ISSN: 2707-1146
e-ISSN: 2709-4189

DOI: https://doi.org/10.36719/2707-1146/55/14-18

Lala Gurbanova
Azerbaijan State Agrarian University
PhD in Biology
https://orcid.org/0009-0003-4572-7123
lala.qurbanova78@list.ru

Morpho-Anatomical Analysis of the Species *Origanum Vulgare* L. (*Lamiaceae* Lindl.)

Abstract

The article provides information on both constant and various structural indicators determined as a result of microscopic study of the taxon *O.vulgare* L.The scientific nature of the species and its distribution area are indicated. The medicinal, nutritional and ornamental properties of the plant are also thoroughly studied and analyzed. Despite the fact that plant classification is based mainly on morphological data, the anatomical method of studying vegetative organs of plants is of great importance in taxonomy and phylogeny. According to the anatomical analysis of *O.vulgare* L., the characteristics of its stem, petiole and leaf were determined. The plant's stem is quadrangular and has numerous collateral-type tufts. The leaves are amphistomatic, the stomata types are mesomorphic, the number of stomata on the lower surface of the leaf is greater than on the upper one. The epidermis of the leaf contains thyroid glandular hairs.The characteristic indicators revealed by microscopic studies were designated as diagnostic signs.

Keywords: *medicine, multiplicity, xylem, collateral, phloem*

Introduction

Recently, due to the increasing anthropogenic impact on the natural environment, there has been a significant reduction in the areas occupied by populations of medicinal plants, and often their complete disappearance. One of these plants is *O. vulgare* L. of the *Lamiaceae* Lindl. family. There are 20 species of the genus *Origanum* L. in Europe and Western Asia, 3 in the Caucasus, and 1 in Azerbaijan. It is widespread in all areas of our country, from the foothill zone to subalpine meadows. It is a perennial herbaceous plant, with rhizomes that develop horizontally. Its leaves are oblong-ovate, with short petioles. Small pink flowers are collected in panicle inflorescences. The stem is 30-70 cm high and covered with small hairs. The plant blooms in June-August, and its fruits ripen in September-October (Figure 1)



Figure 1. Appearance of the taxon *O. vulgare* L. in the natural population:
A-general appearance; **B**- appearance of flowers

The homeland of *O. vulgare* L. is the Mediterranean. It grows almost throughout Europe, the Caucasus, Kazakhstan, Georgia, Central and Asia Minor, North America. *O. vulgare* L.is a

Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)

ISSN: 2707-1146
e-ISSN: 2709-4189

universal crop, it is used in a variety of areas as a medicinal, essential oil, spicy-aromatic and ornamental plant (Askerov, 2016)

Research

The leaves, stems, flowers and essential oil of the plant are used for medicinal purposes. As a medicinal plant, *O. vulgare* L. is included in the pharmacopoeias of many countries. The medicinal raw material is the herb of oregano - the upper part of the shoots with flowers and leaves. It contains 0.07-0.2% essential oil, tannins (up to 20%) and bitter substances, flavonoids, ascorbic acid, pigments, phytoncides, microelements (molybdenum, cobalt, zinc, etc.). The seeds contain up to 30% fatty oil, which is of interest to the pharmaceutical industry. It has been experimentally proven that preparations of this plant have a calming effect on the central nervous system, and also increase the secretion of the digestive and bronchial glands, intestinal peristalsis. Its preparations normalize the processes of fat breakdown, have a pronounced antispasmodic, choleretic, analgesic, antiallergic effect. Water infusions of the herb are used internally as a sedative for neuroses, insomnia, as well as for gastritis with reduced secretory activity, cholecystitis, anorexia, chronic enterocolitis, as an antipyretic; for inflammation of the respiratory tract, bronchial asthma. It relieves stomach spasms, prevents nausea and vomiting, has an anticonvulsant effect. *O. vulgare* L. preparations are also effective in the form of balms and lotions for massage (Damirov, Prilipko, Shukurov, Kerimov, 1988).

In a number of countries (France, Germany, Denmark, Norway, Poland, Austria, India, USA) *O. vulgare* L. is introduced as a medicinal plant. Since ancient times it has been popular in the countries of Southern Europe (Italy, Spain), as well as on the American continent - in Mexico - as a spice. Fresh and dried herb is used as a spice, known throughout the world under the name "oregano" or "pizza spice". The herb of the plant is added to spaghetti, salads, sausages, vegetable and egg dishes, cheeses, soups and sauces. It is also used when frying meat in the oven and on the grill, as well as for stewed and boiled meat, when preparing kvass, canned food, when pickling cucumbers, mushrooms and tomatoes. Buns, gingerbread and flatbreads are baked with it. People call *O. vulgare* L. tea a health drink.

The above-ground part of the oregano plant has coloring properties: orange-red dye for dyeing wool is obtained from the flowers, and black dye for cotton can be obtained from the grass with the addition of iron sulfate. *O. vulgare* L is a good honey plant, it gives a lot of nectar. *O. vulgare* L. is a vitamin-rich plant; in addition to oil, the leaves contain carotene and vitamins C, B_1, B_2.*O.vulgare* L.is a good ornamental plant. It is used in a garden of aromas or in a French-style vegetable garden, where flowers, vegetables and spices coexist in one bed (Angiosperm Phylogeny Group, 2016).

Materials and metods

For the purpose of the study, *O. vulgare* L. plant was taken from the nature of Goygol region territory. The systematic position of the species was clarified using the APG IV (2016) and World flora online databases (World Flora Online, 2020).

Phenological observations were conducted to study its anatomical features. The stem, petiole and leaf of the plant growing in natural conditions in the area were taken after reaching full morphological maturity. The aim of our study is to determine the anatomically permanent morpho-anatomical features of the *O. vulgare* L. taxon. After the vegetative organs of the plant were fixed with 70^0 alcohol, temporary sections were prepared according to the generally accepted anatomical method. The terminology of Esau N., N.A. Aneli was used for terminology and anatomical descriptions. Anatomical images were taken with a light microscope (Aneli,1955; Ezau, 1980; Lotova, 2005). During the preparation of temporary preparations, the material was freshly cut and placed in glycerin. The thinnest sections were transferred to a clean watch glass, and a small amount of watercolor solution was added to it using a pipette (Algan &Toker, 2004). After a few minutes, the section was washed repeatedly to remove the dye and observed under a microscope. The prepared anatomical preparations were examined under a BLM-210 LCD digital (modern microscope) microscope. Reagents, dyes, and auxiliary methods were used for the preparation of preparations and the determination of structural elements. To make the color of live preparations transparent, glycerin was used by adding two parts of glycerin to one part of water (Alexandrov, 1966; Gumbatov, 2017) Ethnobotanical methods were used during observations (Martin, 2004).

ISSN: 2707-1146
e-ISSN: 2709-4189

Results and Discussion

Anatomical analysis of the stem of *Origanum vulgare* L. The trunk has a quadrangular structure in cross section. It is surrounded by a row of epidermal cells from the outside. The surface of the epidermal is covered with cuticle. The outer sheath of the epidermal is thickened. 2-3 layers of chlorenchyma have formed from the epidermal cells inward. This has been formed as an adaptation to the lack of organic nutrients. Multilayered angular collenchyma has developed at the corners. The bark parenchyma is 5-6 layers. These cells are large, round in shape and rich in coloring matter. The conductive tissue is strongly developed. The phloem surrounds the xylem on all sides in the form of a belt. The water tubes in the xylem are arranged one after the other, forming numerous rows (48-50 pieces). Each row contains 5-6 water tubes. The water tubes are densely surrounded by xylem parenchyma. The phloem is composed of polygonal, small-sized cells. The cambium is 2-3 layers. The center of the stem is occupied by large core cells. These cells are small in size in the part bordering the xylem and gradually increase in size towards the center. Starch, dyes and other reserve substances are accumulated in the core parenchyma in the form of reserves. The angular collenchyma located at the corners, together with the xylem, gives the stem special strength. (Figure 2)

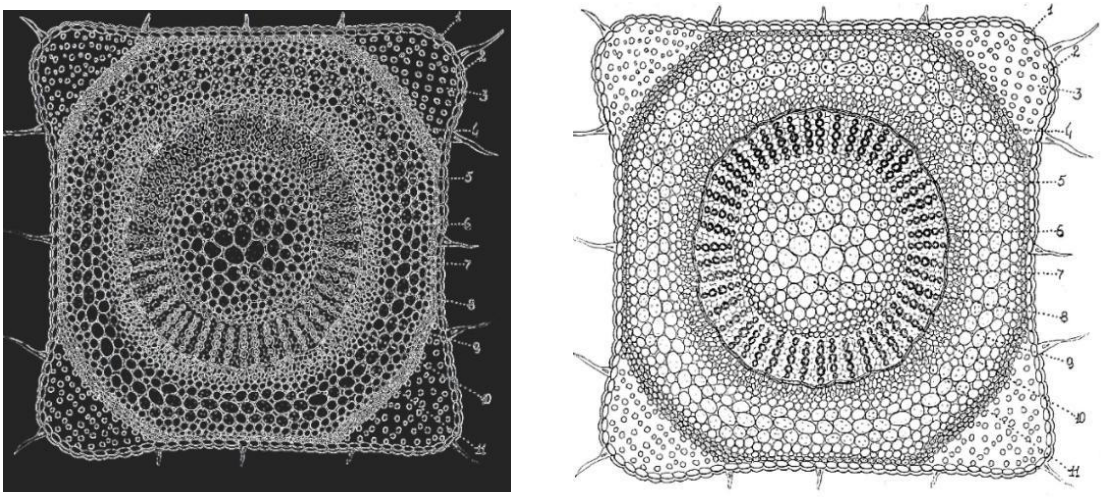


Figure 2 The stem cross section of *Origanum vulgare* L.: 1-cuticle; 2-epidermis; 3-angular collenchyma; 4-chlorphenchyma; 5- bark parenchyma; 6- phloem; 7- cambium; 8- xylem ;9- xylem parenchyma; 10- pith; 11- pigments

Anatomical analysis of the petiole of *Origanum vulgare* L. The petiole is circular in cross section on the lower surface and angular on the upper surface. It is surrounded by a layer of cuticle cells on the outside. The outer sheaths of the cuticle cells are thickened. The surface of the petiole is densely covered with simple hairs. Chlorenchyma consisting of 1-2 layers has developed from the cuticle inward. At first glance, the strong development of the main parenchyma in the petiole attracts attention. These cells are circular in shape and are loosely arranged. One large main ball is formed in the part facing the lower surface of the petiole, and two additional balls are formed in the part facing the upper surface (at the corners). In the balls, the phloem is directed outward, and the xylem is directed inward. Both the main and additional balls are surrounded by covering cells on the outside. In the xylem, water tubes (in the main ball) form rows (7-8 pieces) that are arranged one after the other. Each row has 3-5 water tubes. The water tubes are densely surrounded by polygonal parenchyma cells. The sheath of the water tubes is noticeably thickened. This, in turn, gives the plant considerable strength (Figure 3).

ISSN: 2707-1146
e-ISSN: 2709-4189

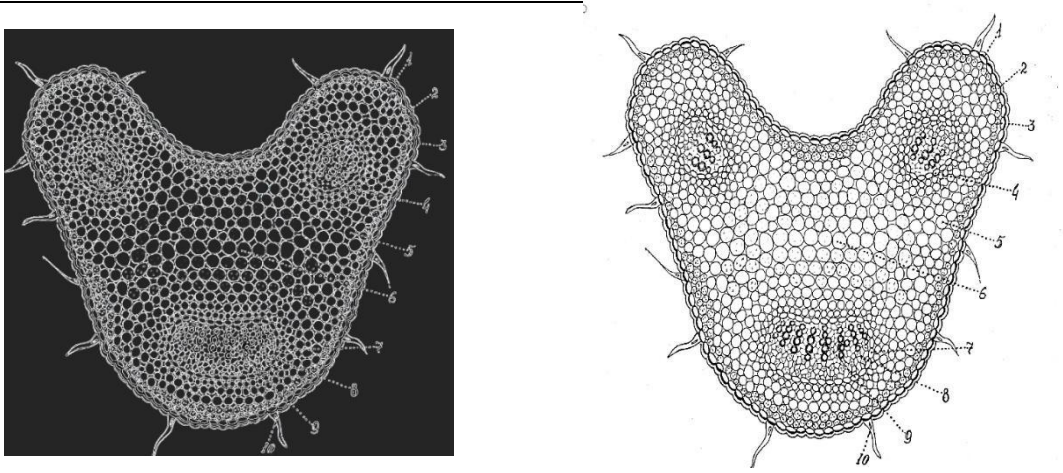


Figure 3 The petiole cross section of *Origanum vulgare* L: 1-cuticle ; 2- epidermis; 3-chlorenchyma; 4-extra corpuscle; 5- bark parenchyma; 6- pith; 7-covering cells; 8-phloem; 9- xylem; 10- hair

Anatomical analysis of the leaf of *Origanum vulgare* L. The leaf is dorsoventral in cross section. It is covered with a thick cuticle layer on both surfaces. The epidermis is single-layered. The upper epidermis cells are voluminous and their outer sheaths are thickened. Together with the cuticle, they constitute 40-45% of the epidermis cell. The spongy parenchyma is single-layered, rich in chloroplasts. The vascular bundles are collateral type. They are surrounded by one layer of surrounding cells from the outside. The xylem is directed towards the upper surface of the leaf, and the phloem is directed towards the lower surface. In the xylem, water tubes are arranged one after the other, forming rows. There are 5-6 water tubes in each row. The phloem is composed of 4-5 layers of cells. Sclerenchyma, composed of 2-3 layers of cells, has formed from the phloem outwards, which greatly increases its strength by giving elasticity to the leaf. Stomata are found only on the lower surface of the leaf. Studies have shown that as altitude increases in the mountainous zone, the stomata decrease in size, but their number increases. Changes occur in the epidermal cells with altitude, as their outer covering thickens, and the cuticle, together with the outer covering of the epidermis, makes up 40-45% of the epidermis. Such a structure should be considered a sign of the adaptation of plants to the harsh climatic conditions of the mountainous zone. Both surfaces of the leaf are densely covered with hairs.(Figure 4)

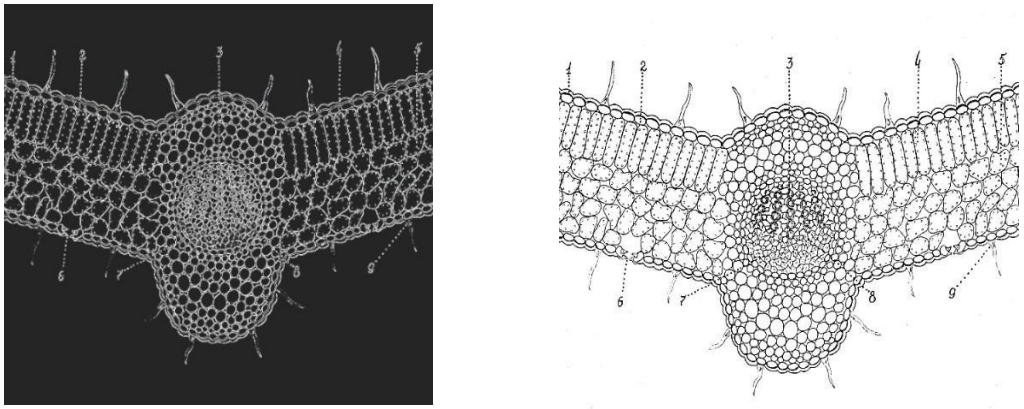


Figure 4 The cross section of the leaf of *Origanum vulgare* L: 1- cuticle; 2-epidermis; 3-xylem; 4-septal parenchyma; 5-spongy parenchyma; 6- stomata; 7-sclerenchyma; 8-phloem; 9-hair

Conclusion

Anatomical studies have shown that the leaves, stems, and flowers of the studied species contain dyes (black-dyeing substances). These dyes can be used to dye cotton and woolen products. These are the main diagnostic features of the species:

 ISSN: 2707-1146
e-ISSN: 2709-4189

- The stem has a quadrangular structure in cross section. Angular collenchyma consisting of 8-9 layers has developed at the corners.
- Chlorenchyma consisting of 2-3 layers has developed from the epidermis of the stem inwards.
- Dyes and other reserve substances accumulate in the bark and other core parenchyma of the stem.
- The conductive tissue in the petiole is characteristic only for that species in terms of its structure, shape and formation and can be used as a diagnostic sign.
- It is a cryoxerophyte according to the anatomical structure of the petiole. It is characterized by the formation of a dense hairy cover, thickening of the outer sheaths of the epidermal cells, the formation of chlorenchyma, strong development and dense arrangement of the main parenchyma.
- It is a cryoxerophyte according to the anatomical structure of the leaf. It is characterized by the dorsoventral structure of the leaf, thickening of the cuticle, the presence of stomata only on the lower surface of the leaf, dense coverage with hairs, etc.

References

1. Algan, G., & Toker, J. (2004). *Plant anatomy and morphology laboratory book*. Ankara: A.S. Faculty of Biology.
2. Alexandrov, V. G. (1966). *Plant anatomy*. Moscow: Science.
3. Aneli, H. A. (1955). *Atlas of the epidermis*. Tbilisi: Metsniereba.
4. Angiosperm Phylogeny Group. (2016). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. *Botanical Journal of the Linnean Society,* 181(1), 1–20. https://doi.org/10.1111/boj.12385
5. Askerov, A. M. (2016). *The flora of Azerbaijan* (Higher plants–Embryophyta). Baku: TEAS Press.
6. Damirov, I. A., Prilipko, L. I., Shukurov, D. Z., & Kerimov, Yu. B. (1988). *Medicinal plants of Azerbaijan*. Baku.
7. Esau, K. (1980). *Anatomy of seed plants* (Vol. 1: 580 p.; Vol. 2: 350 p.). Moscow: Mir.
8. Gumbatov, Z. I. (2017). *Anatomy and morphology of plants*. Baku.
9. Lotova, L. I. (2005). *Botany: Morphology and anatomy of higher plants*. Moscow: KomKniga.
10. Martin, G. J. (2004). *Ethnobotany: Manual of methods*. Uruguay: Routledge.
11. World Flora Online. (2020). *WFO.* Retrieved from http://www.worldfloraonline.org

Received: 10.10.2024
Accepted: 16.03.2025