

## Morphological and Anatomical Characters of Hairs (Trichomes) found in Leaves of *Elsholtzia Blanda* Benth.

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### Abstract

The genus *Elsholtzia* belong to the family Lamiaceae, formerly called Labiatae. In this paper, the species such as *Elsholtzia blanda* Benth. (Yon-pa-bo) were collected from Taunggoke Township, Rakhine State during 2022-2023. The selected plants were studied and identified at the Department of Botany, Dagon University by using literature. In morphological characters, the species was annual, aromatic plants, quadrangular stems, dotted glands on leaf surfaces, verticillasters, bilabiate, didynamous, apostamenous, gynobasic style and hairs present. The anatomical characters of trichomes in petiole, lamina and midrib were investigated in this study. The trichomes containing were different based on the parts of leaves. The trichomes consisted of glandular and non-glandular trichomes. This research attempted to know the outstanding characters of Lamiaceae family and understanding trichomes on leaf parts. And then we understood that this plant is useful in the other researchs based on the trichomes present.

**Keywords** : morphological characters, anatomical characters of hairs (trichomes) found in leaves

### Introduction

*Elsholtzia blanda* Benth. (Yon-pa-bo, Ywang-bway) in Myanmar and Ar-pu in Rakhine of the family Lamiaceae, are well known in Myanmar for their strongly fragrant leaves and stems, traditionally used in very hot Rakhine curry which is known as “Ar-pu-sha-pu”. These species are also used in traditional medicine and growing wild as well as cultivated in Myanmar.

Hundley and Chit Ko Ko (1987) described that *Elsholtzia blanda* Benth. was called as Yon- pa- bo, Yaung- bway.

Kress, et al., 2003 reported that the family Lamiaceae in Myanmar has 38 genera and 150 species. Out of them, the genus *Elsholtzia* contains 8 species and was found in Mandalay and Taninthayi. (Kress, et al., 2003).

*Elsholtzia blanda* Benth. was found in India, China, Myanmar, Thailand, Vietnam, Sumatra (Website - 1).

*Elsholtzia blanda* Benth. was found in the Himalayas, from Nepal to Bhutan, Bengal, NE India, SW China, Bumar, Indo - China, Malaysia, at altitudes of 800 - 2500 m (Website - 2).

Simpson (2006) said that mint family contained 251 genera and 6700 species. Lamiaceae family had a mostly worldwide distribution. Economic importance included medicinal plants, culinary herbs, fragrance plants and cultivated ornamentals. Lamiaceae family were distinctive in being herbs or shrubs.

Moon, et al., (2009) mentioned that the leaf epidermis of all species in Lamiaceae investigated was covered by various hairs. These hairs contained

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nonglandular and glandular, according to the absence or presence of a secretory head on the trichome.

Hazzoumi, Z. (2019) said that in many of lamiaceae, two main types of glandular trichomes were capitate and peltate. The head of the capitate glandular consisted of 1-4 more or less rounded secretory cells, generally horizontal; one to several long cells and a basal cell. The peltate hairs head consisted of 4-8 more flattened cells on a horizontal plane, and basal cell.

Kahraman, et al. (2010) discovered that three different trichome types on the leaf blades and petioles of leaves in Lamiaceae were observed peltate, capitate glandular and non- glandular trichomes.

Camina (2018) described that the essential oil from peltate glandular trichomes of leaves at lamiaceae had 19 compounds, among them, 1,8-cineole,  $\beta$ -caryophyllene, ledol and an undefined oxygenated sesquiterpene were the most abundant compounds.

Chen, et al. (2022) mentioned that genus *Elsholtzia* was commonly used in the folk to treat respiratory infections diseases such as cold and fever, antiviral, antibacterial and anti-inflammatory activities. About 221 non-volatile and 1008 volatile compounds had been identified from *Elsholtzia* plants, mainly containing flavonoids and terpenoids. The results provided that to know the outstanding characters of Lamiaceae family and to give the knowledges about trichomes on leave parts.

## Materials and Methods

*Elsholtzia blanda* Benth. was collected during 2022-2023 from Taunggoke Township. The morphological characters of plant were studied under dissecting microscope and the anatomical characters of hairs (trichomes) found in leaves were investigated under BioBlue-Lab and Olympus microscopes at the Botany Department of Dagon University. Species of identification were undertaken with the help of available literatures of Backer (1965), Hundley and Chit Ko Ko (1987), Ali and Nasiar (1990), Kress, et al., (2003) and Qi Ming (2009). For anatomical characters studying, Metcalfe and Chalk (1950), Esau (1953), Pandey (2002) and Pande (2008) were referred.

## Results

### Morphological Characters of *Elsholtzia blanda* Benth.

Scientific Name	-	<i>Elsholtzia blanda</i> Benth.
Rakhine Name	-	Ar-pu
Myanmar Name	-	Yon-pa-bo, Ywang-bway
Family	-	Lamiaceae

Annual herbs, aromatic plants, quadrangular stems erect with hairs. Leaves were simple, opposite and decussate, ovate-lanceolate, lamina 1.0 – 4.0 cm wide, and 2.5 - 9.5 cm long, apex acuminate, base cuneate, both surfaces with hairs and dotted glands, margin serrate; petiole terete, 0.3 – 1 mm long. Axillary or terminal

verticillasters, each verticillaster with 4 - 10 flowers, 4.5 - 11.0 cm long inflorescences; 0.5 - 2.0 cm long peduncles. Flowers were small, white cream color, bilabiate, 3.0 - 4.0 mm long; bracteate, ebracteolate, about 1 mm long pedicel, complete, bisexual, irregular, zygomorphic flowers, pentamerous, hypogynous. Sepals (2+3), synsepalous, valvate, sepals 4.0 - 5.0 mm long, unequal, sepaloid, both outside and inside of calyx tube with hairs, persistent, inferior. Petals (3+2), synpetalous, 2.0 - 3.0 mm long, unequal, imbricate, outside of corolla lobes with hairs, corolla tube inside with ring hairs, petaloid (white cream color), inferior. Stamens 2+2, didynamous, epipetalous, exserted, filaments 1.5 - 2.0 mm long, introrse, anthers purple when budding and dark-red when flowering, ditheous, dorsifixed, longitudinal dehiscence, inferior. Carpels (2), syncarpous, bicarpellary, four locules with false septum, axile placentation, one ovule in each locule, gynobasic styles 3.0 - 4.0 mm long, slender, white, glabrous, disc present; stigma bifid, ovary superior. Fruits were schizocarpic. Four seeds enclosed within the tube of the persistent calyx; seeds were yellow-brown, obovate and surfaces of seeds are glabrous.

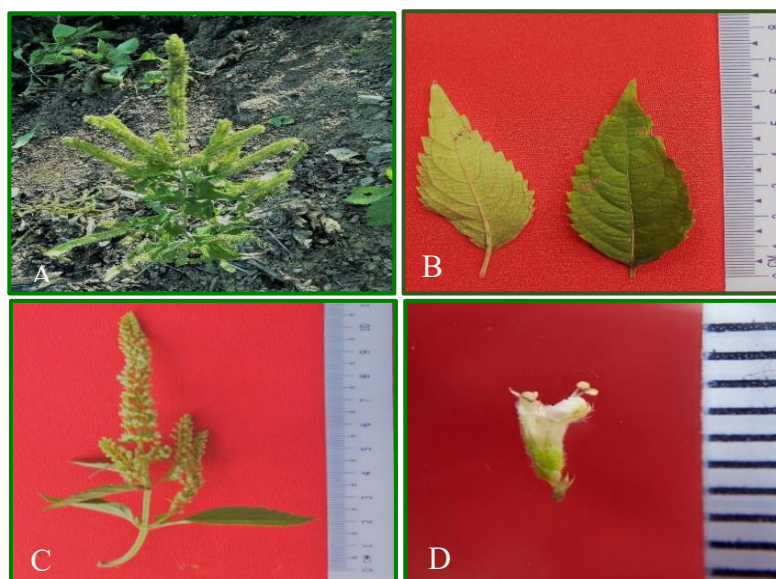


Fig-1. A. Habit of *Elsholtzia blanda* Benth., B. Leaves, C. inflorescence, D. Flower

### **Internal Structures of the Leaves of *Elsholtzia blanda* Benth.**

#### **Anatomical characters of petiole**

In transverse section, the petioles of *Elsholtzia blanda* Benth., studied were that adaxial side was slightly convex or slightly wavy and abaxial side was convex. But the shapes of parts in petiole were different. In the terminal positions of petiole, the wings in petiole were more distinct. In this parts of petiole, one wing was longer than others. Sometime, stomata were found under the large wing.

Epidermis was slightly wavy and one - layered, parenchymatous cells, oval or rounded shaped, thin cuticle. The various kinds of trichomes were found in the basal positions of petiole. However, Glandular trichomes were more abundant than non - glandular trichomes. But in the terminal positions of petiole, non - glandular trichomes were more abundant. Non - glandular trichomes were uniseriate multicellular (2 or 3 cells). Glandular trichomes (1-8 cells) consisted of peltate and capitate. The heads of glandular trichomes were unicellular to bicellular and shortly stalked. Sometime the stalks were not distinct.

Vascular bundles embedded in ground tissue, continuous or discontinuous vascular bundles were crescent in shapes, collateral opened types and two small traces embedded in lateral wings. The vascular bundles in the parts of petiole were different. The bundles in the terminal positions of petiole were continuous and in the basal positions of petiole were discontinuous bundles. If the petiole parts were more near with terminal positions, the small traces bundles were more far from the main bundle and the lateral wings sizes were unequal.

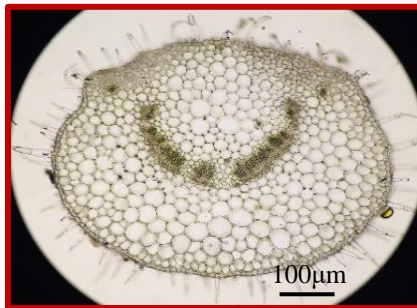


Fig.2 – Basal position of petiole in T.S



Fig.3 – Terminal position of petiole in T.S

#### Types of trichomes found in petiole of leaves

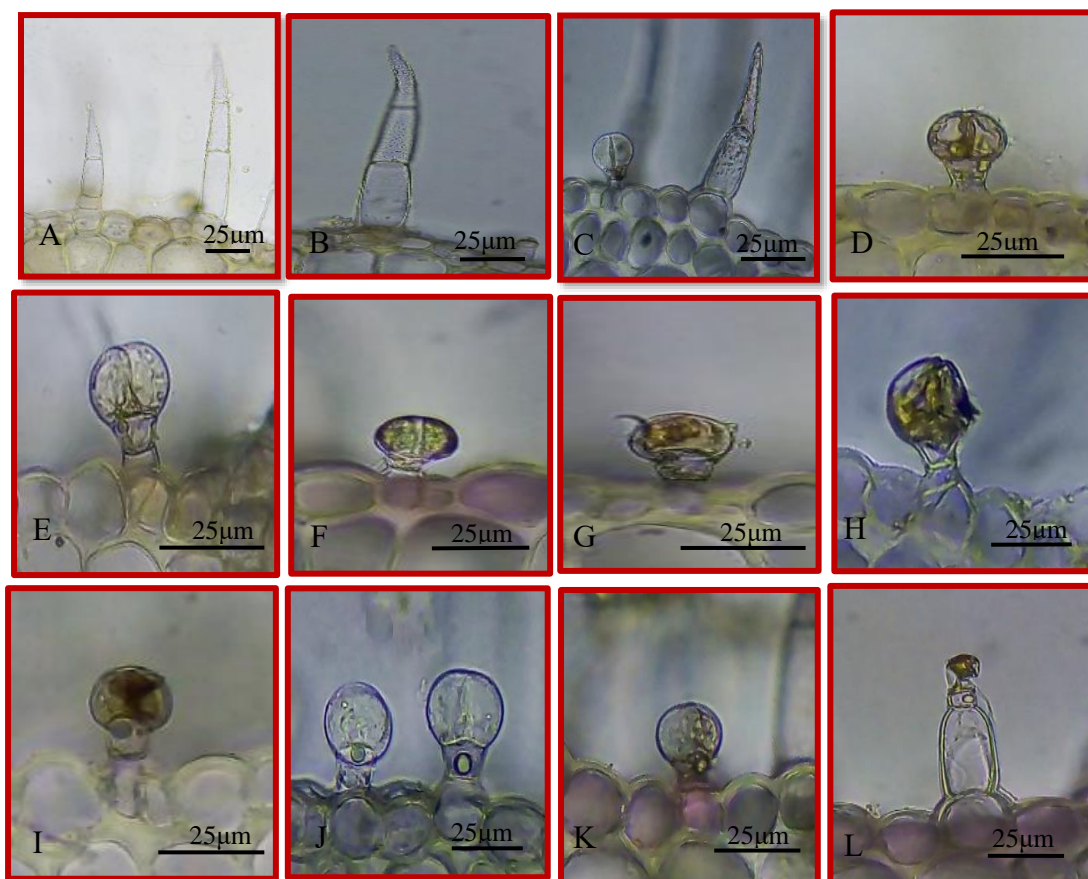


Fig.4 – Trichome types of petioles

A, B, C. Non-glandular multicellular uniseriate trichomes

D, E, F, G, H, I, J, K, L. Capitate glandular trichomes

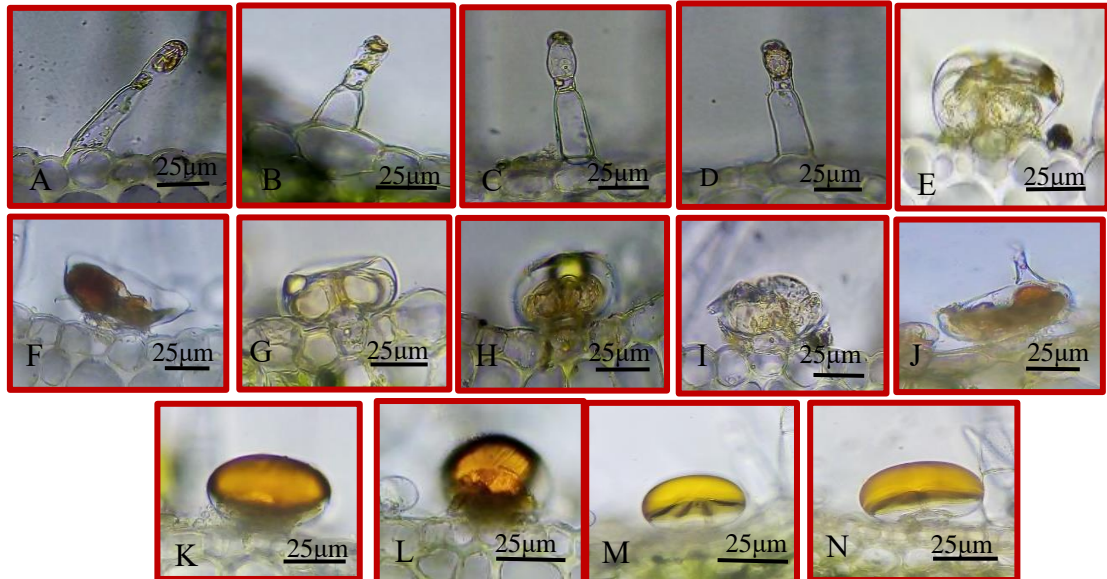


Fig.5 – Trichome types of petioles

A, B, C, D. Capitate glandular trichomes

E, F, G, H, I, J, K, L, M, N. Peltate glandular trichomes

#### Anatomical characters of lamina

The lamina of *Elsholtzia blanda* Benth. studied in transverse section, epidermal layers were composed of one - layered (barrel shapes), diacytic stomata on both surfaces with anticlinal walls wavy, glandular and non-glandular trichomes and cuticle. Non-glandular trichomes (1-3 cells) were more abundant than glandular trichomes (1-8 cells). Non-glandular uniseriate unicellular trichomes were abundant but sometime multicellular trichomes were found on the adaxial epidermis. The peltate glandular trichomes were more abundant than capitate. The glandular trichomes contained the shortly stalk. The spongy layers are more in the middle positions of lamina than in the margin positions of lamina. The abaxial epidermis were more wavy in the margin positions of lamina than in the middle positions.



Fig.6 - Middle position of lamina in T.S

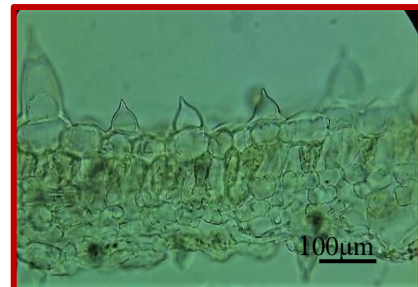


Fig.7- Margin position of lamina in T.S

### Types of trichomes found in upper epidermis of leaves

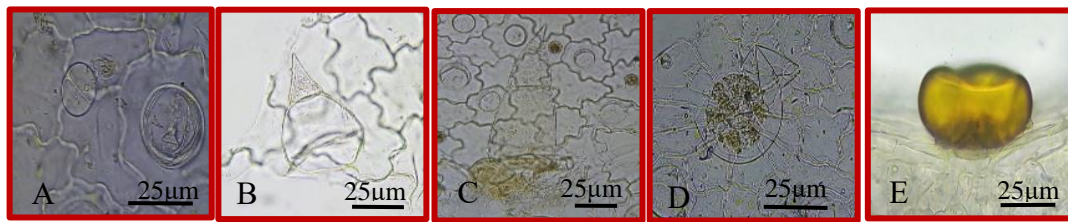


Fig.8 – Trichome types on upper surface of lamina

- A. Non-glandular unicellular uniseriate trichome
- B, C. Non-glandular multicellular uniseriate trichomes

### Types of trichomes found in lower epidermis of leaves

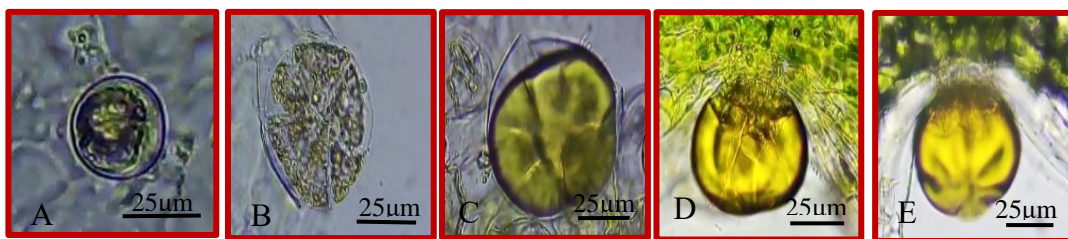


Fig.9 – Trichome types on lower surface of lamina

- A. Capitulate glandular trichome
- B, C, D, E. Peltate glandular trichomes

### Anatomical characters of midrib

The midribs of *Elsholtzia blanda* Benth. studied in transverse section, the shapes of midrib parts were different. Epidermis were wavy, one - layered, oval or rounded shapes, thin cuticle, glandular trichomes (1-4 cells) and non-glandular trichomes (1-3 cells). Glandular trichomes were found capitulate in the basal positions of midrib than peltate trichomes. Glandular trichomes contained slightly stalk. But glandular trichomes were not found in the terminal positions of midrib. Non-glandular trichomes were uniseriate multicellular (2 or 3 cells) in the based positions of midrib. Sometime in the terminal positions of midrib can not found any trichomes. Vascular bundles embedded in ground tissue, continuous or discontinuous vascular bundles were crescent shapes, collateral opened types in the basal positions of midrib. Two small traces were found only in the basal positions of midrib. Sometime the bundles in the terminal positions of midrib were very small and were difficult distinct to define the bundle shapes.

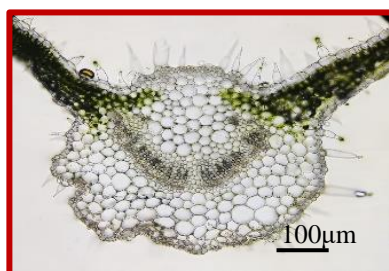


Fig.10 – Basal position of midrib in T.S

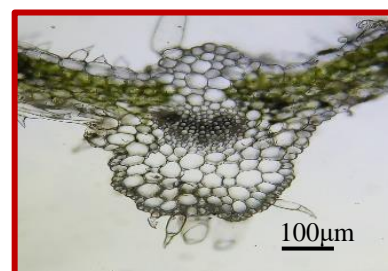


Fig.11- Terminal position of midrib in T.S

### Types of trichomes found in midrib of leaves

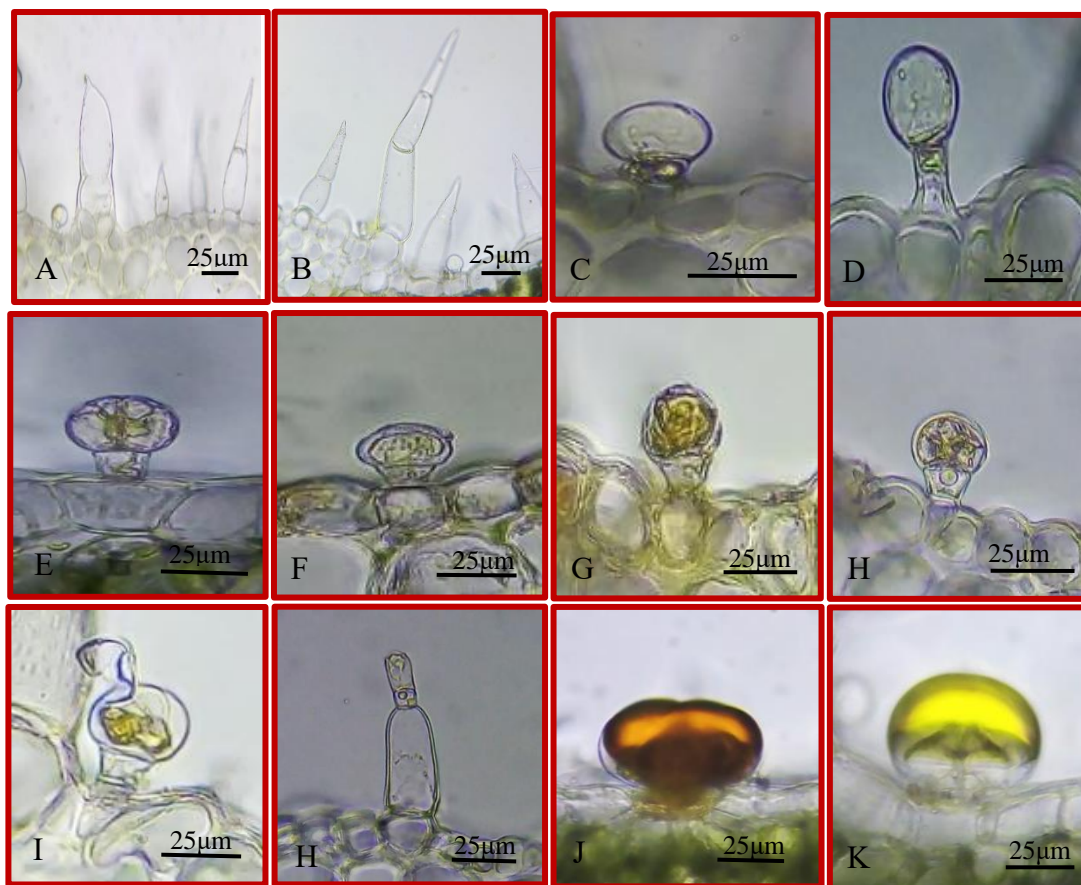


Fig.12 – Trichome types of midrib in T.S

- A, B. Non-glandular multicellular uniseriate trichomes  
 C, D, E, F, G, H. Capitulate glandular trichomes

### Discussion and Conclusion

The habits of *Elsholtzia blanda* Benth. were annual herbs, aromatic plants, quadrangular stems erect with hairs, in this studies which was agreed with Wu and Raven (1994) and Website - 2. But Website - 1 described that the habits was shrubby perennial herb.

In this results, the leaves of *E. blanda* Benth. were simple, opposite and decussate, ovate-lanceolate, apex acuminate, base cuneate, both surfaces with hairs and dotted glands, margin serrate, petioles present which in agreement with Wu and Raven (1994), Website - 1 and Website - 2.

The inflorescences of *E. blanda* Benth. in this papers are axillary or terminal verticillasters, each verticillaster with 4-10 flowers in this studies. This was agreed with Wu and Raven (1994), Website - 1 and Website - 2.

In this studies, the flowers of *E. blanda* Benth. were white cream color, bracteates and ebracteolate which in agreement Website - 1 and Website - 2. But Website - 1 described that flowers with bracteolate.

In this papers, the calyx of *E. blanda* Benth. were both outside and inside of calyx tube with hairs, persistent which in agreement with Wu and Raven (1994) and Website - 1.

The corolla of *E. blanda* Benth. in this results are imbricate, outside of corolla lobes with hairs, corolla tube inside with ring hairs, petaloid (white cream color) that is agreed in according to Wu and Raven(1994) and Website - 1.

In this investigations, the androecium of *E. blanda* Benth. were stamens 2+2, didynamous, epipetalous, exerted which in agreement with Wu and Raven (1994), Website - 1 and Website - 2.

The seeds of *E. blanda* Benth. were four seeds enclosed within the tube of the persistent calyx, seeds were yellow-brown and obovate in this papers which in agreement with Wu and Raven (1994), Website - 1 and Website - 2. But Wu and Raven (1994), Website -1 and Website - 2 stated that seeds were oblong.

This morphological characters of *E. blanda* Benth. were agreed with genus expression of Ali and Nasiar (1990), Backer (1965) and Qi Ming (2009).

In the petioles of *E. blanda* Benth., vascular bundles embedded in ground tissue, continuous or discontinuous vascular bundles were crescent shapes, collateral and opened types. This was agreed with Metcalfe and Chalk (1950).

Both epidermal cells of lamina of *E. blanda* Benth. were parenchymatous cells, stomata present on both surfaces, diacytic types of stomata. This was agreed with Metcalfe and Chalk (1950).

In the leaves of *E. blanda* Benth., vascular bundles embedded in ground tissue, continuous or discontinuous vascular bundles, collateral and opened types. In this study, trichomes were glandular and non - glandular trichomes. Glandular trichomes contained capitate and peltate This was agreed with Metcalfe and Chalk (1950), Moon, et al. (2009), Kahraman, et al. (2010) and Hazzoumi (2019).

In conclusion, for the better identification and differentiation of the structures of leaves and to give the knowledge about the useful facts of trichomes. Morphological and anatomical characters play a vital role in plant based crude drug identification and standardization. About 60% to 80% of world population rely on plant-based medicines which are being used since the ancient ages as traditional health care system.

The fresh leaves of *E. blanda* Benth., are eaten for reducing high blood pressure, the leaf is applied on forehead in dizziness, the leaf decoction is eaten in cough and dyspepsia and the leaf infusion is useful for application to apathy and sore throat.

Because of their medicinal values, these plants may be utilized for various socio-economic activities of mankind. And then, glandular trichomes have many chemical compounds that was described in references. These plants are required for finding out the active components of medicinal value for further study.



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### Reference

- Ali, S. I. and Nasir, Y. J., 1990. Flora of Pakistan (No. 192). I. C. Hedge, Royal Botanic Garden, Edinburgh.
- Backer, C. A., R. C., Bakhuizen Van Den Brink Jr, Ph. D., 1965. Flora of Java (Vol.II). N. V. P & Noordhoof Groningen. The Netherlands.
- Camina, J. L., Dambolena, J. S., Zygadlo, L.A. and Ashworth, L., 2018. Chemical composition of essential oils of peltate glandular trichomes from leaves and flowers of *Lepechinia floribunda* (Lamiaceae). *Bol. Soc. Argent. Bot.* 53 (3), Argentina.
- Chen, S., Chen, J., Xu, Y., Wang, X. and Li, J., 2022. *Journal Ethnopharmacology*, Vol- 297.
- Esau, K., 1953. Plant anatomy, John Wiley and Sons, nc. New York, London, Toppan Company, LTD., Tokyo, Japan.
- Hazzoumi, Z., Moustakime, Y. and Joutei, K. A., 2019. Essential oil and glandular hairs: diversity and roles. London, SW 72 QJ, United Kingdom.
- Hundley, H. G. and Chit Ko Ko, 1987. List of Trees, Shrubs, Herbs and Principles Climbers of Myanmar. Government Printing Press, Yangon.
- Kahraman, A., Celep, F. and Dogan, M., 2010. *South African Journal of Botany* Volve- 76. South African.
- Kress, J. W., Defilipps, R. A., Farr, E. and Yi Yi Kyi, Daw., 2003. A Checklist of the Trees, Shrubs, Herbs and Climber of Myanmar. Department of Systematic and Biology-Botany, National Museum of Natural History Washington, D. C.
- Metcalf, C. R. and Chalk, L., 1950. Anatomy of the Dicotyledons Leaves, Stem, and Wood in Relation of Taxonomy with Notes on Economic Uses, Vol. II. The Clarendon Press, Oxford.
- Moon, H. K., Hong, S.P., Smets, E. and Huysmans. S., 2009. Phylogenetic significance of leaf micromorphology and anatomy in the tribe Mentheae (Nepetoideae: Lamiaceae). *Botanical Journal of the Linnean Society*.
- Pandey, B. P., 2002. Plant anatomy, Embryology and morphogenesis of Angiosperms. S.CHAND &Company LID, Ram Nagar, New Delhi.
- Pande, 2008. A Text Book of Botany: Angiosperm, printed at Capltal Offset Press, New Delhi India.
- Qi-ming, H., 2009. Flora of Hong Kong (Vol. III). Agricultural, Fisheries and Conservation Department, Hong Kong.
- Simpson, Michael G., 2006. Plant Systematics, Elsevier Academic press, London.
- Wu, Z. Y. & Raven, P. H., eds., 1994. Flora of China. Vol. 17. Science Press, Beijing. And Missouri Botanical Garden Press, St. Louis.

### Website:

1. [www.ingentaconnect.com/content/nhn/blumea](http://www.ingentaconnect.com/content/nhn/blumea) (2015).
2. <https://www.flowersofindia.net> (2005).