Study on Morphological and Microscopical Characters of *Millingtonia hortensis* L. f.

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Abstract

A research has been undertaken on the species *Millingtonia hortensis* L.f. of the family Bignoniaceae growing in Mawlamyine, Mon State. The collected specimens were measured and recorded for taxonomic description. The microscopical studies of specimens were examined by preparing freehand sections and phytochemical test was also studied. The plant was tall tree, flower white. Epidermal cells were wavy. Lower epidermal cells were larger than the upper ones. Stomata were abundant in lower surface. Striation and trichomes present in both surfaces. Vascular bundles were collateral and open type. The wood was used as puppetry, furniture, timber and the bark was used to cork. The plant parts were applied as traditional medicine for the treatment of kidney stone aliments, giddiness, hypoglycemic, lung tonic and antipyretic activities. This paper tends to present on morphological and microscopical characters and phytochemical test of *Millingtonia hortensis* L. f. (Egayit). These characters provide in identification of the traditional medicine for standardization.

Introduction

Millingtonia hortensis L. f. is a species of the Bignoniaceae family that has been widely studied in the last decades due to its therapeutic potential. Many of the family Bignoniaceae are night flowering. The fragment white flowers of *M. hortensis* L. f. which were native to Burma and Malaya has now become naturalized in India (Backer, 1965).

M. hortensis L. f., also known as tree jasmine and Indian cork tree, is a deciduous plant that is mostly distributed in South Asia (Blatter, 1954). The tree is chiefly grown for its handsome foliage and attractive fragrant flowers from October to November. Wood of this tree yields durable timber. It is suitable for making furniture and ornamental work (Cronquist, 1981). The bark consists of bitter substance and some tannin. The leaves and bark are used as antipyretic in Indonesia (Rastogi, 1980). In Thailand, the flower is called 'peep' and used for the treatment of asthma, sinusitis and as a cholagogue and tonic. The flowers are added to tobacco for smoking as treatment for throat aliments. The leaves of cork tree are very ornamental and extracts of leaves has good antimicrobial activity. Bark is used as yellow dyes. Roots can be used for the treatment of tuberculosis and as antiasthma (Magayarkarasi and Nagarajan, 1984).

Materials and Methods

In this study, the specimens of *Millingtonia hortensis* L. f. were collected from Dine Won Kwin Quarter, Mawlamyine Township, Mon State, during the months of June to December. After collected specimens were measured, they were recorded in detail for taxonomic description and identification of genera and species were carried out by using Backer (1965), Dassanayake (1985) and Hooker (1885). The microscopical studies of lamina, midribs, petiolules and petioles were examined by

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preparing free hand sections from the fresh specimens. The freehand sections and powdered samples were examined according to the methods of Trease and Evans (2002) and WHO (1998). Phytochemical tests were carried out by using Robinson (1983).

Morphological characters of *Millingtonia hortensis* L. f.

Trees (15-20) ft about height. Stems woody, teretes, glabrous. Leaves opposite and decussate, bi-tri pinnately compound, imparipinnate, the leaflets 3-7, ovate, 2.1-3.3 cm long and 1.1-1.7 cm wide, unicostate, the tips acuminate, the margins sinuate-crenate, the bases obtuse to oblique, both surfaces puberulent; petiolules 0.5-0.6 cm long, puberulent, petioles cylindrical, 0.2-0.6 cm long, puberulent, exstipulate. Inflorescences terminal and axillary, paniculate cymes, 15-25 cm long and 9-16cm wide; peduncles cylindrical, 15-25 cm long, glabrous. Flowers white, fragrant, about 10.5 cm and 3.9 cm wide, bisexual, zygomorphic; the bracts elliptic, light green, about 0.1 cm long and 0.1cm wide, both surfaces pubescent; pedicels cylindrical, about 1.2cm long, glabrous; the bracteoles minute; sepals 2+3, fused, cupular, the calyx tubes about 1.0-1.2 cm long 0.3-0.4 cm wide, the calyx lobes shortly dentate and recurved, light green, valvate, both surfaces glabrous; petals 2+3, fused, salverform, white, the corolla tube about 8.8 cm long and 3.9 cm wide, the corolla lobes white, 3 anterior ones elliptic-oblong and 2 posterior ones acute, about 1.5 cm long and 1.2 cm wide, both surfaces glabrous; stamens $2+2+1^{st}$, didynamous, petalostemonous, alternate to the petals, the long filaments 1.3 cm long and the shorter ones 0.7 cm long, exserted from the corolla tube, glabrous, the anthers dithecous, connivent and divergent, one cell of each anther well developed and the other one rudimentary, oblong, light brown, about 0.3-0.5 cm long and 0.2-0.2 cm wide, dorsifixed, longitudinal dehiscence, introrse; ovary superior, oblongoid, light green Fruit septifragal capsule, elongated, linear, compressed, green about 45.0 cm long and 1.7 cm wide, glabrescent; seeds numerous, suborbicular, light green about 0.9 cm long and 1.2 cm wide; flat with a thin whitish wings, basally and apically narrowed ring, glabrous. (Fig.1-8).

Microscopical characters of *Millingtonia hortensis* L. f.

Lamina

In surface view, the epidermal cells of both surfaces were parenchymatous and more or less polygonal in shape. Epidermal cells were wavy. Lower epidermal cells were larger than the upper ones. Stomata were abundant in lower surface. Striation present in both surfaces. In transverse section, the epidermis one-layered, parenchymatous cell rectangular in shaped and compactly arranged, cuticle thick on both surfaces. The palisade cells were 2 layered on upper surfaces. The cells were vertically elongated and cylindrical. Spongy mesophyll cells were 5 to 7 layered and loosely arranged. Vascular bundle were embedded in mesophyll. Xylem consisted of vessels, tracheids, xylem fibres and xylem parenchyma. Pholem lied towards the lower side. It consisted of sieve tubes, companion cells phloem fibres and phloem parenchyma (Fig.9-11).

Midrib

In surface view, the epidermal cells were thin-walled, parenchymatous cells. The cells were elongated and rectangular in shaped. Glandular and non-glandular trichomes were present. In transverse section, the upper epidermal cells were parenchymatous, compactly arranged. The lower epidermal cells were smaller than the epidermis. Below the upper epidermis, collenchyma cell 2-3 layered on above the vascular bundle and 1-2 layered below the vascular bundle. The cells were isodiametric and rounded in shape. Under the collenchyma, parenchyma cells were 3-4 layered. Parenchyma cells below the vascular bundle were 7-9 layered. The cells were thin-walled, irregular in shape. Parenchyma cells are present in the center of vascular bundle. Vascular bundle was crescent-shaped in structure. The vascular bundle of midrib was collateral type, xylem lied towards the center and composed of vessels, tracheid, xylem fibre and xylem parenchyma. Phloem lied towards the outers and composed of sieve tube, companion cells, phloem fibre and phloem parenchyma (Fig.12-13).

Petiolule

In surface view, the epidermal cells of both surfaces were more or less rectangular or polygonal in shape. Glandular and non-glandular trichomes are present in both surfaces. In transverse section, cuticle thick, epidermal cells were parenchymatous, barrel shaped compactly arranged one layered thick. 4-5 layers of parenchymatous cells lie beneath the epidermis. Vascular bundles were collateral type. Xylem lies towards the center and consists of vessels, tracheids, xylem fibres and xylem parenchyma. Phloem lied towards the outer sides is made up of sieve tubes, companion cells and phloem fibres and phloem parenchyma. Sclerenchyma cells were surrounded by vascular bundle. Crystals were present in some parenchyma cells (Fig.14-15).

Petiole

In surface view, the epidermal cells of both surfaces were more or less rectangular or polygonal in shape. Stomata, glandular and non-glandular trichomes were present. In transverse section, cuticle thick, epidermal cells were parenchymatous, rectangular in shaped compactly arranged one layered thick. 3-4 layered of parenchymatous cells lie beneath the epidermis. Vascular bundles were collateral type. Xylem lies towards the center and consists of vessels, tracheids, xylem fibers and xylem parenchyma. Phloem lied towards the outer sides is made up of sieve tubes, companion cells and phloem fibers and phloem parenchyma. Sclerenchyma patches were present in the cortex. Crystals, oil drops and tannin were present in some parenchyma cells (Fig.16-17).

Young stem

In transverse section, the stem was square or broadly in outline. The epidermis consisted of a single layer barrel or rectangular shaped cells. The epidermis was the cortex of parenchyma cells that were rounded or oval 12-16 layers. Sclerenchyma patches were surrounded by the vascular bundles. The center of the stem was occupied by the pith with parenchyma cell. The cells of the pith were parenchymatous with rounded in shape. Vascular bundles were collateral and open

type. Vascular cambium was 4-6 layered. Xylem was composed of vessel, tracheid, xylem fibre and xylem parenchyma. Phloem consisted of sieve tubes, companion cell, phloem fibre and phloem parenchyma (Fig.18).

Mature Stem

In transverse section, the mature stem was circular in outline. The phellem 3-4 layered compactly rectangular in shaped. The phellogen 4-5 layered thin wall and rectangular in shaped. The phelloderm 4-5 layered of parenchymatous cells with rounded or polygonal in shaped. The cortex consisted of 10-12 layered. Pith was 35-40 layered in thickeness and cells were rounded or polygonal in shaped. Vascular bundles were collateral and open type. Vascular bundle forming a ring like structure. Vascular cambium was 3-4 layered. Xylem lying inwards and phloem outwards. Xylem was composed of vessel, tracheid, xylem fibre and xylem parenchyma. Phloem consisted of sieve tubes, companion cell, phloem fibre and phloem parenchyma. The medullary ray was narrow and 2-3 layered (Fig.19).

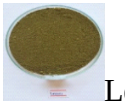
Table 1. Epidermal characters of *Millingtonia hortensis* L. f.

Scientific name	Stomata		Trichomes		Epidermal cells	
	Upper surface	Lower surface	Non-glandular	Glandular	Upper	Lower
Millingtonia hortensis L. f.	Rarely	Numerous (diacytic)	Uniceriate unicellular, or bicellular	Peltate or globose	Wavy	Wavy

Sensory characters of powdered leaves and stem of *Millingtonia hortensis* L. f.

The color of powdered leaves were dark green and the color of stems was pale yellow. These were aromatic odour and bitter taste. Texture of powdered leaves and stem were fibrous.

Table 2. Sensory characters of powdered leaves and stem of *Millingtonia hortensis* L. f.

Sensory characters	 Leaves	 Stem
Colour	Dark green	Pale yellow
Odour	Aromatic	Aromatic
Taste	Bitter	Tasteless
Texture	Fibrous	Fibrous

Diagnostic characters of powdered leaves and stem of *Millingtonia hortensis* L. f.

In powdered leaves, fragments of epidermal cells, stomata and trichomes were occured. Tracheids, fragments of vessels with spiral, double spiral, annual and pitted were found in leaves. Fragment of pitted, tracheid and fibre were found in stem (Fig. 20-28).

Preliminary phytochemical test of leaves of *Millingtonia hortensis* L. f.

The preliminary phytochemical test of the leaves of *Millingtonia hortensis* L. f. indicated the presence of alkaloids, -amino acid, carbohydrate, starch, reducing sugar, glycosides, phenolic compounds, Saponins, tannin, Steroids/terpenoids, flavonoids, protein. The results were tabulated in Table (3).

Table 3. Preliminary phytochemical test of leaves of *Millingtonia hortensis* L. f.

No.	Test	Extract	Test reagent	Observation	Result
1	Alkaloids	EtOH	Dragendroff's reagent	Orange brown ppt	+
			Mayer's reagent	Pale yellow ppt	+
			Wagner's reagent	Reddish brown ppt	+
			Hlger's reagent	Yellow ppt	+
2	-amino acid	Ethnol	Ninhydrin	Pink spot	+
3	Carbohydrate	H_2O	DW,	Red ring	+
			Benedict's solution		
4	Starch	EtOH	Potassium Iodine solution	Reddish brown ppt	+
5	Reducing sugar	H_2O	Fehling A & B	Orange ppt	+
6	Glycosides	H_2O	$NaOH^+$	Pale yellow	+
7	Phenolic	EtOH	DW 2ml water	Blue black ppt	+
	Compounds				
8	Saponins	H_2O	Distilled water	Frothing	+
9	Tannins	EtOH	3% ferric chloride solution	Black ppt	+
10	Steroids/	EtOH	H_2SO_4	Green red ppt	+
	Terpenoids		$CHCO_3$		
11	Flavonoids	95%	2g naphthol	Pink ppt	+
		EtOH	50% EtOH		
12	Protein	EtOH	Millon's Reagent	White ppt	+

Antimicrobial activities of leaves of *Millingtonia hortensis* L. f.

In the experiment, the antimicrobial activities of crude extracts were carried out by using various extracts such as acetone, ethyl acetate, ethnol, methanol, pet ether and distilled water. These result, among various extracts of leaves *M. hortensis* L. f. Methanol extract showed highest activity on all six test organisms. The results are shown in Table (5) and (Fig, 29).

Table.5 Antimicrobial activities of leaves of *Millingtonia hortensis* L. f.

Solvents	Organisms					
	B. pumalis	*B. subtilis*	*C. albican*	*E. coli*	*P. fluorescens*	*S. aureus*
Acetone	8	14	12	12	8	10
Ethyl acetate	8	8	10	8	8	8
Ethanol	10	12	14	12	12	12
Methanol	12	18	18	14	12	12
Pet ether	-	-	-	-	-	-
Distilled water	10	14	14	10	12	12

Fig. 1

Fig. 2 Leaves

Fig. 3

Fig. 4

Fig. 5

Fig. 6 L.S of flower and T.S of ovary in box

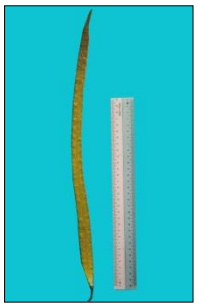


Fig. 7 Fruit

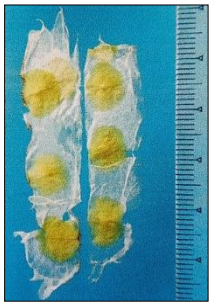


Fig. 8

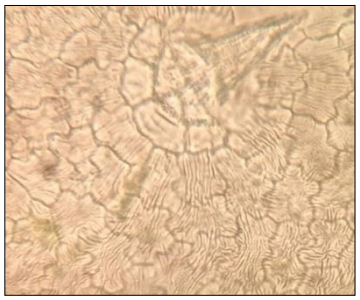


Fig. 9 Upper surface of lamina (X400)

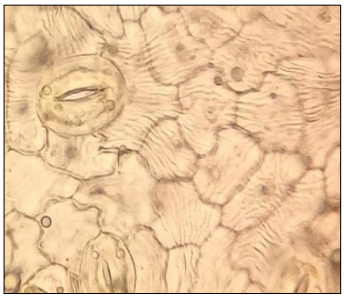


Fig. 10 Lower surface of Lamina (X400)

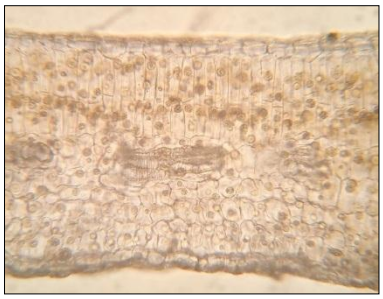


Fig. 11 T.S of lamina

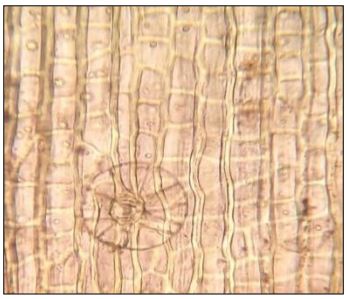


Fig. 12 Surface view of midrib (X400)

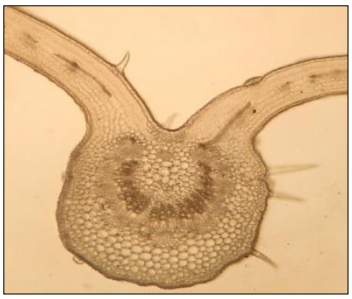


Fig. 13T.S of midrib

Fig. 14 Surface view of Petiolule (X400)

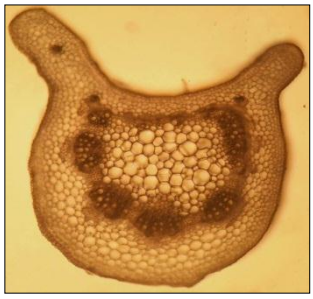


Fig. 15 T.S of petiolule

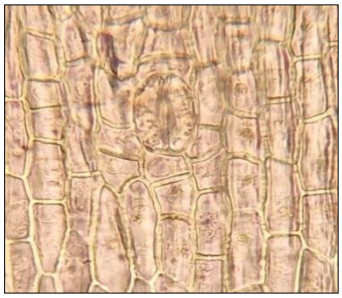


Fig. 16 Surface view of petiole (X400)

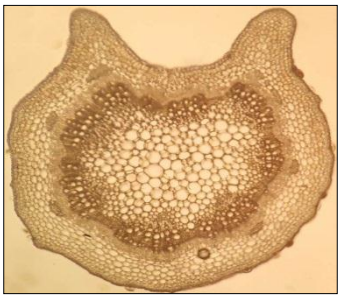


Fig. 17 T.S of petiole

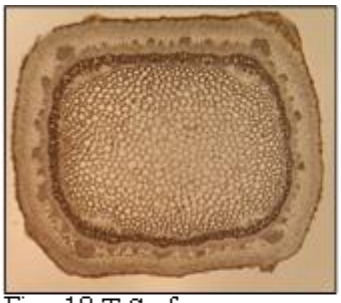


Fig. 18 T.S of young stem (X40)

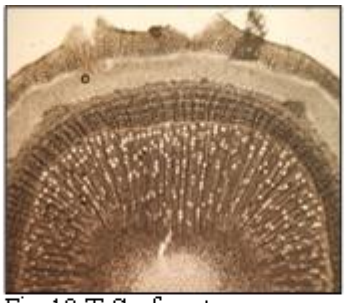


Fig. 19 T.S of mature stem (X40)

Fig. 20 Non Glandular trichomes (X400)

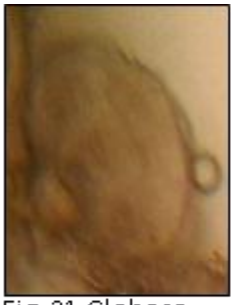


Fig. 21 Globose trichome

Fig. 22 Peltate trichomes (X400)

Fig. 23 Annual vessels (X400)

Fig. 24 Spiral vessels

Fig. 25 Double spiral vessels (X400)

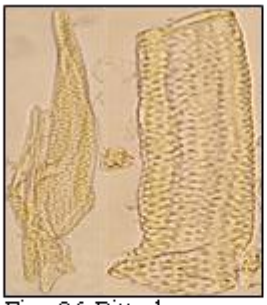


Fig. 26 Pitted vessels (X400)

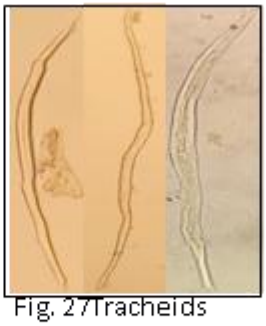


Fig. 27Tracheids (X400)

Fig. 28 Fibres

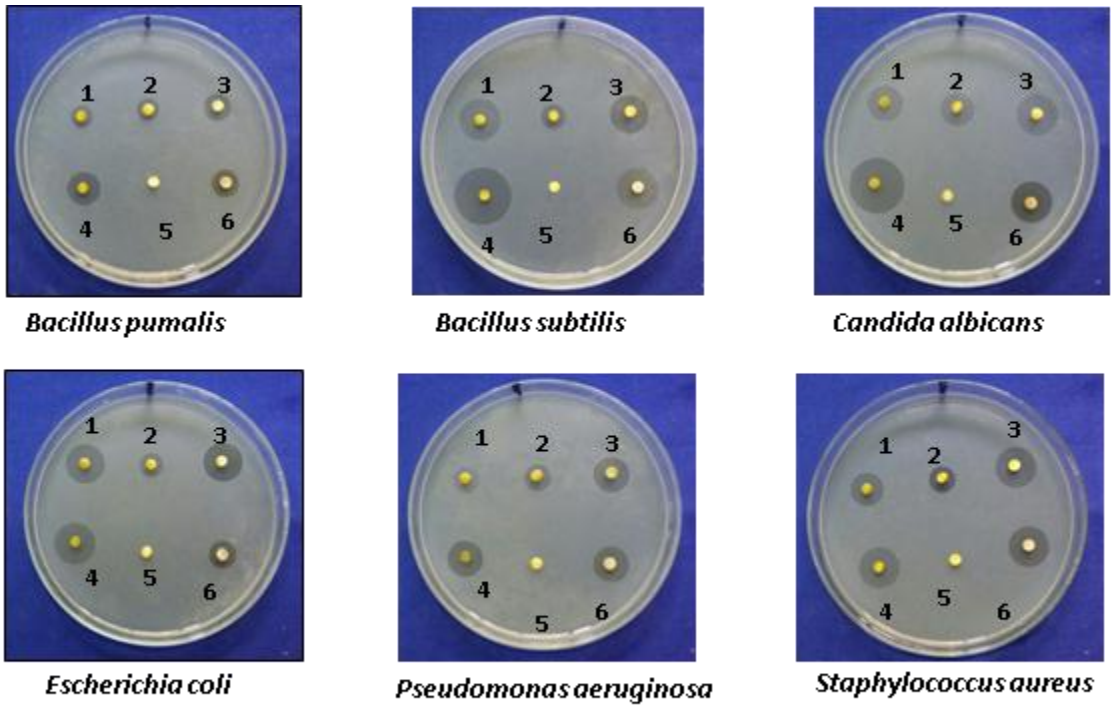


Fig. 29 Antimicrobial activities of leaves extracts of *Millingtonia hortensis* L. f.

Discussion and Conclusion

In the present study, the plant is a tall tree, stem straight with corky bark. The leaves are opposite and decussate, bi-tri pinnately compound, imparipinate. Inflorescences terminal and axillary, paniculate cymes and flowers white, bisexual and hypogynous. Calyx persistent, corolla lobed, 3 anterior ones elliptic-oblong recurved apex, 2 posterior ones connate about half acute apex. Stamens didynamous, petalostemonous, anthers connivent and divergent, one cell of anther well developed and other cell rudimentary. Ovary superior, two carpels, many ovules in each locule with axile placentation. These characters are in agreement with those given by Backer (1965), Dassanayake (1985) and Hooker (1885).

In surface view, upper and lower epidermal cells of lamina are wavy. Diacytic types of stomata are abundant in lower epidermal cell. Striation, glandular and non-glandular trichomes are present on both surfaces. In transverse section of lamina, upper epidermal cells are larger than lower epidermal cell. Palisade cells are two layers. In transverse section, vascular bundle of midrib is crescent-shaped. Vascular bundle of petiolules are ring-like structure, vascular bundle of petiolules are surrounded by sclerenchyma cells. In transverse section, vascular bundle of petiole is ring-like structure, sclerenchymatous patches present in cortex. In transverse section, vascular bundle of stem is ring-like structure, bicollateral and open-typed. Glandular trichomes are sunk in the epidermal cell. The glandular trichomes are peltate structure and capitate or globose. Non-glandular trichomes are uniseriate, unicellular, bicellular and tricellular. These characters are in agreement given by Melcalfe and Chalks (1950), Pandey (1996) and Trease and Evans (2002). In preliminary phytochemical test for alkaloid, -amino acid, carbohydrate, starch, reducing sugar, glycoside, phenolic compound, saponin, tannin, steroid/terpenoid, flavonoid and protein were

carried out on leaves. All of the constituents were present in leaves. In antimicrobial activity, methanol extract is better activity than other extracts.

Acknowledgements

The authors would like to express their gratitude to Dr. Aung Myat Kyaw Sein, Rector and Dr. San San Aye, Prorector of Mawlamyine University, for their kind permission to carry out this research paper. We are thankful to Dr. Marlar Aung, Professor and Head, Department of Botany, Mawlamyine University, for allowing this research.

References

Backer, C. A., (1965). **Flora of Java,** Vol II., Noordoh Groningen Company, Netherland British Pharmacopeia, 1968. The Pharmaceutical Press, London and Bradfod.

Blatter, E. and W. S. Millard, (1954). **Some Beautiful Indian Trees**, The Bombay natural History Society, Mumbai.

Cronquist, A., (1981). **An Integrated System of Classification of Flowering Plants**, Columbia University Press, New York Guirdford, Surrey, Printed in the United Stated of America.

Dassanayake, M. D., (1981). **Flora of Ceylon**, Vol III, Published for the Smithsonian Institution and the National Suence Foundation, Washington, D.C., Amerind Publishing Co, Pvt. Ltd., New Delhi.

Esau Katherine, (1965). **Plant Anatomy**, 2nd Edi, Porinted in Japan, by Toppan printing Company, LTD.

Hooker, I. D., (1885), **The Flora of British India**, Vol II., Published under the L. Reeve and Co., Ltd., Coventgarden London.

Mangayarkarasi A. and S. Nagarajan, (1984). **Chemical examination of the leaves of *Millingtonia hortensis* Linn.,** Indian Drugs.

Metcalfe, C. R. and L. Chalk, (1950). **Anatomy of the Dicotyledon**, 1st Edi., Vol. II., Oxford at the Clarendon Press.

Pandey, S. N. and A. C. Chadha, (1996). **Plant Anatomy and Embryology, Vikas,** Publishing House PVT. LTD.

Rastogi, R. P. and B. N. Mehrotra, (1980). **Compendium of Indian Medical Plants**, Central Drug Research Institute, Lucknow.

Trease and Evans, (2002). **Pharmacognosy**, 15th Edition, Edinburgh London, New York.

WHO, (1998). **Quality Control Methods for Medicinal Plant Materials**, printed in England.