

Morphological, Microscopical and Phytochemical Studies on Leaves of *Solanum lasiocarpum* Dunal

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Abstract

Medicinal plants play major role in the livelihood from all over the world. *Solanum lasiocarpum* Dunal (Sin-hkayan) belongs to the family Solanaceae. These plants were occurred wild plants and cultivated plants in Rakhine State. They were collected from Taunggoke Township, Rakhine State. In this paper, the morphological, microscopical, diagnostic characters and phytochemical studies of leaves were studied at the Department of Botany, Dagon University. In morphological study, the plant was perennial, densely prickly undershrubs, glandular hairy; leaves densely glandular hairy and prickly on both sides; inflorescence supra-axillary cyme; flowers were white; dehiscing by apical porous. In microscopical study, anisocytic type of stomata was present on both surfaces, multiseriate stellate trichomes and uniseriate glandular and non-glandular trichomes were abundant. In transverse section, vascular bundles were bicollateral and opened type. In powdered leaves composed of annular, spiral, scalariform and pitted vessel elements, tracheid element and fiber. The phytochemical screening of leaves showed the presence of alkaloids, α -amino acids, phenolic compounds, flavonoids, glycosides, saponins and tannins.

Keywords : morphological, microscopical, phytochemical

Introduction

The Solanaceae are a family of considerable economic importance. Many of Solanaceae are also important for commercials and medicines in Myanmar. Among many Solanaceae spp. in Taunggoke, *Solanum lasiocarpum* Dunal is one of the popular in Solanaceae spp.. The plant grow as a wild and cultivated for commercial in local region. It is commonly known as Sin-hkayan in Myanmar and in English popularly called “Hairy-fruited eggplants” because of the appearance of fruits.

Solanum lasiocarpum Dunal, previously known as *Solanum ferox* Linn, is an indigenous non-seasonable plant in the Solanaceae Family. It is a thorny and woody perennial plant which grows to a height of approximately 1.0 to 2.5 meters (Nurulaili, 2022). The plant (part not specified) is used in Bangladesh and India to treat coughs, asthma, fever, vomiting, sore throat, gonorrhoea and female sexual disorders (Fern, 2014).

In Malaysia, the hairy-fruited eggplant is used to help stimulate the release of urine and to calm symptoms of splenic trouble in Suriname. It is used as a remedy for coughs, asthma, fever, vomiting, sore throat, syphilis disease, gonorrhoea and female sexual disorders in Bangladesh and Indian traditional folk medicine. In the Philippines, the leaves of the hairy-fruited eggplant as poultices are used to help reduce swelling and body pains. Leaf has been used traditional medicine to treat against allergy, body ache and swelling, skin injuries and headache. It is used by locals as Chinese herbal medicine for effective curing of cough, bruises, hernia, sore throat, and tooth decay, edema as well as having anesthetic effect (Sylvia, 2021).

In this research, morphological characters, microscopical characters, diagnostic characters and phytochemical studies of leaves of *Solanum lasiocarpum* Dunal will carried out. The aim of the presence research is to know the chemical compound and the

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usefulness of *Solanum lasiocarpum* Dunal plants in Myanmar. The objectives are to verify and confirm the morphological characters of vegetative and reproductive part, to examine the microscopical characters and diagnostic characters of leaves and to study phytochemical studies for the presence or absence of chemical compound in powdered leaves of *Solanum lasiocarpum* Dunal.

Materials and Methods

Botanical Studies

Collection and identification

The specimens of *Solanum lasiocarpum* Dunal were collected from Taunggoke Township, Rakhine State, during the flowering and fruiting periods from February to June, in 2022. After collection, the samples of *Solanum lasiocarpum* Dunal plant were thoroughly washed with water and dried at room temperature about three weeks. When constant weight of the sample was obtained, the dry samples were pulverized by grinding machine into fine powder and kept in air tight bottle to study the diagnostic characters of powder and phytochemical studies.

For morphological studies, *Solanum lasiocarpum* Dunal of all the vegetative and reproductive parts of the fresh specimens were used. The selected plant of the habit, leaves, inflorescence and flowers were recorded by photographs. These specimens were identified by using available literatures such as Lawrence (1964); Backer (1965); Dassanayake (1987) and Qi-ming *et al.*, (2009); Hundley and Chit Ko Ko (1987) and Kress *et.al.*, (2003).

Microscopical studies

For microscopical studies, the petiole, lamina and midrib were cut by free hand section to examine under electron microscope (Bioblue Lab. and Olympus) at the Department of Botany, Dagon University. The powdered were cleared in chloral hydrate solution on a glass slide and discovered under electron microscope. The characters of powdered leaves were also photographed. The following chemicals and reagents were used to examine for freehand sections and the powdered samples.

- (1) Chloral hydrate solution was used as a clearing reagent.
- (2) Solution of phloroglucinol B.P followed by with concentrated hydrochloric acid for lignin.

For microscopical studies, the samples of fresh specimens were examined according to the method Metcalfe and Chalk (1950); Esau (1953); Pandey (2002) and Tandon (2011).

Phytochemical Studies

Phytochemical studies of powdered leaves of *Solanum lasiocarpum* Dunal

The phytochemical studies of the dried powdered leaves of *Solanum lasiocarpum* Dunal had been undertaken. The experiment was carried out to determine the presence or absence of alkaloid, α -amino acid, carbohydrate, phenolic compound, reducing sugar, starch, flavonoid, glycoside, saponin and tannin according to the method of British Pharmacopoeia (1968); Marini Bettalo, *et.al.*, (1981); Central Council of Research in Unani Medicine (1987) and Harbone (1998) at Department of Botany, Dagon University.

Results

Botanical Studies

Morphological characters of *Solanum lasiocarpum* Dunal

Scientific name	- <i>Solanum lasiocarpum</i> Dunal
Synonym	- <i>Solanum ferox</i> L.
English name	- Hairy fruited eggplant
Family	- Solanaceae
Flowering and Fruiting Period	- Throughout the year
Part used	- Leaves

Perennial, densely prickly undershrubs, up to 1.5-2.0 m high; stems and branches terete, densely prickles, glandular hairy. Leaves simple, alternate, estipulate; petiolates; leaf blades ovate, cordate at the base, irregularly dentate along the margin, acute at the apex, densely glandular hairy and prickly on both surfaces. Inflorescences supra-axillary cymes, 2- to 3- flowered; peduncles 3.0 mm long. Calyx campanulate, 5 lobed, synpetalous, persistent; lobes broadly triangular, about 0.2 cm long, prickly and pubescent. Corolla rotate, 5-lobed; lobes lanceolate to elliptic-ovate. Stamens 5, free, adnate to the base of corolla tube; filaments filiform; pubescent; anthers ditheous, basifixed, dehiscent by apical pores. Carpels 2, united; ovary superior, ovoid, bilocular with many ovules in each locule on the axile placenta; style filiform, stigma capitate. Fruits berry, globoid or ovoid, many-seeded, glabrous.

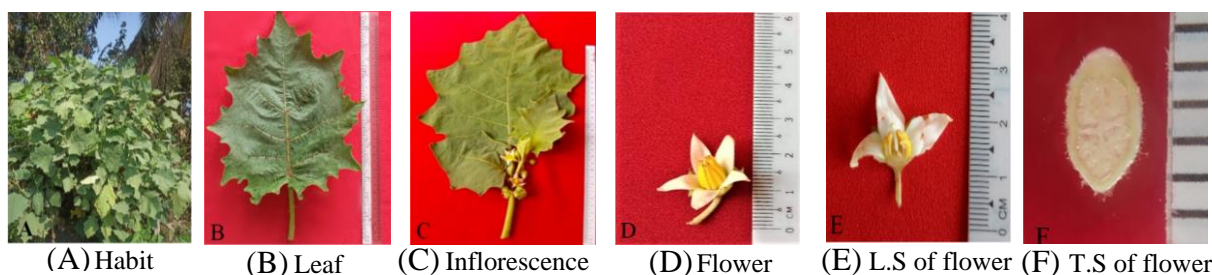


Figure (1) Morphological characters of *Solanum lasiocarpum* Dunal

Microscopical characters of leaves of *Solanum lasiocarpum* Dunal

Petiole

In surface view, a single layer of the epidermal cells, thin-walled and mostly polygonal to rectangular shaped and along the length of petiole.

In transverse section, the petiole was basically semi-circular in outline and slightly concave in the upper side. The cuticle layer was thin. Multiseriate stellate trichomes, uniseriate glandular and non-glandular trichomes were present. The epidermal cells were parenchymatous oval to barrel shaped. Below the epidermis, the cortex was made up of two different types of tissues, collenchymatous and parenchymatous tissues. The collenchymatous cells below the epidermis consisted of 2-4 layers on the upper surface and 3-5 layers on the lower surface, oval or angular shape. The parenchymatous tissue composed of 5-9 layers in thickness above the vascular bundle and 4-7 layers in thickness below the vascular bundle, polygonal or rounded shapes. Vascular bundles embedded in ground tissue, arc shaped in outline and two small traces embedded in lateral wings. Vascular bundle was bicollateral and opened type.

Lamina

In surface view, the upper and lower epidermal cells were parenchymatous, anticlinal walls wavy, thin wall and completely arranged. Stomata were abundantly present on both surfaces, anisocytic types of stomata. Multiseriate stellate trichomes, uniseriate glandular and non-glandular trichomes were present.

In transverse section, the lamina was dorsiventral and thin cuticle layer was present on both surface. The epidermal cells were one layer on both sides, rectangular to oval shape. The mesophyll cells consisted of palisade and spongy parenchymatous cells. The palisade mesophyll was found on both side, a single-layer, and the cells vertically erect, compact, chloroplast present. The spongy mesophyll consisted of 2-3 layers of cells loosely, chloroplast present. The vascular bundles embedded in mesophyll cells; bundles arranged in bicollateral and opened type.

Midrib

In surface view, both the epidermal cells were thin-walled, parenchymatous cells, compactly arranged and rectangular in shaped and along the length of midrib. Multiseriate stellate trichomes, uniseriate glandular and non-glandular trichomes were present.

In transverse section, the midrib was circular in outline and slightly convex on the upper side, the cuticle layer was thin. The epidermal cells were parenchymatous oval to barrel shaped. Below the epidermis, the cortex was made up of two different types of tissues, collenchyma and parenchymatous tissues. The collenchymatous cells below the epidermis consisted of 3-5 layers on the upper surface and 2-4 layers on the lower surface. The parenchymatous tissue composed of 5-8 layers in thickness above the vascular bundle and 4-7 layers in thickness below the vascular bundle, polygonal or rounded shapes. Vascular bundle was bicollateral and opened type and crescent shaped in outline.

Dignostic characters of powdered leaves of *Solaum lasiocarpum* Dunal

In powdered leaves composed of annular, spiral, scalariform and pitted vessel elements, tracheid element and fiber. Fiber was simple with lumen. Fragment stellate trichomes were observed.

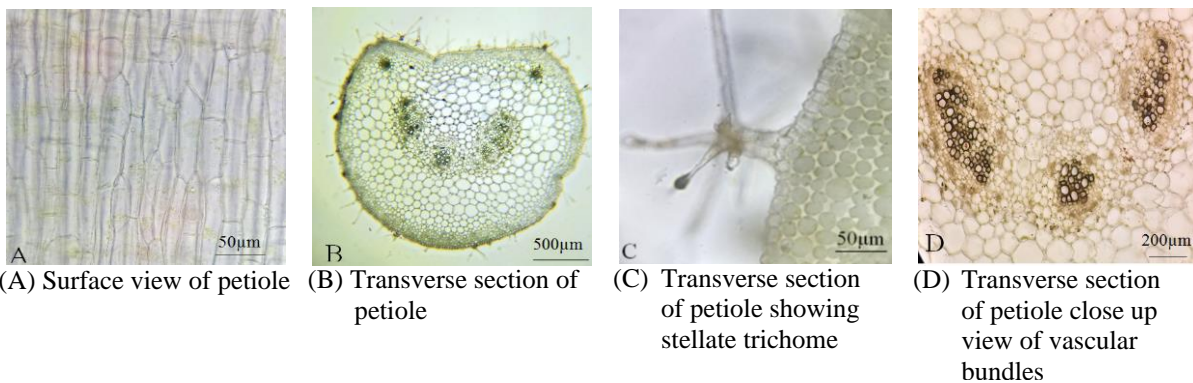


Figure (2) Microscopical characters of petiole of *Solanum lasiocarpum* Dunal

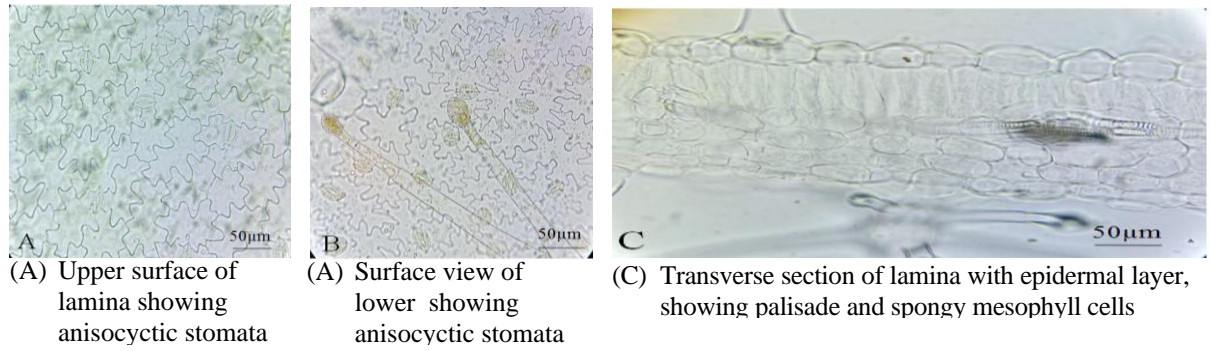


Figure (3) Microscopical characters of lamina of *Solanum lasiocarpum* Dunal

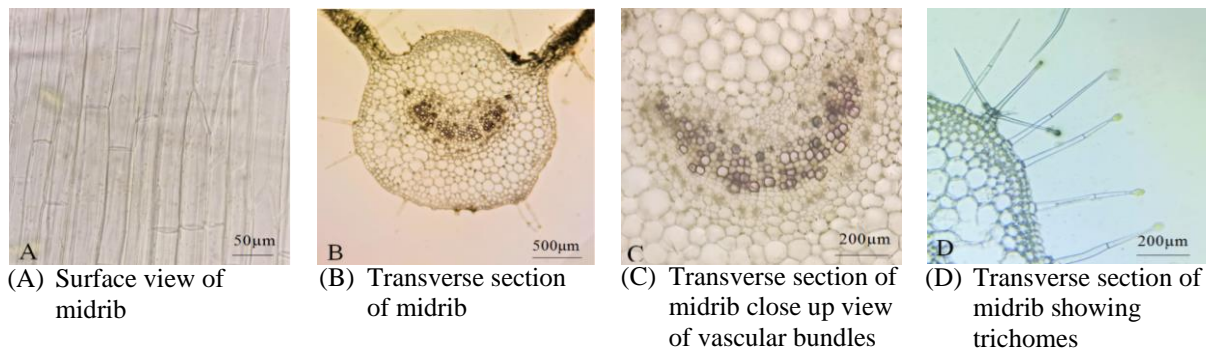


Figure (4) Microscopical characters of midrib of *Solanum lasiocarpum* Dunal

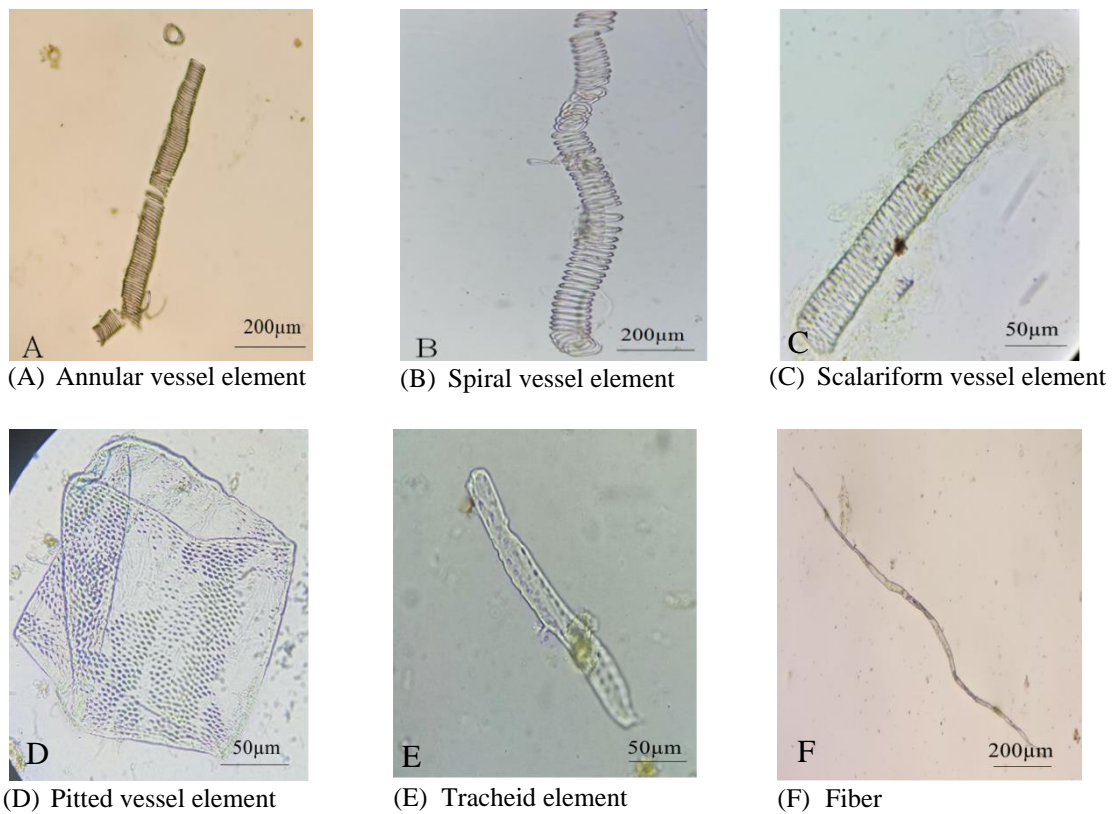


Figure (5) Diagnostic characters of powdered of leaves of *Solanum lasiocarpum* Dunal

Phytochemical Studies

Phytochemical studies of powdered leaves of *Solanum lasiocarpum* Dunal

The phytochemical studies of the powdered leaves of *Solanum lasiocarpum* Dunal indicated the presence of alkaloid, α -amino acid, phenolic compound, flavonoid, glycoside, saponin and tannin.

Table (1). Phytochemical studies of powdered leaves of *Solanum lasiocarpum* Dunal

No.	Test	Extract	Test reagent	Observation	Results
1.	Alkaloid	DW	1. Mayer's reagent	White ppt.	+
			2. Dragendroff's reagent	Orange ppt.	+
			3. Wagner's reagent	Yellow ppt.	+
2.	α -amino acid	DW	Ninhydrin reagent	Violet color	+
3.	Carbohydrate	DW	10% α -naphthol+ Conc:H ₂ SO ₄	Creamy color	-
4.	Phenolic compound	DW	10% FeCl ₃ solution	Deep brown	+
5.	Reducing sugar	DW	Benedict's solution	Black green ppt.	-
6.	Starch	DW	Iodine Solution	Orange	-
7.	Flavonoid	DW	Conc: HCl, Mg burning	Deep brown	+
8.	Glycoside	DW	10% lead acetate	White ppt.	+
9.	Saponin	DW	Distilled water	Frothing	+
10.	Tannin	DW	1%FeCl ₃	Yellowish brown ppt.	+

(+) = present (-) = absent ppt. = precipitation

Discussion and Conclusion

In this research paper, morphological, microscopical and phytochemical studies of *Solanum lasiocarpum* Dunal have been undertaken. The specimens of *Solanum lasiocarpum* Dunal belonging to the family Solanaceae, was collected from Taunggoke Township, Rakhine State. The morphological characters of vegetative and reproductive parts of the plant, the microscopical characters of leaves and phytochemical tests from leaves of *Solanum lasiocarpum* Dunal have been studied.

In morphological study, the plant of *Solanum lasiocarpum* Dunal is perennial, shrub, stem erect, densely prickly. Leaves are simple, alternate, exstipulate, leaf blade ovate, acute at the apex. Inflorescence is supra-axillary. Flowers are pedicellate, bisexual, actinomorphic, hypogynous, and white. Sepals are campanulate, synsepalous, valvate and persistent. Corolla are rotate and lobes lanceolate. Stamens 5, free, anate to the base of corolla tube. The anther ditheous, basifixed, and dehiscing by apical porous. Carpel (2), syncarpous, axile placentation, the stigma capitate. These characters were in agreement with those mentioned

by Kirtikar and Basu (1933); Lawrence (1964); Backer (1965); Kurz (1974); Dassanayake (1987); Subrahmanyam (1995); Simpson (2006); Wairt (2006) and Qi-ming (2009).

In microscopical study, in transverse section of petiole, the vascular bundle is arc shaped and bicollateral and opened type. In surface view of lamina, stomata are anisocytic type on both surfaces. In T.S of midrib, vascular bundle is crescent shaped, bicollateral and opened type. These characters were in agreement with those stated by Metcalfe and Chalk (1950); Benson (1957); Esua (1953); Fahn (1974); Goldberg (1986); Siemonsma (1994); Trease and Evans (2002) and Simpson (2006).

In phytochemical constituents, the leaves of *Solanum lasiocarpum* Dunal contain alkaloids, α -amino acids, phenolic compounds, flavonoids, glycosides, saponins and tannins. These characters were similar to the statements described by Padua *et al.*, (1999); Trease and Evans (2002); Simpson (2006); Ali (2008); Dent (2019) and Medrano (2021).

Solanum lasiocarpum Dunal consists of many chemical constituents that are important for medicines. Alkaloids and phenolic compounds protect cardioprotective and inflammatory. Glycosides protect heart diseases. Flavonoids, α -amino acids, saponins and tannins are present, which affect to treat antimicrobial infections, anti-inflammatory, diabetes and cancer.

In conclusion, the morphological and microscopical of *Solanum lasiocarpum* Dunal were very essential for identifying and evaluating of drugs. The phytochemical studies of leaves showed the presence of alkaloids, α -amino acids, phenolic compounds, flavonoids, glycosides, saponins and tannins. This plant is mainly used to cure stomach-ache. *Solanum lasiocarpum* Dunal is herbal medicine in our country and it is useful based on folk. It hopes that this plant can be utilized to treat cough, fever, bruises, stomach-ache, sore throat, and tooth decay. Therefore, as *Solanum lasiocarpum* Dunal possesses many nutritional and pharmacological values, this plant can be very useful in medicinal drugs. And then, some activities of this plant for antimicrobial activity, nutritional value, antioxidant activity and EDXRF test should be needed to investigate for the future research work.

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References

- Ali, D.M., (2008). Pharmacognosy (Pharmacognosy & Phytochemistry), Vol.I, In Binding House, Noida (UP).
- Backer, C.A., R.C, Bakhuizen Van Den Brink Jr, Ph.D., (1965). Flora of Java, Vol.II, N.V.P. Noordhoff, Groningen, the Netherland.
- British Pharmacopoeia, (1968). Published Under the Direction of the Chemical and Chromatographic procedure under field condition, Journal of Chromatography, 31, 14-17.
- Benson L., (1957). Plant Classification, Pomona College Claremont, California.
- Central Council of Research in Unani Medicine, (1987). Phytochemical standards of Unani Formation Ministry of Health, Government India, New Delhi.
- Dassanayake, M.D., (1987). Flora of Ceylon, Vol.VI, Amerind Publishing Company, New Delhi.
- Dent, A. UM., (2019). Anticarcinogenic Properties of *Solanum ferox* L. Ethanol Extract, University of Malaya.
- Esau, K., (1953). Plant Anatomy, John Wiley & Sons Inc, New York, London.

- Fahn, A., (1974). *Plant Anatomy*, 2nd edition, Hakkibutz Hameuhad Publishing House L.td.
- Fern, K., (2014). *Useful Tropical Plants*, Creative Commons Attribution-Noncommercial-Share Alike 3.0 Unported License.
- Goldberg, A., (1986). *Classification, Evolution, and Phylogeny of the Families of Dicotyledons*, Smithsonian Institution Press, City of Washington.
- Harbone, J.B., (1998). *Phytochemical Methods, A Guide to Modern Technique of plant Analysis*, 3rd edition, Chapman and Hall Ltd., USA.
- Hundley H.G and U Chit Ko Ko, (1987). *List of Trees, Shrubs, Herbs and Climbers, etc*, Government Printing Press, Yangon.
- Kress, J.W., Robert, A., Defilipps, Ellen Farr and Yin Yin Kyi, Daw., (2003). *A Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar*, Department of Systematic and Biology-Botany, National Museum of Natural History Washington, D.C.
- Kirtikar, K.B and B.D. Basu., (1933). *Indian Medicinal Plants*, Vol.I 2nd Edition. LALIT MOHAN BASU, M.B, 49, Leader Road, Allahabad, Indian.
- Kurz. S., (1974). *Forest Flora of British Burma*. Vol. II. New Connaught Place, Dehra Dun and D-42, Vivek Vihar, Delhi-32.
- Lawrence, G.H.M., (1964). *Taxonomy of Vascular Plants*, the Macmillam Company, New York.
- Metcalf, C.R. and Chalk, L., (1950). *Anatomy of the dicotyledons: Leaves, stems and wood in relation to taxonomy with notes on economic uses*, Vol.II, The Oxford University Press. London.
- Marini-Bettalo G.B., M. nicoletti and M. Patamia., (1981). *Plant Screening by Chemical and Chromatographic procedure under field condition*, Journal of chromatography.
- Medrano, A.W., (2021). *Frontiers in Nutrition*, (Vol.VII), Mexico.
- Nurulaili, (2022). *Journal of Sustainability Science and Management*, Vol.17, No.2. Faculty of Applied Sciences, University Technology MARA, Malaysia.
- Padua L.S. de, Bunyapraphatsara and R.H.M.J. Lemmens, (1999). *Plant Resources of South-East Asia*, Bogor Indonesia.
- Pandey, S.N., (2002). *Plant Anatomy*. S.Chand & Company Ltd. Ram Nagar, New Delhi. Area, Yangon Region.
- Qi-ming H.U and WU De-lin, (2009). *Flora of Hong Kong*, Vol.I, Government of the Hong Kong Special Administrative Region, Hong Kong.
- Siemonsma, J.S. and Kasem Piluek, (1994). *Plant Resources of South-East Asia*, Bogor Indonesia.
- Simpson M.G, (2006). *Plant Systematics*, Elsevier Academic Press Publication.
- Subrahmanyam, N.S., (1995). *Modern Plant Taxonomy*, Vikas Publishng House PVT LTD, 576, Masjid Road, Jangpura, New Delhi.
- Sylvia, (2021). *Traditional Uses and Benefits of Hairy Eggplant*, Health Benefits Times.com.
- Tandon Neeraji, (2011). *Quality Standards of India Medicinal Plants*, Vol.IV, Medicinal Plants United India Council of Medicinal Research, New Delhi.
- Trease, G.E. and Evans, W.C., (2002). *Pharmacognosy*, 15th edition, London: Casselk & Collier Macmillan Publisher Ltd., New York.
- Wiat. C.P.D., (2006). *Medicinal Plants of Asia and the Pacific*, Taylor & Francis Group, LLC.