



Comparative Anatomy for Some Species of the Genus *Lavandula* L. (Lamiaceae)

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Abstract: The anatomical features of the three species of the genus *Lavandula* L. (Lamiaceae) is very important to distinguish and differentiate between *Lavandula angustifolia* Mill, *L. dentata* L and *L. stoechas* L. The results have shown that the leaf blade was uniseriate epidermis in *L. angustifolia* Mill, the adaxial epidermis have small isodiametric which covered with a very thin cuticle layer, while in *L. dentata* the leaves were hypostomatic covered with a thin and striate cuticle layer, have diacytic stomata and branched non-glandular trichomes but in *L. stoechas* L. the epidermis was one layer which was rectangular cells has a thin cuticle. The glandular hairs were observed on both upper and lower epidermis.

Keywords: *Lavandula*, Anatomy, Lamiaceae, Leaf blade

Lamiaceae family is the sixth largest angiosperm family contain over than 236 genera and 7173 species distributed in the world on both temperate and tropical regions (Abdel-Hady and Gamil 2018). Lamiaceae plants are generally aromatic and widely used as culinary herbs, like basil, lavender, marjoram, mint, oregano, rosemary, sage, savory and thyme (Alcione et al., 2017). Different species for Lamiaceae family contain different types, distribution, morphology, and density for glandular trichomes, that considered important taxonomic characters traditionally, taxonomy of plants based mainly on comparative morphological features that help in taxa delimitation and identification. *Lavandula* is very important perennial shrub for the family of Labiales (Lamiaceae), species are used for essential oils, that contain up than 300 chemical compounds. The species belongs to family Lamiaceae can be characterized using the presence of these secretion hairs. The diverse kinds of glandular and non-glandular trichomes is characteristic for Lamiaceae (Asmma and Raghad 2013). The aim of the study is to study anatomical aspects of three species of *Lavandula* for identification.

MATERIAL AND METHODS

Collection of the plants: The plants were collected from different regions of Baghdad and between 2016-2018 during the flowering period (spring). The plants were preserved in special glass ampoules containing alcohol 70% for the conducting the transverse anatomy section process.

Anatomical study: The transverse anatomy sections of stems were conducted using hand section (Barbara et al., 2018).

Trichomes study: The epidermis was peeled to remove the trichomes from each part of plant species for identify their types with the general shape and the number of cells (Durdona et al., 2020).

RESULTS AND DISCUSSION

Leaf Blade

***Lavandula angustifolia* Mill:** The leaf blades were with uniseriate epidermis, the adaxial epidermis have small isodiametric which covered with a very thin cuticle layer. The leaf abaxial epidermis have small cells. The vascular bundles were collateral, the bundles for lateral veins have four xylem and phloem vessels. The stomata were anomocytic. So they are of different sizes. The trichomes were found in the abaxial and adaxial surfaces.

***Lavandula dentata*:** The leaves were hypostomatic covered with a thin and striate cuticle layer, have diacytic stomata and branched non-glandular trichomes. The cells in epidermis are more sinuous from other species. The mesophyll was dorsiventral with a large vascular bundle for the midrib (Khansaa 2020). The xylem and phloem were forming the vascular sheath, and a very small amount of collenchyma, trichomes, capitate and pelleted glandular spread heavily in this species.

***Lavandula stoechas*:** The epidermis was one layer which was rectangular cells has a thin cuticle. The glandular hairs were found on both upper and lower epidermis. Hairs branched and multicellular, 2-6 celled have smooth cuticle (Heba et al., 2013). The leaves amphistomatic have diacytic stomata. Bifacial and the palisade tissue 2 layer have spongy parenchyma 3-4 layer. Vascular bundles were collateral,

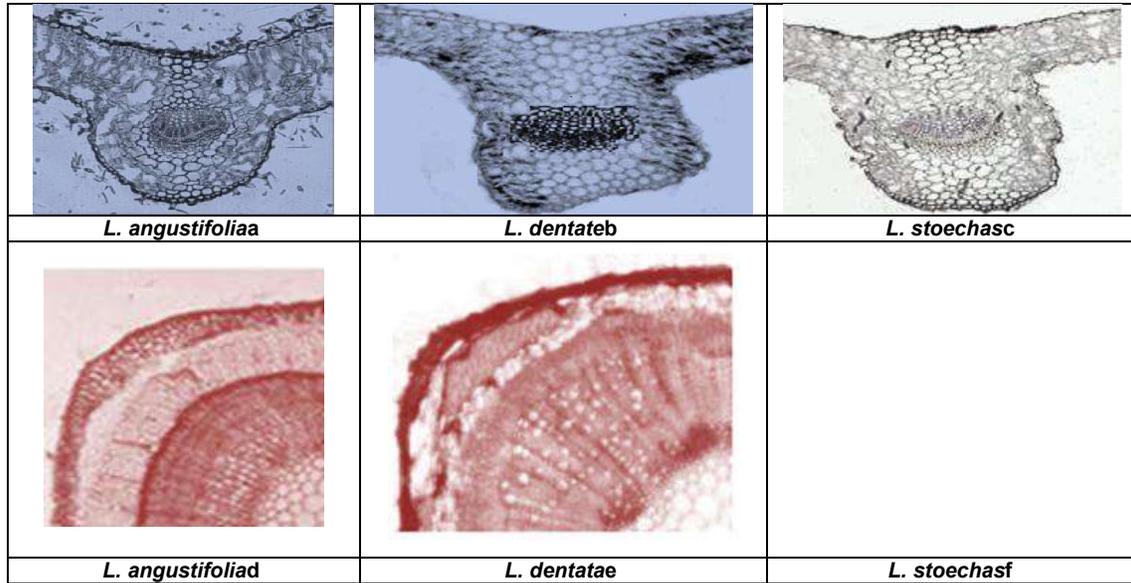


Fig. 1. Anatomical features of the three species *L. angustifolia*, *L. dentata*, *L. stoechas* a-c Anatomical sections of leaves for the three species, d-f Anatomical sections of stem for the three species

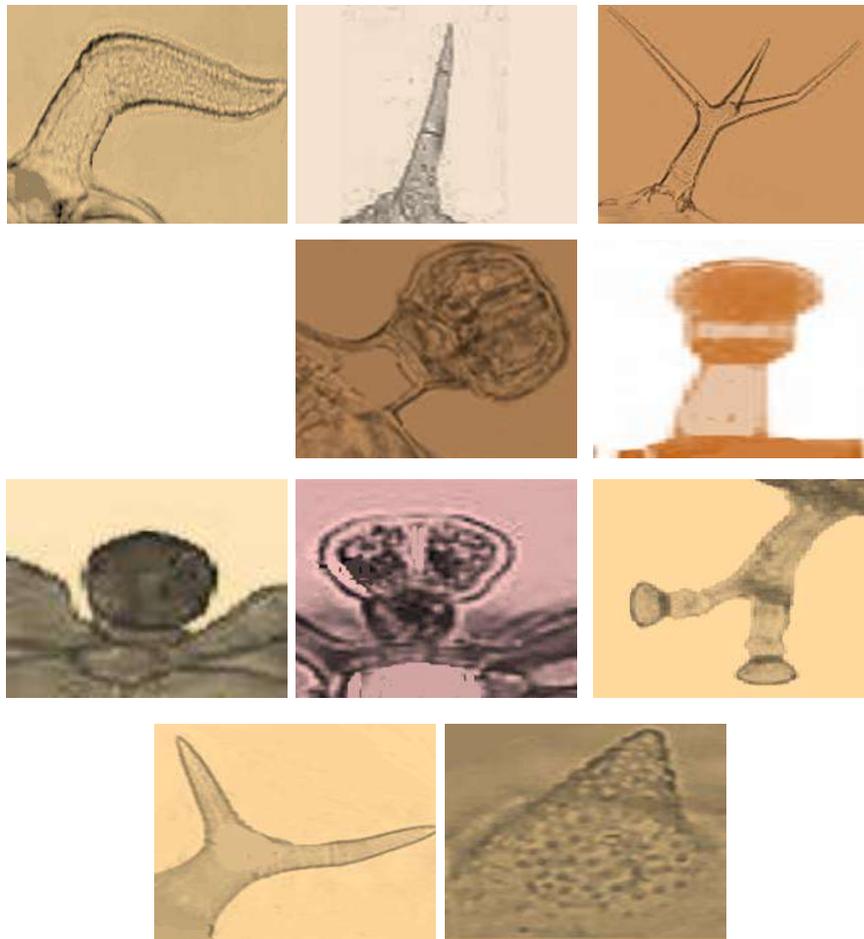


Fig. 2. Light micrographs of variety of shapes of hairs spread over the epidermis of the three species

phloem was in the abaxial, xylem was in the adaxial direction.

Stem

L. angustifolia: The stem was square shape, with angular collenchyma alternated the cortical parenchyma, so the sclerenchymatic fibers developed on the edges for the stem. It has been observed the capitate and peltate glandular trichomes with striate cuticle (Fig. 1).

L. stoechas: The stem was rectangular and the epidermis was one layer and have a thick cuticle layer. Hairs were stellate, branched. 4 rows collenchyma tissue were found at four angles, endodermis was flattened cells which distinguish from its cortex parenchyma, so the pericycle have cylindrical multi-layered sclerenchyma. The complete cylinder of xylem surrounded by phloem. The pith composed of parenchymatous which covers a large area (Sevim et al., 2019).

Trichome diversity: Trichome diversity have been determined by using the light microscope. According to their morphology features (Shan et al., 2008) were divided two groups.

1. Non-glandular trichomes

- The simple non-glandular trichomes.
- The non-glandular multicellular trichomes.
- Stellate trichomes sparse stellate.
- Rough papillate.

2. Glandular trichomes multicellular

- Bifurcated glandular trichomes with different stalk lengths.
- Vesicular-capitate glandular trichomes.
- Bladde-like, head one cell, sessile, found in stem, leaves and corolla (Fig. 2). Erect-capitate glandular Peltate glandular trichomes.

The morphological similarity alone, was insufficient criterion of delimitation for trichome types like taxonomic characters. Despite the higher number for trichome types and subtypes was known (Rajkumar 2020), their contribution for the relationships in generic level was rather small (Kim and Lee 2000). Apart from the above mentioned, the analysis was based in trichomes characters did not reveal any other trends, that would be in congruence with results obtained from different data. Glandular hairs, in the Lamiaceae, may be present at the vegetative and floral parts. In the capitula they were found at the receptacle, bracts, corolla and also on the ovary.

This paper represents the comparative analysis for leaves, stems and trichome morphology for the three species *L. angustifolia* Mill, *L. dentata* L, *L. stoechas* L. The species contain a large variety of hairs and a dense like: non-

glandular trichomes and glandular trichomes multicellular which was bifurcated glandular trichomes, Bladde-like, erect-capitate glandular and peltate glandular trichomes. The stem, leaf anatomical and trichome features provide useful characters for distinguishing the three species in the genu.

REFERENCES

- Alcione DR, Claudia P and Branca MAS 2017. Caracterização anatomical de folhas e inflorescências de espécies de *Lavanda* (Lamiaceae) utilizadas como medicinais no Brasil. *Ciência e Natura. Santa Maria* **36**(2): 120-127.
- Abdel-Hady NM, Gamil M and Nagi F 2014. Phytochemical studies and in vivo antioxidant activity of two *Lavandula* species (Lamiaceae) against streptozotocin induced oxidative stress in albino rats. *Journal of Biomedical and Pharmaceutical Research* **3**(4): 30-40.
- Anhar AY, Soad AH, Zeinab AE, Hassan MI and Omayma AE 2018. Morphological and Anatomical Studies on Selected Lamiaceae Medicinal Plants in Bani Matar District, Sana'a (Yemen). *Taekholmia* **38**: 17-39.
- Asmma E and Raghada 2013. Study of *Lavandula officinalis* L. Buds of flowers extracts activity against some species of multi-drug resistant clinical isolates of bacteria. *Iraqi Journal of Biotechnology* **12**(2): 82-91.
- Barbara J, Valter P, Melissa MG, Daniele P, Debora MB, Andres FMA, Beatriz HL, Josiane DP, Jane MB and Paulo VF 2018. Chemical composition and biological activities of the essential oil and anatomical markers of *Lavandula dentata* L. cultivated in Brazil. *Brazilian Archives of Biology and Technology* **61**: 1-12.
- Durdona KF, Tashkhanim R, Feruza MD, Guljan MD, Sodikjon HA and Ismatjon N S2020. The anatomical structure of vegetative organs *Lavandula officinalis* Chaix in the introduction of Tashkent Botanical Garden American. *Journal of Plant Sciences* **11**: 578-588.
- Hamad KJ, Al-Shaheen SJA, Kaskoos RA, Ahamad J, Jameel M and Mir SR 2013. Essential oil composition and antioxidant activity of *Lavandula angustifolia* from Iraq. *International Research Journal of Pharmacy* **4**(4): 117-120.
- Heba M, Azza MS, Omnia F and Abou El-Leel 2017. Analysis of genetic diversity of *Lavandula* species using taxonomic, essential oil and molecular genetic markers. *Middle East Journal of Applied Sciences* **07**(01): 141-154.
- Kim N and Lee D 2000. Comparison of different extraction methods for the analysis of fragrances from *Lavandula* species by gas chromatography-mass spectrometry. *Journal of Chromatography A* **982**: 31-47.
- Khansaa RA 2020. Taxonomic study for the species *Volkameria inermis* L. (Lamiaceae). *Plant Archives* **20**: 2550-2552.
- Rajkumar Y, Ashok S, Ketan T and Kamboj RD 2020. Comparative study on diversity of trees and shrubs in protected areas - Vandsa National Park and Ratanmahal Sanctuary of Gujarat State, India. *Indian Journal of Ecology* **47**(4): 1014-1018.
- Sevim K, Ayhan A, Betul D, Fehmiye K and Kemal HCB 2019. Morphological, anatomical and phytochemical characterizations of *Lavandula stoechas* L. subsp. *stoechas* Growing in Turkey. *Nat. Volatiles & Essent. Oils* **6**(2): 9-19.
- Shan H, Bruce KK, and Jing-Ping Liao 2008. The capitate and peltate glandular trichomes of *Lavandula pinnata* L. (Lamiaceae): histochemistry, ultrastructure, and secretion. *Journal of the Torrey Botanical Society* **135**: 155-167.