and Objectives

- To classify and identify the sample plant *Plumeria rubra* L.
- To study the histological characters from leaves of this plant
- To examine the diagnostic characters of powdered leaves for the standardization
- To investigate the antimicrobial activity

Material and Methods

The plant specimen of *Plumeria rubra* L. were collected from North Dagon Township, Yangon region during the flowering periods of March to October. The collected fresh specimen of both vegetative and reproductive parts of the plant were identified with the available literature of Hooker (1882), Bailey (1939), Backer (1963), Lawrence (1969), Hundley and Chit KoKo (1987) and Flora of Hong Kong (2009). Taxonomic description was recorded with the photograph of habit, leaves, inflorescences, flowers, L.S of flower and T.S of ovary and parts of the plant with measurement.

The histological characters of leaves were also identified by the cut section according to the literature of Metcalf and Chalk (1950). The cut sections were used to clean with chlorohydrate solution and permanent slides were taken on the Olympus microscope. The specimens of leaves were washed with water and dried at room temperature for 2-3 weeks. The leaves were crushed by grinding with a blender to get the powder. Then, the powder sample was stored in the air tight container. Then the powder samples were examined for the diagnostic characters and used in standardization of the plant material for medicinal purpose

The test organisms in this study were obtained from the Developments centre for Pharmaceutical Technology for determination of antimicrobial activity. The study of antimicrobial activity was performed by agar well diffusion method described in Cruickshank.(1968)

Results

Trees with milky latex, perennials, 8m in high. Stem erect, branched. Bark rough, grey brown. Leaves simple, whorled, leaf blade oblong to lanceolate, laticiferous, 14-25 cm in length

and 5-9 cm in breadth, petiole, 1.6-3.6 cm in length and 0.4-0.7 cm in breadth, exstipulate. Inflorescence terminal, cymose, 5-9 flowers, 14-17 cm in length. Flowers whitish pink, bracteates, bracteolate, pedicellate, complete, bisexual, regular, actinomorphic, pentamerous, hypogynous. Sepals 5, aposepalous, imbricate, petaloid (dark red), 0.1-0.4 cm in length and 0.1-0.3 cm in breadth, inferior. Petals (5), synpetalous, twisted, funnel form, petaloid, 3.4-3.9 cm in length and 2.1-2.7 cm in breadth, inferior. Stamens 5, apostamenous, epipetalous, filament very short, anther dithecal, dorsifixed, longitudinal dehiscence, introrse, inferior. Ovary bicarpellary, syncarpous, tetralocular (due to false septum present), stigma bifid, style slender, many ovules in each locule, axile placentation, superior. Fruits follicle, oblong, 11-25 cm in length and 2-3 cm in breadth. Seeds many, flat with a membranous wing, brown.



Habit



Ventral view of leaves



Dorsal view of leaves



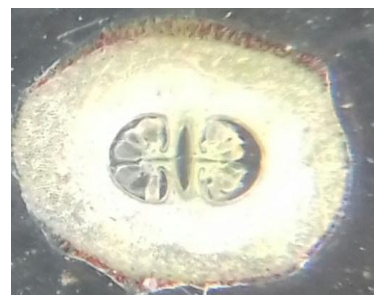
Inflorescences



flowers



L.S of flower



T.S of ovary

Histological characters of leaves of *Plumeria rubra* L.

Lamina

In surface view, the epidermal cells of both surface were smooth, and thin wall. The cell wall of upper and lower surface were straight in lamina. Stomata were present on the upper surface and abundant in the lower surface. It was oval in shape and guard cell was crescent in shape. They were paracytic type.

In transverse section; multicellular trichomes, calcium oxalate crystals, thin-smooth cuticles were present on both surface. The upper and lower epidermal cells were rectangular in shaped. The mesophyll consisted of palisade and spongy parenchyma. The palisade was made up of two layers and spongy was irregular in shaped; which were loosely 7-9 layers and arranged with one another. They contained numerous chloroplast, oil cells and latex vessels. Vascular bundle embedded in the mesophyll cells, and bicollateral type.

Midrib

In surface view, the epidermal cells of both surface were rectangular in shaped. The lower surface cells were similar to upper surface cells. Stomata, unicellular trichomes and laticiferous canals were abundant on lower surface.

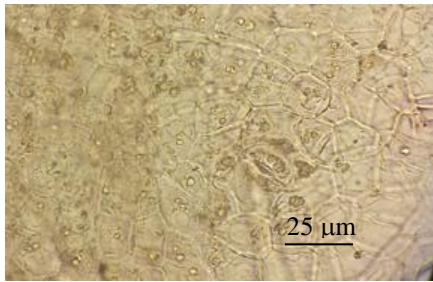
In transverse section, the cuticles were thin and smooth. The upper and lower epidermal cells were rectangular in shaped, single layer, thin-walled. Multicellular trichomes were present on adaxial side and collenchymatous cells were 20-24 layers and parenchymatous cells were 12-15 layers. At abaxial side, collenchymatous cells were 15-18 layers and parenchymatous cells were 17-20 layers. These cells were oval or polygonal in shaped and thin-walled, solitary crystals, oil cells and laticiferous canals were present on these layer. Vascular bundles were crescent in outline. These bundles were bicollateral type, xylem inner region and phloem peripheral and inner region, phloem cells 4-7 layers and xylem cells 3-6 per rows

Petiole

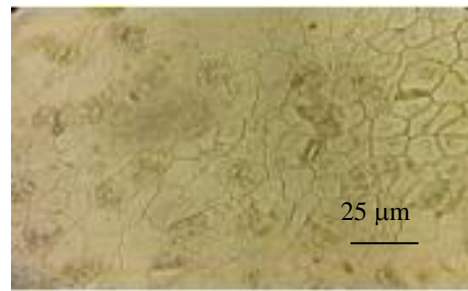
In surface view, the epidermal cells of both surface were rectangular to polygonal shaped and cell wall straight, stomata, oil cells, trichomes and calcium oxalate crystals were present on both surface.

In transverse section, the cuticles were thin and smooth, the upper and lower epidermal cells were angular or rounded, thin-walled, single layered. At adaxial side was heart-shaped, 21-24 layers of collenchymatous cells and 13-17 layers of parenchymatous cells. At abaxial side was convex, 16-20 layers of collenchymatous cells and 15-18 layers of parenchymatous cells. These cells were oval or polygonal in shaped and oil cells, calcium oxalate crystals and laticiferous canals, intercellular space were present. Vascular bundles were circular in outline. These bundles were bicollateral type, xylem inner region and phloem peripheral and inner region, phloem cells 2-4 layers and xylem cells 2-5 per rows.

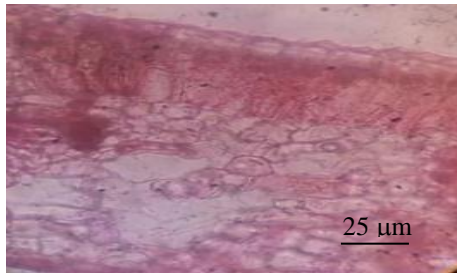
Histological characters of leaves of *Plumeria rubra* L.



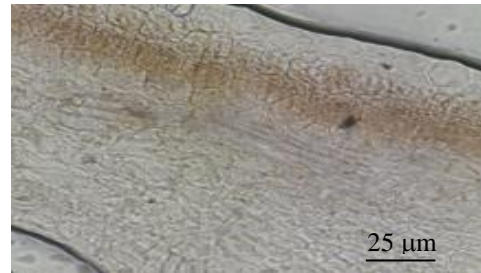
Upper surface of Lamina



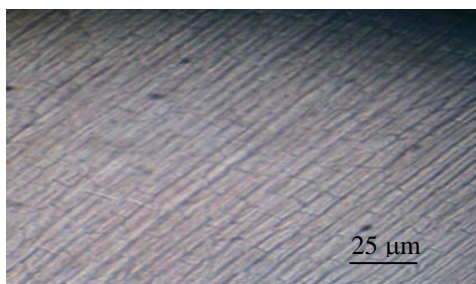
Lower surface of Lamina



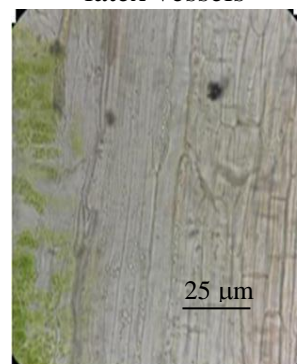
Transverse section of Lamina



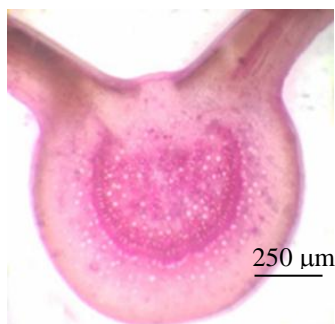
Transverse section of lamina with latex vessels



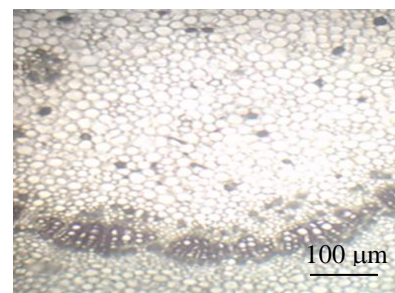
Upper surface of midrib



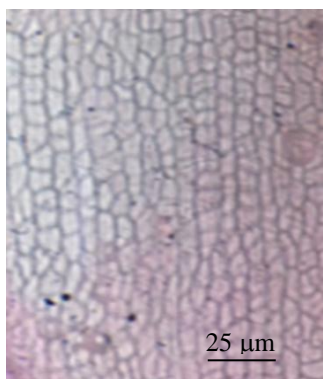
Lower surface of midrib showing trichome



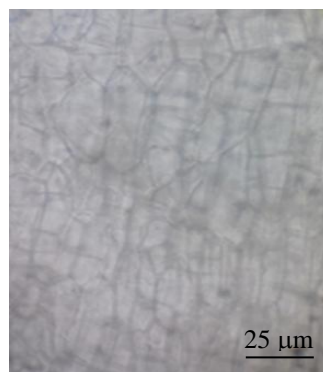
Transverse section of midrib



Close up view of vascular bundle of midrib



Upper surface of petiole



Lower surface of petiole



Transverse section of petiole

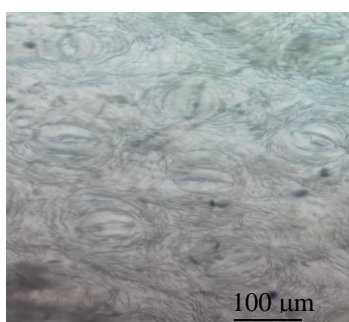


Close up view of vascular bundle of petiole

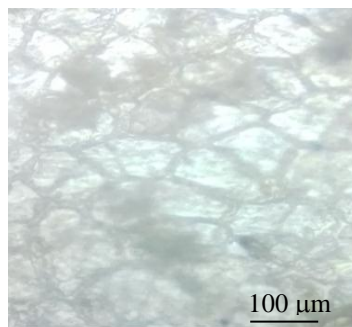
Sensory characters from powdered leaves of *Plumeria rubra* L.

Samples	Color	Odor	Taste	Texture
Leaves	Dark Green	Aromatic	Bitter	Granular

Histological characters of powdered leaves of *Plumeria rubra* L



Stomata



Epidermal cell



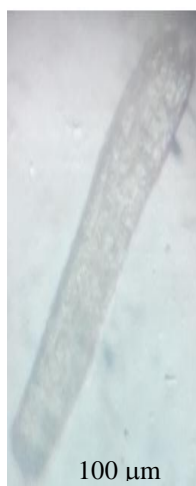
Unicellular trichome



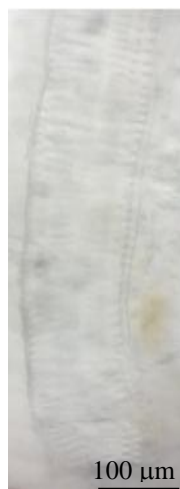
Tracheid



Fiber

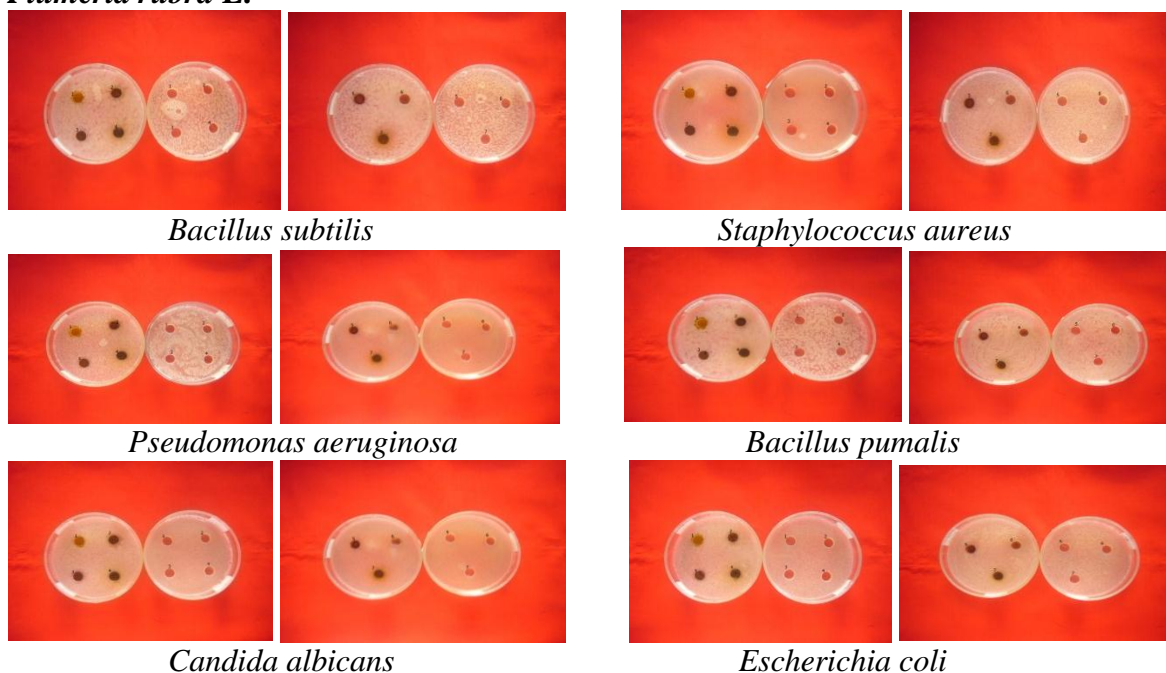


Pitted vessel



Scalariform vessel

Comparative antimicrobial activities of control and different solvent extracts of leaves of *Plumeria rubra* L.



Antimicrobial activity of different solvent extracts of leaves of *Plumeria rubra* L.

Solvents	Organisms					
	<i>Bacillus subtilis</i>	<i>Staphylococcus aureus</i>	<i>Pseudomonas aeruginosa</i>	<i>Bacillus pumalis</i>	<i>Candida albican</i>	<i>Escherichia coli</i>
Pet-ether	11mm	-	-	11mm	11mm	11mm
CHCL ₃	11mm	11mm	-	11mm	12mm	13mm
MeoH	12mm	12mm	-	12mm	13mm	12mm
Acetone	14mm	13mm	-	12mm	13mm	13mm
EtoAc	12mm	12mm	-	-	13mm	13mm
EtoH	14mm	13mm	-	11mm	12mm	12mm
Water	-	11mm	-	11mm	11mm	11mm

Agar well – 10 mm

Discussion and Conclusion

In this research, the plant of *Plumeria rubra* L. belonging to the family Apocynaceae have been studied. This plant was collected from North Dagon Township Yangon Region. The morphological characters of vegetative and reproductive parts of the plant, the histological characters and antimicrobial activity from leaves of *Plumeria rubra* L. were studied..

In morphological studies, *Plumeria rubra* L. was perennial tree, latex present. The leaves were simple, whorled, margin entire, leaf blade lanceolate. Inflorescences were cyme (corymb) terminal or axillary. Flowers were pink, fragrant, actinomorphic, pentamerous. Stamen epipetalous, anther sagittate or ditheous. Ovary bicarpellary, stigma bifid, style 1, axile placentation, disc present. Fruit follicles or berry. The seeds were membranous wings. These characters were in agreement with those mentioned by Hooker, 1882; Bailey, 1939; Backer, 1963; Lawrence, 1969 and Dassanayake, 1983.

According to the leaves of histological character studies; the stomata were present on both surface and paracytic type. Vascular bundles of midrib and petiole were circular shaped. These bundles arranged in the form of ring and bicollateral type. Multicellular trichomes, laticiferous canals, calcium oxalate crystals were present. Latex traces were large radial channels or strands. These characters were in agreement with those mentioned by Metcalf and Chalk, 1950.

In the antimicrobial activity of crude extracts from leaves of *Plumeria rubra* L. were tested on six microorganisms. Acetone extracts showed the best activity on *Bacillus subtilis*, *Staphylococcus aureus*, *Bacillus pumalis*, *Candida albicans*, *Escherichia coli*. From this finding, it may be inferred of leaves of *Plumeria rubra* L. can be effective in the formulation of medicine for the treatment of many diseases such as eye infection, urinary infection, respiratory system infection, boil, wound, food poison, pneumonia, intestinal diseases, bone and joint infections, gastrointestinal, chronic lung infections and skin infection. The effectiveness of leaves were carried out for clinical trial of their drugs.

Acknowledgements

I would like to express thanks to Dr Aye Pè, Professor and Head, Dr Myint Aung (Professor), Dr Baydar (Professor), Dr Thandar Aye (Professor), Department of Botany, University of Yangon for their encouragement and guidance in this research.

References

- Bailey, L.H, (1939), **The Standard Cyclopedia of Horticulture Vol.I**, The Macmillan Company, New York
- Backer, C.A., (1963), **Flora of Java Vol II**, N.V.P Noordhoff-Groningen, Netherland
- Cruickshank, C.B.E., (1970). *Medicinal Microbiology*. London :hurchillLiyingstone.
- Hundley, H.G and Chit KoKo, (1987), **List of Trees, Shrubs, Herbs and Principal of Climbers**, etc, Government Printing Press, Yangon.
- Hooker, SIR J.D, (1882). **The Flora of British India Vol.III**, L. Reeve and Company, London
- Kirtikar, K.R and Basu, B.D., (1984), **Indian Medicinal Plants Vol.III**, India
- Kyaw Soe & Tin Myo Ngwe, (2002), **Medicinal Plants of Myanmar**, Identification and Uses of some 100 Commonly Used Species, Series I, Pyizone Publishing Hourser, Lanmadaw Township, Yangon
- Lawrence, G.H.M, (1969), **Taxonomy of Vascular Plants**, the Macmillan Company, New York
- Metcalf, C.R and Chalk, L, (1950), **Anatomy of the Dictyledons**, Leaves, Stems and Woods in Relation to Taxonomy with Notes on Economic Uses Vol.II, Oxford University Press, London
- Richard, A., (1998), **Ornamental flowers;Plumeria**, Department of Horticulture, College of Tropical Agriculture & Human Resources.
- Trease, G.E and Evans, W.C, (1989), **Pharmacognosy 14thEdn**; ELBS, Baillre Tindal, London
- U San Hla, (1960), **Handbooks of Natural Foods**; the Universal Printing Works, 76 A, Inya Road, Rangoon.
- U Mya Win, (1966), **နွယ်မြက်သစ်ပင်ဆေးဖက်ဝင်ကြသည့် ရုပ်ပြဆေးဘယ အဘိဓာန် အမှတ်(၂)**, Yangon
- Wiat, C., (2002), **Medicinal Plants of Southeast Asia**, Kuala Lumpur, Pearson Malaysia