

Anatomical and Palynological Features of *Linaria pelisseriana* (L.) Mill. (Plantaginaceae)

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ABSTRACT

In this study, the anatomical and palynological properties of *Linaria pelisseriana* (L.) Mill. taxon (Plantaginaceae) was investigated. Taxon is perennial and herbaceous. Cross-sections of root, stem and leaf and surface sections of leaf were taken and photographed, then evaluated. Pollen morphology was taken from the Herbarium specimens is investigated under Light microscope and Scanning Electron Microscope. Pollen grain microphotographs of examined taxa have been taken from preparates which were made by Wodehouse and Erdtman techniques in LM. The pollen of the analysed taxon is radially symmetrical, isopolar, tricolporate, oblate-spheroid. Exine is tectate-reticulate.

Keywords: *Linaria pelisseriana* (L.) Mill., (Plantaginaceae), Anatomy, Palynology

INTRODUCTION

The genus *Linaria* Miller, which belongs to the Plantaginaceae family, is distributed in the Northern Hemisphere and especially around the Mediterranean Sea. The genus, which is represented by 150 species on earth, has 20 species and 12 subspecies, 9 of which are endemic. The genus is represented by about 150 species in the world. There are 12 subtypes (Davis, 1978). *Linaria* species known as Nevruz grass in Anatolia and having a wide spread are used as folk medicine in Anatolia, Japanese and Indian people is widely used in medicine. Antidiabetic, diuretic and purgative, because of their effects as well as emollient and wound healing properties are used in the treatment of various diseases (Baytop 1984, Singh and Prakash 1987, Kitagawa et al 1973). It has also been used in the treatment of eczema due to its antiallergic effects (Dobrescu et al 1985). There are revision, anatomical, morphological, ecological and palynological studies on other types of *Linaria* (Ietswaart 1980, Metcalfe and Chalk 1965, Erdemoğlu et al 1998, Juan et al 1999, Gönüz et al 2005, Zimmerman 1996, Jacobs 2006, İnceoğlu and Karamustafa 1975, Tatlıdil et al 2004).

The aim of this study is to reveal the anatomical and palynological characteristics of *Linaria pelisseriana* taxa which is distributed in and around Manisa for the first time and to contribute to plant systematics.

MATERIALS AND METHODS

The research materials were *L. pelisseriana* collected from different localities between 2018-2019. In this study, the collected plant samples were dried and transformed into herbarium samples and preserved in Eskişehir Osmangazi University Faculty of Arts and Sciences Herbarium. Plant samples were collected between May and October, which are flowering and fruiting periods. The materials used in anatomical studies are directly from the localities where *Linaria* taxa is grown and 70% ethyl alcohol. Flora of Turkey was used for plant identification.

Anatomical studies were made from materials stored in 70% alcohol. Root, stem and leaf sections were taken by hand with a razor blade. The sections were first examined under a Nikon microscope and the appropriate ones were made into a permanent preparation with Canadian balsam. From these preparations which were made permanent, Nikon Ophthophot microphotography device was used to take 10x and 20x magnification photographs.

Pollen samples were taken from dried plants found in Herbarium (OUFE) of Osmangazi University Faculty of Science and Letters Biology Department. The examination of the current pollen under light microscope was carried out by Wodehouse (1935) method and the examination of fossil pollen by Erdtman (1969). Morphological examination of the pollen was carried out with Prior binocular microscope, oil immersion lens (x100). To determine the averages given, 50 times measurements were made for all parameters. Standard deviation and variations were calculated. Each range in the ocular micrometer is 0.98 μm . Microphotographs were taken with the KAMERAM Digital camera in the Biology Department of the Faculty of Arts and Sciences of Osmangazi University with a Nikon 80i microscope. The magnification of photos is x 1000. For scanning electron microscope (SEM) investigations, unacetolized pollen grains were placed on the anchor plate and coated with gold and examined under Jeol 5600 LV Scanning electron microscope (SEM) (Walker, 1974a-b). Various basic palynological books and various studies have been used for the diagnosis of pollen (Wodehouse 1935, Kuprianova 1967, Erdtman 1969, Faegri and Iversen 1975).

RESULTS AND DISCUSSION

Morphological Features

Single or perennial herbaceous plants. Foliage simple, complete, stemless, often narrow, mostly at the bottom verticillate, upper alternate. Flowers terminal, racemate or spike, bracheled; calyx deeply and usually unequal 5-lobed, adaxial lobe usually the longest, rarely short. Corolla, hairless, except the palate; tube cylindrical; conical or cylindrical at the bottom spur, two lips on the mouth, two lobes on the upper lip, bottom three lobes, usually close to the mouth of the tube portion (patale). Stamens 4 didynam. The capsule is more or less rounded, evenly loculated; large amount of seeds, angular and rugulos or discoid and winged. Monographically needed is a difficult genus. A clearly heterogeneous breed seed, although traditionally in two groups. It is ongoing. In the layout of the diagnostic key for ease of identification relatively recently seed character prominently.

Anatomical Features

Root

Thick multi-layer periderma outside the root layer consisting of cells located. The cortex is 6-8 rows suberized. Multilayer phloem under the cortex and a large. Xylem covering the area. Phloem and Xylem cambium located. After this layer wooded a large central cylinder of cells located. Much between Cambium and Core self-rays are apparent. Xylem The trachea cells are very prominent (Fig. 1).

Stem

The cuticle layer on the outermost body single-row isodimetric epiderma cells. Epiderma cells There are 8-9 rows of cortex underneath. Cambium crushed and in 1-2 rows seen. On the side facing the cambium trache of xylem elements in a messy way tracheids are prominent. Cambium's outward-facing Phloem cells are found. A very large center self parenchymatic cells in the area. Self rays are wooded and into small cells outwardly. The area covers a large area and is parenchymatic cells (Fig. 2).

Leaf

Cuticle which is very prominent on the leaves epidermis located. The epidermis is similar to the lower and upper surface feature. Leaf cross section photosynthetic palisade parenchyma both sides lateral isobilateral 'or' equifacial is called. Palatine parenchyma 2-3 sequentially. Transmission bundles of leaf located in the middle. Superficial sections stomata Anomocytic type. (Fig. 3).

Palynological Features

Linaria pelisseriana (L.) Mill. Pollen grains radially symmetrical, isopolar, 3colporate. Colpus equatorially constricted or bisected by an exine bridge (Fig. 4). Equatorial limb (Amb) circular with flat or invaginated

"furrows", maximum outline more or less circular with invaginated or open colpi. Colpus membrane granular, Exine 0.6-0.8 µm thick. Sexine per-reticulate, band-like microreticulate areas not unusual. Lumina more or less angular, variable in size. Muri also variable in size. Endosexine is bacular. The pollen of the analysed taxon is radially symmetrical, isopolar, tricolporate, oblate-spheroid. Exine is tectate-reticulate.

A study close to our study Erdemoglu et al. *Linaria genistifolia* (L.) Miller ssp. confertiflora to anatomical study Erdemoglu et al (1998). In this study *L. pelisseriana* leaf transverse section and bundles of lateral vessels a regular line, epidermis end of the leaves, which is covered with a layer of stoma cells on both sides, mesophylic tissue crystals and clustered starch grains and prismatic crystals found. Findings generally parallel to our findings. This study is reveal the anatomical and palynological characteristics of *Linaria pelisseriana* taxa which is distributed in and around Manisa and to contribute to plant systematics.

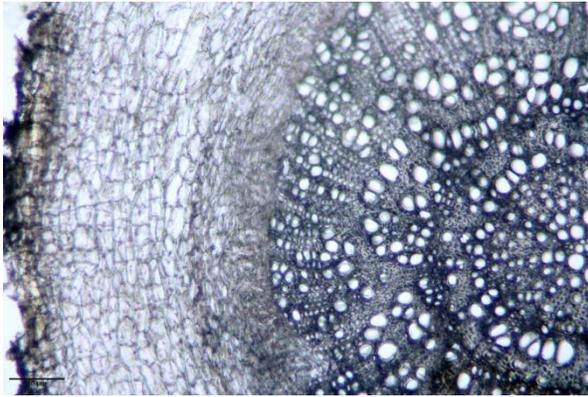


Fig 1. *L. pelisseriana* Root

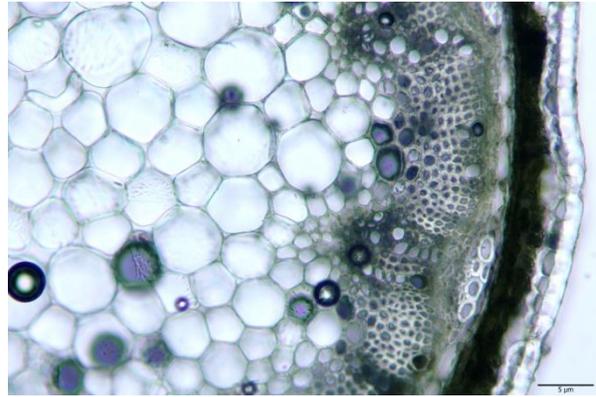


Fig 2. *L. pelisseriana* Stem

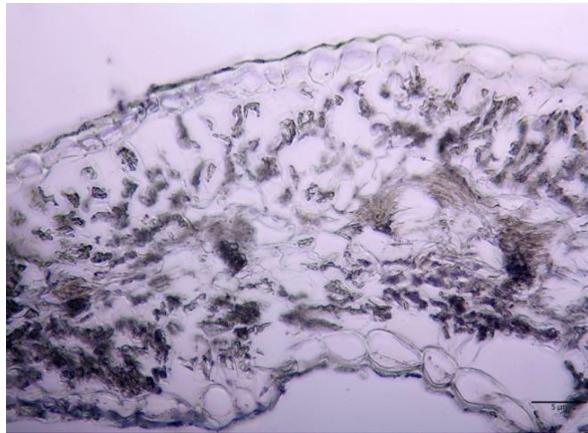
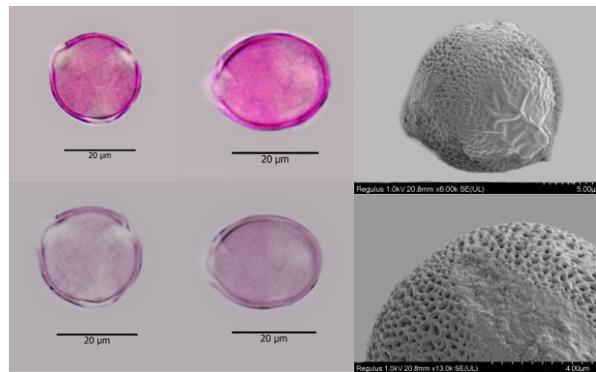


Fig. 3. *L. pelisseriana* Leaf



a

b

Fig 4. *L. pelisseriana* Pollen Morphology.
a) in Light Microscope b) In SEM

REFERENCES

Baytop, T (1984). Türkiye'de Bitkiler ile Tedavi (Geçmişte ve Bugün). İstanbul Üniversitesi yayınları, No:3255, Sanal Matbaacılık, İstanbul, 420.

Davis, P H (1978). Flora of Turkey and The East Aegean Islands, Vol.6, University Press, Edinburgh, 654-72.

- Dobrescu, D., Cristea, A., Susanu, M (1985). Experimental pharmacodynamic study of *Linaria vulgaris* used in folk medicine for the treatment of eczemas, *Farmacia Bucharest*, 33, 215-20.
- Erdemoğlu, N., Bingöl, F., Şener, B (1998). *Linaria genistifolia* (L.) Miller ssp. *confertiflora* (Boiss.) Davis Üzerinde Anatomik Bir Çalışma, *Ankara Ecz. Fak. Derg.*, 27 (1) 23-30.
- Erdtman (1969) Handbook of palynology morphology, taxonomy, ecology. An introduction to the study of pollen grains and spores. Hafner Pub. New York.
- Fægri and Iversen (1975). Textbook of pollen analysis. ed. 3. Munksgaard, Copenhagen.
- Gonuz, A., Dulger, B., Kargiöglu, M (2005). The Morphological, Anatomical Properties and Antimicrobial Activity of Endemic *Linaria corifolia* Desf. (*Scrophulariaceae*) in Turkey, *Pakistan Journal of Biological Sciences*, 8(2),220-226.
- Ietswaart, J.H (1980). A Taxonomic Revision of The Genus *Linaria*. Lerdem University Press, London.
- İnceoğlu, Ö., Karamustafa, F., (1975). The Pollen Morphology of Plants In Ankara Region IV. *Scrophulariaceae*, Hacettepe Üniv.
- Jacobs, J (2006). Ecology and Management of yellow toadflax [*Linaria vulgaris* (L.) Mill.], United States Department of Agriculture, Natural Resources Conservation Service Invasive Species Technical Note No. MT-6.
- Juan, R., Pastor, J. And Fernandez, I (1999). Morphological and Anatomical Studies of *Linaria* Species from South-west Spain: Seeds, *Annals of Botany* 84: 11-19.
- Kitagawa, L, Tani, T., Akita, K., Yosioka, I (1973). Constituents of *Linaria japonica*. I. Structure of linarioside, a new chlorinated iridoid glucoside and identification of two related glucosides, *Chem. Pharm. Bull.*, 21(9), 1978- 87.
- Kuprianova A (1967). Apertures of pollen grains and their evolution in Angiosperms. *Paleobot Palynology* 3: 73-80.
- Metcalf, C. R.,and Chalk, L (1965). *Anatomy of the Dicotyledons*, Vol.11, Clarendon Press, Oxford, 979-88.
- Singh, M., Prakash, L (1987). "A new flavone glycoside and other chemical constituents from *Kickxiaramosissima* Wall. (Syn. *Linaria ramosissima* Wall.) (*Scrophulariaceae*)" *Pharmazie*, 42(7), 490-1.
- Tatlıdil, S., Avar, E., Bıçakçı, A., Malyer, H., Kargıoğlu, M., Özyurt, S (2004). Afyon ve Çevresinde Yayılış Gösteren *Linaria* Miller Türlerinin Polen Morfolojileri, *F. Ü. Fen ve Mühendislik Bilimleri Dergisi*, 16(2), 183-194.
- Walker JW (1974a). Evolution of exine structure in the pollen of primitive Angiosperms. *Am J Bot* 61: 891-902.
- Walker JW (1974b). Aperture evolution in the pollen of primitive Angiosperms. *Am J Bot* 61: 1112-1137.
- Wodehouse, R.P (1935). *Pollen grains*. New York, USA, McGraw-Hill.

Zimmerman, J.A.C (1996). Ecology and distribution of *Linaria vulgaris* (L.) Miller, Scrophulariaceae. USGS Biological Resources Division, Colorado Plateau Field Station-Flagstaff, Arizona.