

## A Study on Morphological, Anatomical and Phytochemical tests of *Lantana camara* L. in Loikaw Township

Khin Cho Cho Oo<sup>1</sup>

### Abstract

The medicinal plant of *Lantana camara* L. is locally known as Sein-na-pan(or)Nadaung-ban in Myanmar, this plant belongs to the family Verbenaceae had been studied. It was collected from Loikaw University campus, Kayah State. Morphology of the vegetative and reproductive parts of this plant was studied for classification and identification. *Lantana camara* L. is perennial shrubs, quadrangular stem with stiffy hairs, aromatic, brightly coloured flower with fleshy fruits. In the anatomical study, different parts of *Lantana camara* L. were investigated. The anticlinal walls of lower surface of lamina are wavier than the upper one. Anomocytic type of stomata is present on both surfaces. Glandular trichomes with very small head and simple trichomes with cystoliths in the cells surrounding their bases are found in lamina, midrib, petiole and stem. Open arc-shaped of vascular bundle, closed collateral types are present in midrib and petiole. In the diagnostic characters, the odour of leaves is pungent and pieces of trichomes are abundant. In the preliminary phytochemical tests, *Lantana camara* L. was found to be abundant tannin and did not show cyanogenic glycoside.

Keywords: Anticlinal wall, Anomocytic type, Cystoliths

### Introduction

Medicinal plants are potential sources of new drugs and hold a great value for developing pharmaceutical products, phytomedicines, and dietary supplements. The World Health Organization (WHO) has listed 21000 plants, which are used for medicinal purposes around the world.

Verbenaceae family is widely distributed and consists of about 76 genera and 3,450 species and subspecies taxa, found in all portions of the world except the driest, hottest parts of the Sahara Desert and in the Arctic and Antarctic regions, most abundant in the tropics (Dassanayake, 1983).

Verbenaceae family is predominantly New World tropical herbs to forest trees. Habitats range from open ground, deserts, and high alpine places to evergreen forests. This family is well known for ornamental herbs (especially *verbena* and *Glandularia*) and shrubs (*Lantana*, *Duranta*, *Citharexylum*), and *Phyla nodiflora* is widely grown as a ground-cover plant. Essential oils are extracted from *Lantana* and infusions and medicinal remedies come from *verbena*, and *stachybtarpheta* while tubers of *pitraea* are edible (Heywood, 2007).

Economically, the Verbenaceae family is perhaps most important for teak lumber (*Tectona grandis*) of East India. A number of genera contain important ornamentals; notable among them are: *Callicarpa*, *Caryopteris*, *Clerodendrum*, *Duranta*, *Holmskoldia*, *Lantana*, *Petrea*, *Verbena*, and *Vitex*. (Lawrence, 1964).

Verbenaceae family consists of (22) genera and (120) species (Kress et al; 2003) *Lantana camara* L. is locally known as Sein-na-ban (or) Nadaung-ban and lantana in English. It belongs to the family Verbenaceae.

In Guiana and La Reunion, the plant is considered vulnerary, diaphoretic, carminative, antispasmodic. A decoction is given in tetanus, rheumatism, malaria. It is a powerful tonic, much used in atoxy of the abdominal viscera (Kirtikar and Basu, 1987).

These plants are antirheumatic, antimalarial; used in tetanus and ataxy of abdominal viscera. Pounded leaves are applied to cuts, ulcers and swellings; a

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<sup>1</sup> Dr. Associate Professor, Botany Department, Loikaw University

decoction of leaves and fruits is used as a lotion for wounds. The bark of stems and roots contain a quinine-like alkaloid, lantanine. The extract of the shoot showed antibacterial activity against *E.coli* and *Micrococcus pyogenes* var. *aureus*. Flowers contain anthocyanin (Khare, 2007).

Phytomedicine obtained from herbal sources are in great demand in the developed world as they are able to cure many infectious diseases. The world is now phytochemical screenings of plants have revealed that the presence of numerous chemicals including alkaloids, tannins, flavonoids, steroids, glycosides, saponins, etc. (Iqbal, 2011).

In this research, the morphological characters of the whole plant and histological characters of fresh leaves, stems, roots and powdered sample of *Lantana camara* L. leaves have been studied for verification and standardization of this plant.

The aim of the present research is to promote the wide application of Myanmar traditional or herbal medicine scientifically. The objective of this research is to study the morphology and histology of collected plants and, to investigate phytochemical test of this plants.

### Material and Methods

The specimen of *Lantana camara* L. was collected from Loikaw University campus, Kayar State, at latitudes 19° 11' 51.99" N and longitudes 97° 12' 4.24" E and 2589 ft above the sea level, from July to August 2016. This plant was classified and identified by using Hooker (1885), Backer (1965), Dassanayake (1983) and Heywood (2007). The habit, inflorescence, leaves and flowers of this specimen was collected and recorded by using digital camera (Sony DSC-TX 66).

In anatomical study, *Lantana camara* L. was prepared by free hand sections and examined according to the methods of Metcalfe and Chalk (1950), Esau (1965), Pandey (1996), Trease and Evans (2002) at Botany Department, Loikaw University. The following reagents were used to examine the section cutting and powdered samples.

- Chloral hydrate solution B.P as clearing reagents.
- Solution of phloroglucinol B.P followed by concentrated hydrochloric acid for testing lignin.



Fig. (1) Sample site of Loikaw University area

### Qualitative analysis of powdered leaves from *Lantana camara* L.

Preliminary phytochemical investigation *Lantana camara* L. was carried out to examine the plant constituents.

The powdered leaves from *Lantana camara* L. was tested qualitatively for the presence or absence of alkaloid,  $\alpha$ -amino acid, and carbohydrate, starch, reducing sugar, cyanogenic glycoside, glycoside, phenolic compound, saponin, tannin, flavonoid, steroid and terpenoid.

According to the methods of Marini Bettolo, *et.al.*, (1981), Harbone (1984) and Trease and Evans (2002), the investigation of phytochemical studies was applied. The results were as shown in Table (2).

## Results

Scientific name	-	<i>Lantana camara</i> L.
Family	-	Verbenaceae
Local name	-	Sein-na-ban (or) Nadaung-ban
English name	-	Lantana
Flowering time	-	Throughtout the year
Specimens examined	-	Loikaw University Campus

### Morphological character

Perennial shrubs, 0.5 - 1.0 m high; stems are quadrangular with stiffy hair. Leaves simple, opposite and decussate, lamina ovate, 3.7-7.4cm long and 2.2-4.5cm wide, the tip acute or short acuminate, the margin dentate, the bases rounded, both surfaces with densely short stiffy hair, paler green beneath, aromatic when crushed, very rough, petiolate, extipulate. Inflorescences axillary, racemose, umble, bracteate, ebracteolate. Flowers brightly pink turning yellowish orange, about 1.3cm long and about 0.5cm in diameter, sessil, complete, bisexual, irregular, zygomorphic, tetramerous, cyclic, hypogynous; sepals 2 fused, synsepalous, valvate, tubular, densely pubescent, petaloid (reddish white); petals 4 fused, synpetalous, salver form; stamens 4, apostamenous, epipetalous, the filaments didynamous, the anther dithecou, introse, dorsifixed, longitudinal dehiscence; ovary superior, globoid, bicapellary, syncarpous, bilocular, the placentation axile, many ovule, in each locule, the style slender, the stigma oblique, subcapitate. Fruids freshy, globose, 0.4-0.5 cm long and 0.4-0.5 cm wide, purplish black. Seeds blackas shown in figures ( 2 -13). Flowering and fruiting time throughout the year.



Fig. (2) Habit



Fig. (3) Inflorescence



Fig. (4) Ventral view of leaf



Fig. (5) Dorsal view of leaf



Fig. (6) Close up view of flower



Fig. (7) L.S of flower

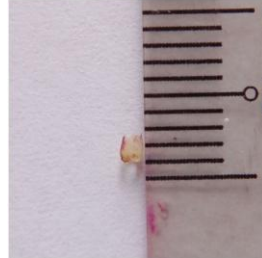


Fig. (8) Calyx



Fig. (9) Open corolla with anther

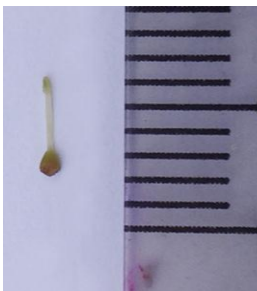


Fig. (10) Pistal

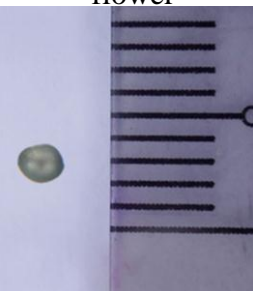


Fig. (11) T.S of ovary



Fig. (12) Fruit

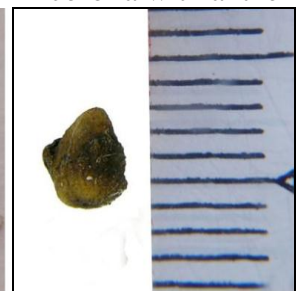


Fig. (13) Seed

## **The Anatomical Study of *Lantana camara* L.**

### **Lamina**

In surface view, the cuticle is thin walled parenchymatus cells. Glandular and non-glandular trichomes are present on both surfaces. The epidermal cells of both surfaces are parenchymatous and thin-walled cells. The upper epidermal of anticlinal wall are thin and wavy but lower epidermal layer is wavier than the upper one. Anomocytic type of stomata are present on both surfaces but they are abundantly found on the lower surfaces.

In tranverse section, the upper epidermis of cuticle layer is thicker than the lower surface. The upper and lower epidermal cells are barrel-shaped. Trichomes are present on both surfaces. Mesophyll consists of one layer of palisade parenchyma and two to five layers of spongy mesophyll cells. They are rounded to elongated cells and contain numerous chloroplasts as shown in Figures (15 -17).

### **Midrib**

In the surface view, the epidermal cells of both surfaces are thick walled parenchymatous cells and rectangular in shape. Glandular and non-glandular trichomes are present on both surfaces.

In transverse section, epidermal cells are rounded to oval shaped parenchymatous cells. Below the epidermis, angular collenchyma and parenchyma layers are present. They composed of two or three layers of angular collenchymatous cells and three to five layers of parenchymatous cells are found in lower portion. Trichomes are present on both surfaces.

Vascular bundles are open arc-shaped in outline and closed collateral type. The bundles are surrounded by a sheath of sclerenchymatous cells. Xylem lies towards the lower epidermis and consists of vessels, tracheids, fibres and xylem parenchyma. The phloem cells are thin walled and mainly composed of sieve tubes and companion cells, phloem fibres and phloem parenchyma as shown in Figures (18 -20).

### **Petiole**

In surface view of petiole, epidermal cells are thin-walled, rectangular in shaped and elongated along the axis of parenchymatous cells. The trichomes are present in this petiole.

In transverse section, petioles are oval-shaped in outline. Single layer of epidermal cells are barrel-shaped in both surfaces. The cortex is below the epidermis. It consists of two to three layers of angular collenchymatous cells and six to eight layers of parenchymatous cells. They are rounded to oval-shaped.

Vascular bundles are open arc-shaped in outline and closed collateral type. Each bundle lies in the middle region and more fibrous on the lower side. The second layer is larger and small bundles alternating with each other as in the midrib. Xylem consists of vessels, fibres, tracheids and xylem parenchyma. Phloem lies on the lower surface and made up of sieve tubes, companion cells, phloem parenchyma and phloem fibres shown in Figures (21 -22).

### **Stem**

In surface view of stem, epidermal cells are thin walled and rectangular to polygonal in shape. Endodermis is only one layer of barrel-shaped parenchymatous cells and sclerenchymatous cells are located beneath the endodermis.

In transverse section of stem, stem are quadrangular shaped in outline. Epidermal cells have thick cuticle on the surface. The cortex is below the epidermis. It consists of two layers and composed of three to four layers of rounded to oval shaped collenchymatous cell and four to six layers of irregular shaped in parenchymatous

cells. These cells are more or less rounded. In this region, discontinuous patches of sclerenchymatous cells are found in the stem.

Vascular bundles are quadrangular shaped, opened collateral type. Glandular trichomes and multicellular trichome are present. Small glandular trichomes are a uni-celled stalk with small head and multicellular trichomes are long and large pointed cell. Xylem lies towards the inner and consists of vessels, tracheids and xylem parenchyma. Phloem lies towards the lower epidermis shown in Figures (23-24).

### Root

In surface view of root, the epiblema cells are polygonal to rectangular in shape. Unicellular trichomes are present in the surface. The cells are elongated along the length of the root.

In transverse section of root, it is circular in outline. Epiblema is single layered and the cells are rectangular to nearly polygonal in shape. The cortex lies below the epiblema layer and it is made up of parenchymatous cells. Single layer of endodermis lies between the cortex and pericycle, xylem arrangement is polyarch. Xylem and phloem are arranged in separate bundles and their arrangement is radial. Medullary ray cells are thin walled and radially elongated parenchymatous cells.

Vascular bundles are opened collateral type. The protoxylem occurred near the periphery and metaxylem towards the center. Vascular bundles are exarch shown in Figures (25 -26).

### Diagnostic characters of powdered leaves of *Lantana camara* L.

The powdered leaves of *Lantana camara* L. was green and pungent in odour. It was also slightly bitter in taste and granular in texture. It consists of fragment of pieces of epidermal cells spiral vessel, pitted vessel, fiber and pieces of trichomes as shown in Figures (27 -31). The sensory characters of powdered leaves are as shown in Table (1) and Figure (14).

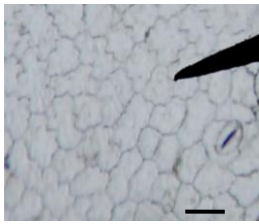
Table (1) Sensory characters of powdered leaves of *Lantana camara* L.

Sample	Leaves
Sensory characters	
Colour	Dark green
Odour	Pungent
Taste	Slightly Bitter
Texture	Granular

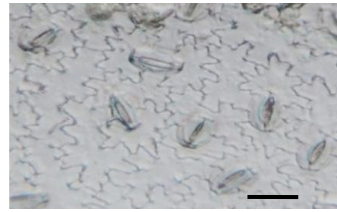


Fig. (14) Powdered leaves of *Lantana camara* L.

**Anatomical characters of leaves from *Lantana camara* L.**



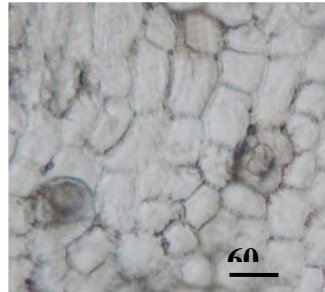
**Fig. (15) Upper surface of lamina**



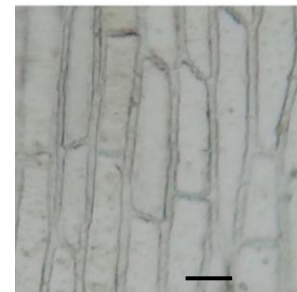
**Fig. (16) Lower surface of lamina**



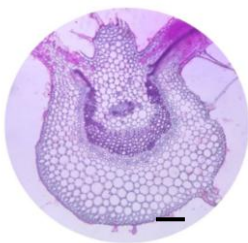
**Fig. (17) T.S of lamina**



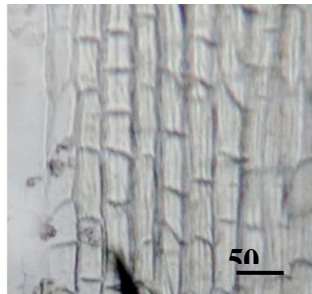
**Fig. (18) Upper surface of midrib**



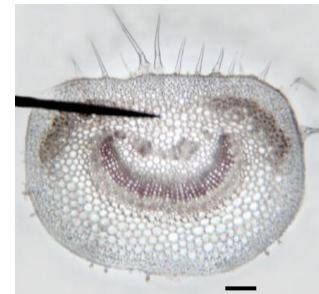
**Fig. (18) Lower surface of midrib**



**Fig. (20) T.S of midrib**



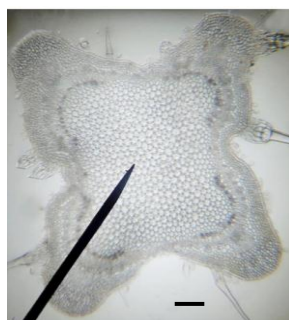
**Fig. (21) Surface of Petiole**



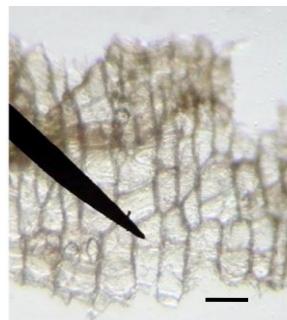
**Fig. (22) T.S of Petiole**



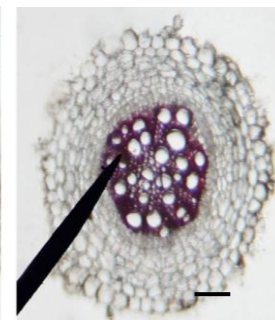
**Fig. (23) Surface of stem**



**Fig. (24) T.S of stem**

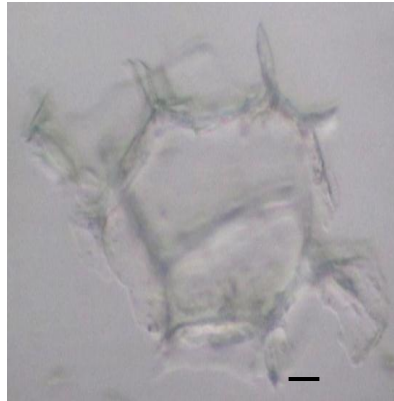


**Fig. (25) Surface of root**



**Fig. (26) T.S of root**

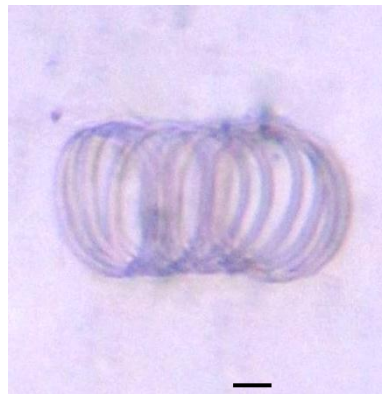
**Diagnostic characters of powdered leaves of *Lantana camara* L.**



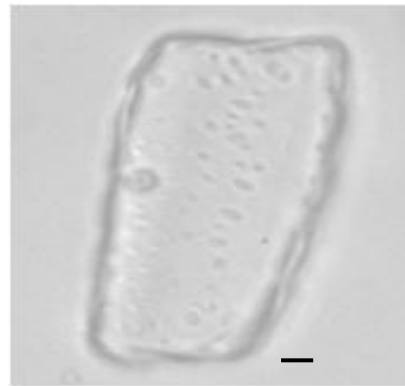
**Fig. (27) Fragment of parenchyma cells**



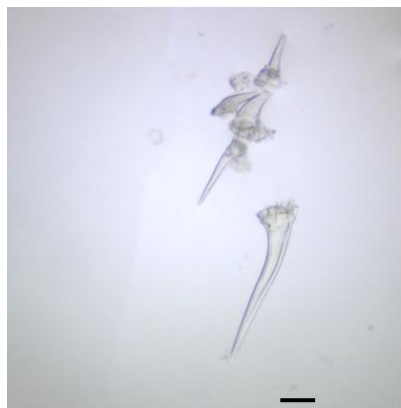
**Fig. (28) Fiber**



**Fig. (29) Spiral vessel**



**Fig. (30) Pitted vessel**



**Fig. (31) Pieces of trichomes**

### Qualitative analysis of powdered leaves from *Lantana camara* L.

In preliminary phytochemical test, the presence or absence of alkaloid,  $\alpha$ -amino acids, carbohydrate, starch, reducing sugar, cyanogenic glycoside, glycoside, phenolic compound, saponin, tannin, flavonoid, steroid and terpenoid were observed in the leaves. cyanogenic glycoside was absent. The results were shown in Table (2).

**Table (2) The qualitative analysis of powdered leaves from *Lantana camara* L.**

(+) present (-) absent ppt (precipitate)

No	Test	Extract	Test Reagents	Observation	<i>L. camara</i> L.
1	Alkaloid	1% HCL	(1) Mayer's Reagent (2) Wagner's Reagent (3) Dragendorff's Reagent (4) Hager's reagent	White ppt Brown ppt Orange ppt Yellow ppt	+ + + +
2	$\alpha$ -amino acids	H <sub>2</sub> O	Ninhydrin solution	Light purple colour	+
3	Carbohydrate	H <sub>2</sub> O	10% $\alpha$ -naphthol+conc-H <sub>2</sub> SO <sub>4</sub>	Red ring	+
4	Starch	H <sub>2</sub> O	I <sub>2</sub> KI solution	Blue color	+
5	Reducing sugar	H <sub>2</sub> O	Benedict's solution	Brick red ppts	+
6	Cyanogenic glycoside	H <sub>2</sub> O	H <sub>2</sub> O, Conc-H <sub>2</sub> SO <sub>4</sub> acid, Sodium picrate paper	No change in color	-
7	Glycoside	H <sub>2</sub> O	10% lead acetate solution	White ppts	+
8	Phenolic compound	H <sub>2</sub> O	5% Ferric chloride solution	Deep blue color	+
9	Saponin	H <sub>2</sub> O	Distilled water	Frothing	+
10	Tannin	H <sub>2</sub> O	1% Gelatin & 10% NaCl solution	Deep blue color	+
11	Flavonoid	EtOH	(1) Mg turning (2) Conc HCL acid	Pink color	+
12	Steroid	P.E	Acetic anhydride+ conc- H <sub>2</sub> SO <sub>4</sub>	Blue green color	+
13	Terpenoid	P.E	Acetic anhydride+ conc- H <sub>2</sub> SO <sub>4</sub>	Deep pink color	+



### Discussion of Conclusion

In the present study, the morphological characters of both vegetative and reproductive parts of *Lantana camara* L. and anatomical characters of leaves, stems, and roots had been studied.

In the morphological study, the plants are perennial shrubs; stems are quadrangular with stiffy hairs. The leaves are simple, opposite and decussate, lamina ovate with dentate margin, both surfaces densely short stiff hair, aromatic when it is crushed. These characters are similar to those mentioned by Hooker (1885) and Backer (1965).

Inflorescences are axillary, racemose, umbel with bracts and the flowers are sessile, bisexual, zygomorphic, tetramerous and brightly pink turn to yellowish orange which are in agreement with the finding Lawrence (1964) and Kirtikar and Basu (1987).

The calyx are 2, fused, tubular and 2-dentate, reddish white densely pubescent. The corolla are 4, fused, tubular, yellowish orange, glabrous. These characters are similar to those mentioned by Dassanayake (1983) and Heywood (2007).

The stamens are 4, apostamenous, epipetalous, didynamous, and inserted, the anthers ditheous, dorsifixed and longitudinal dehiscence. The ovary is globose, bicarpellary, syncarpous, axile placentation, the style slender and the stigma oblique and subcapitate. The fruits are fleshy, globose and purplish black and the seeds are black. These characters are in agreement with those mentioned by Hooker (1885) and Lawrence (1964).

In the anatomical study, both upper and lower surfaces of epidermal cells of lamina are irregular cells. The anticlinal walls of lower epidermis are wavier than the upper epidermis. Glandular and non-glandular trichomes are present on both surfaces. Anomocytic type of stomata is present on both surfaces but a few of stomata are present on upper surface. One layer of palisade parenchyma and two to five layers of spongy mesophyll cells are found in tranverse section of lamina. These characters are in accordance with those stated by Metcalfe and Chalk (1950) and Esau (2006).

In transverse section of midrib, below the epidermis, angular collenchyma and parenchyma layers are present. Vascular bundles are open arc-shaped and closed collateral type. A transverse section of petiole occurs oval-shaped in outline and open arc-shaped vascular bundles are closed collateral type. Glandular and non-glandular trichomes are present on both surfaces of midrib and petiole which are in agreement with those described by Pandey (1996) and Trease and Evans (2002).

In transverse section of stem is quadrangular shaped in outline. Epidermal cells are one layered and composed of rounded-shaped parenchymatous cells. Glandular trichomes with very small heads are consisting of one and non-glandular trichomes. Metcalfe and Chalk (1950) stated that trichomes with cystoliths in the cells surrounding their bases in the species of *Lantana*. In this paper, the basal cells of multicellular trichome of *Lantana camara* were found to be deeply stained, but no distinct cystoliths were observed in the basal cells. The cortex lies below the epidermis. These cells are more or less rounded. In this region, discontinuous patches of sclerenchymatous cells are found in stem. Vascular bundles are quadrangular shaped, opened collateral type. In transverse section of root, the epiblema cells are rectangular to polygonal in shape. It is circular in outline. The vascular bundles are polyarch, opened collateral type. These characters are agreed with Metcalfe and Chalk (1950) and Pandey (1996). According to the sensory characters, fragment of parenchyma cell, spiral vessel, pitted vessel, fiber and pieces of trichomes are present in powdered of *Lantana camara* L. leaves.

In this study, investigation of preliminary phytochemical test on the leaves of *Lantana camara* L. showed that alkaloid,  $\alpha$ -amino acid, carbohydrate, starch, reducing sugar, glycoside, phenolic compound, saponin, tannin, flavonoid, steroid and terpenoid are present but cyanogenic glycoside were not observed. Venkatachalam *et al.*, (2011) stated that alkaloid, saponin, and tannin did not show on the aqueous extract of *Lantana camara* L leaves.

Moreover, for further research is needed to evaluate the potential of the traditional medicinal uses, especially the use for the treatment of malaria. In general, the leaves of *Lantanacamara* L. can display antimicrobial, fungicidal and insecticidal properties. The bio activities of this plant such as anticancer activities should be conducted.

### Acknowledgements

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### References

- Backer, C.A. & Bakhuizen Van Den Brink, R.C. 1965. **Flora of Java**. (Vol. II). The Netherlands: Wolters-Noordhoff N.V.-Groningen.
- Dassanayake, M.D. 1983. **A revised hand book to the Flora of Ceylon**. (Vol. IV).
- Esau, K., 2006. *Plant Anatomy*. (3<sup>rd</sup>) John Wiley and Sons, Inc. Hoboken, New
- Harbone, J. B. 1984. **Phytochemical Methods. A Guide to Modern Techniques of Plant Analysis**. Chapman and Hall Ltd., London.
- Heywood, V.H., Moore, D.M., Richardson, I.B.K & W.T., Stearn, (Eds.), 2007. **Flowering Plants of the World**. London: Oxford University Press.
- Hooker, J.D., 1885. **The Flora of British India**. (Vol. IV). V Reeve & Co., Ltd. The Oast House, Brock, NR. Ashford, Kent. England.
- Hundley, H.G and U Chit KoKo, 1987. **List of Trees, Shrubs, Herbs and Principle Climbers**. Third Revised and Enlarge Edition, SUPDT, GOVT. Printing and STATY., Union of Burma, Rangoon.
- Iqbal, S.A. and N.A.Khan, 2011. **Text Book of Phytochemistry**, Discovery publishing house PVT.LTD., Ansari Road, New Delhi, India.
- Khare, C.P., 2007. **India Medicinal Plants**. JankPuri, New Delhi, India.
- KirtiKar, K.F. and B.D Basu, 1987. **Indian Medicinal Plants**. (Vol. 1). (4<sup>th</sup>ed.) LatitmoanBasu, Alahabad, India.
- Kress, J.W., Robert, A.D., Farr, E. & Yin YinKy, 2003. **A checklist of the trees, shrubs, herbs, and climbers of Myanmar**. (Vol. 45). pp.1-590, Department of Systematic Biology – Botany, National Museum of Natural History, Washington DC, USA.
- Lawrence, G.H.M, 1964. **Taxonomy of vascular plants**. (10<sup>th</sup>ed). New York: The MacMillian Company.
- Marini-Bettolo, G.B. *etal.* 1981. **Plant Screening by chemical and chromatographic procedure under field condition**. J. Chromato. 213. 113. 127.
- Metcalf, C.R. and Chalk L., 1950. **Anatomy of the Dicotyledons**. (Vol.II). Oxford University Press.
- Pandey. B.P. 1996. **Plant Anatomy**. S. Chard and Company, New Delhi, India.
- Trease and W.C. Evans, 1978, 2002. **Pharmacognosy**, 11<sup>th</sup>, 13<sup>th</sup>ed. BilliereTindall. London.
- Venkatachalam,T., Kishorkumar,V., and P. Kalaiselvi 2011. **Physiochemical and preliminary phytochemical studies on the *Lantana camara* L. fruits**. Vol.III, Issue 1, International Journal of Pharmacy and Pharmaceutical Sciences, Namakkal, Tamil Nadu, India.