ATATURK UNIVERSITY PUBLICATIONS

Research Article

DOI: 10.5152/Pharmata.2023.23018

Anatomy of *Paeonia mascula* (L.) Mill. (Paeoniaceae)

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ABSTRACT

Objective: The primary aim of this investigation was to explore the anatomical structures of the stem, leaf, petiole, petal, and fruit of *Paeonia mascula*.

Methods: Plant specimens were collected from Aşkale/Erzurum (Turkey) in July 2017. Subsequently, standard herbarium techniques were employed to dry and preserve the samples, which were stored at the Herbarium of Atatürk University, Biodiversity Application and Research Center. For anatomical analysis, the materials were preserved in 70% alcohol. Characteristic elements of these plant parts were identified through sectioning, and their structures were visually documented with photographs.

Results: The leaf exhibited a bifacial arrangement, and stomata were observed on the lower leaf epidermis. Furthermore, unicellular trichomes and druses were observed to prominent in both the leaf and stem of *P. mascula*. Additionally, starch-bearing parenchyma was identified in the pericarp anatomy, and druses were also present in the seed.

Conclusion: Comprehensive characterization of the anatomical properties of *P. mascula* was demonstrated in this study. The findings obtained in this study suggest that the observed anatomical diversity may have potential benefits in taxonomical classification.

Keywords: *Paeonia mascula*, Paeoniaceae, plant anatomy

INTRODUCTION

The name *Paeonia* is known to come from the Greek mythology, referring to the supreme god who was the physician of the gods or the one who healed the gods, known as "Paean" (Paeeon, Paeon). In ancient Greece, the origin of the name signifies "healing."[1]

The genus *Paeonia* has attracted significant attention from the scientific community due to its potential as a source of bioactive compounds. *Paeonia* belongs to the Paeoniaceae family and comprises 179 scientifically named plant species. Among these, 36 species have been accepted according to The Plant List database. The genus has a rich traditional use in treating various conditions such as amenorrhea, hematemesis, dysmenorrhea, epilepsy, spasms, and gastritis, with 21 species, 2 subspecies, and 7 varieties reported in traditional treatments. The root and root bark are the most commonly used parts of *Paeonia* plants. 451 compounds from these plants have isolated, including monoterpenoid glucosides, flavonoids, tannins, stilbenes, triterpenoids and steroids, and phenols. Additionally, *Paeonia* has demonstrated various biological activities such as antioxidant, anti-inflammatory, antitumor, antimicrobial, cardioprotective, and neuroprotective effects .[2]

Paeonia mascula (L.) Mill, which is relatively widespread from Spain to Iraq via France, Italy, the Balkans, Cyprus, and Turkey, holds particular significance. An infusion of young aerial parts of *P. mascula* subsp. *arietina* is used on an empty stomach to lower blood glucose in folk medicine *P. mascula* (L.) Miller is employed in managing jaundice and urinary system disorders. Furthermore, *P. mascula* roots have been used as a sedative for epilepsy and cough management, as well as a respiratory regulator. In Anatolia, *P. mascula* roots and flowers are utilized to deal with ulcer, cough, and epilepsy.[2]

P. mascula (L.) Mill. Paeoniaceae) is known as "Gülorç, Gülhorç, Ayı gülü, Eşek gülü in Turkey[3]. It is grown in Amasya, Gümüşhane, Bayburt, Rize, Balikesir, Yozgat, Tunceli, Elazığ, Bitlis and Bingöl cities in our country.[4] The aerial part of *P. mascula* contains tannins, flavonoids, essential oils, and alkaloids.[5,6] The leaves of the plant are used in Turkish folk medicine as antidiabetic, sedative, and antitussive.[3,6] In this study, anatomical structures of the stem, leaf, petiole, petal, and fruit of *P. mascula* were investigated. The characteristic elements of stem, leaf, petiole, petal, and fruit were identified with taking the sections. Theirs structures were illustrated with photographs.

Received: 28.07.2023
Accepted: 13.09.2023
Publication Date: 06.10.2023

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Cite this article as: Gözcü S, Karakaya S, Güvenalp Z. Anatomy of *Paeonia mascula* (L.) mill. (Paeoniaceae). *Pharmata* 2023;3(4):95-98.

METHODS

Plant Material

The sample of *Paeonia mascula* was collected on July 2017, at an elevation of 2020 meters, from the foothills of Aşkale Mountain, Erzurum, Turkey. The plant specimen is stored at the Herbarium of Atatürk University, Biodiversity Application and Research Center (AUEF 1351). The general appearance of *P. mascula*,fruits, and a herbarium specimen with flower, are shown in Figure 1.

Anatomical Studies

The specimens for anatomical analysis were kept in a 70% alcohol solution. This study aimed to examine the anatomical features of the stem, leaf, petiole, petal, and fruit of *P. mascula*. Sections were made to distinguish and identify the specific components of these plant parts. The structures were visually represented through the use of photographs. The imaging process involved a Zeiss 51425 camera, attached to a light microscope (Zeiss 415500-1800-000, Carl Zeiss Microscopy).

RESULTS

Anatomy of Stem

The stem cross section appears like a bear head, approximately 7 vascular bundles are regular. Cuticle is thin and striated. The central cylinder is large. Starch grains and druses can be found within the central cylinder of parenchyma. The stem has also trichomes, which are long and short. The anatomy of stem is shown in Figure 2.

Anatomy of Leaf

Anatomy of the Leaf Midrib

The leaf is bifacial. Druses and parenchyma containing starch grains are located in the mid-vein. Cuticle is thin and the leaf midrib vein has trichomes which are long and short. The anatomy of the leaf midrib is shown in Figure 3.

Figure 1. (From left to right) The general appearance of *Paeonia mascula*, fruits, and a herbarium specimen with flower.

Anatomy of the Leaf Upper and Under Surfaces

The leaf is bifacial. There isn't stoma on the upper surface. Stoma type is anisocytic on the under surface. The anatomy of the leaf upper and under surfaces is shown in Figure 4.

Anatomy of Petiole

There are 5 vascular bundles and it is regular. One of them is central and is the biggest, others are laterals. The size of the others is gradually diminishing. Cuticle is thin and there are druses everywhere especially on central vascular bundle. The anatomy of petiole is shown in Figure 5.

Anatomy of Fruit

Both exocarp and mesocarp are thick. Pericarp is bright yellow. There are parenchyma with starch grains and stone cell. The anatomy of fruit is shown in Figure 6.

Anatomy of Seed

There is parenchyma with starch grains. There are druses on central parenchyma cells. The anatomy of seed is shown in Figure 7.

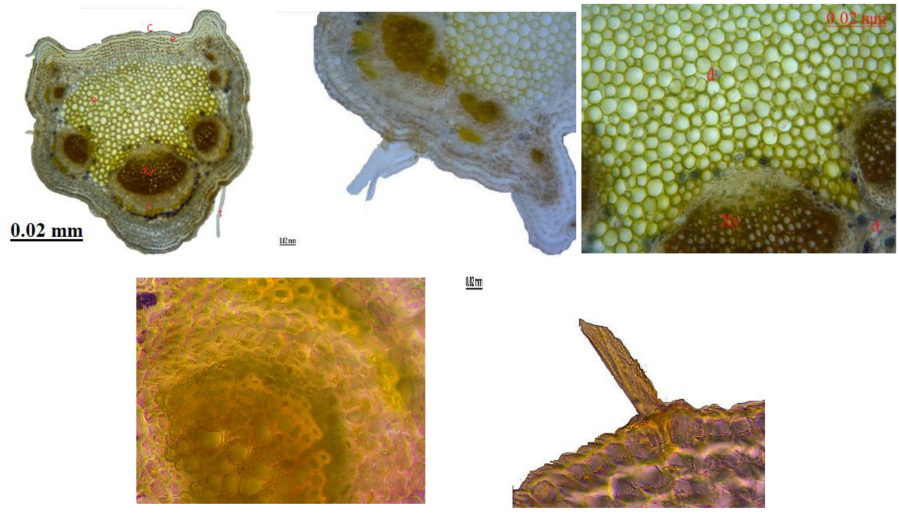

Figure 2. The anatomy of stem. c, cuticle; d, druse; e, epidermis; P, parenchyma; ph, phloem; t, trichome; xy, xylem.

Figure 3. The anatomy of mid-vein.

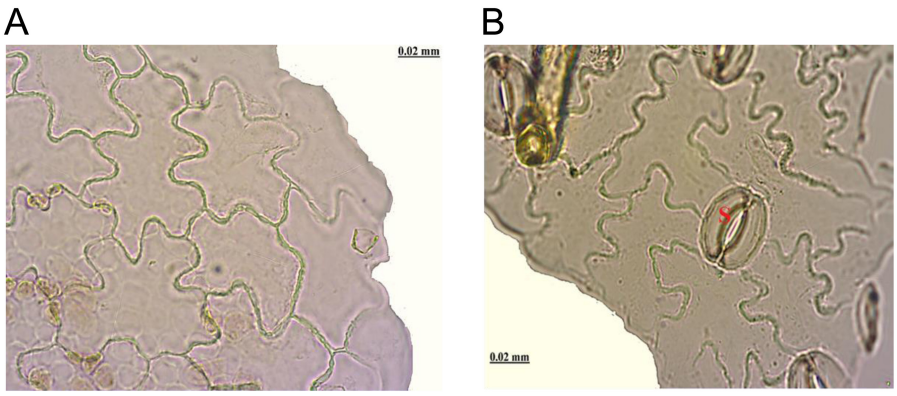

Figure 4. The anatomy of upper (A) and under (B) surfaces. S, stoma.

DISCUSSION

This study focused on examining the anatomical characteristics of the stem, leaf, petiole, seed, and fruit of *P. mascula*. The anatomical attributes described in this investigation offer a comprehensive portrayal of *P. mascula*. The results obtained from this study suggest that the observed anatomical variations could hold significance in the taxonomical categorization of the species.

The diverse array of plant species found on Earth serves as the primary source of raw materials for crude drugs. In the pharmacopoeial texts of crude drugs, a comprehensive description

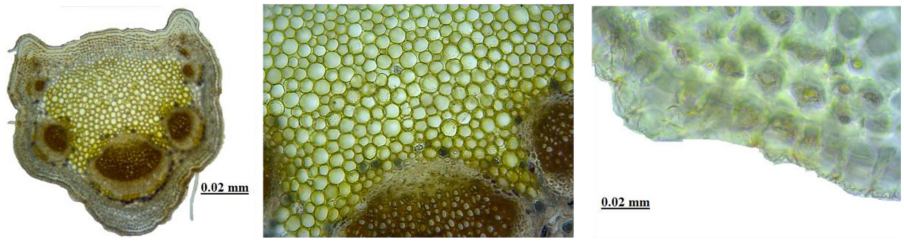

Figure 5. The anatomy of petiole.

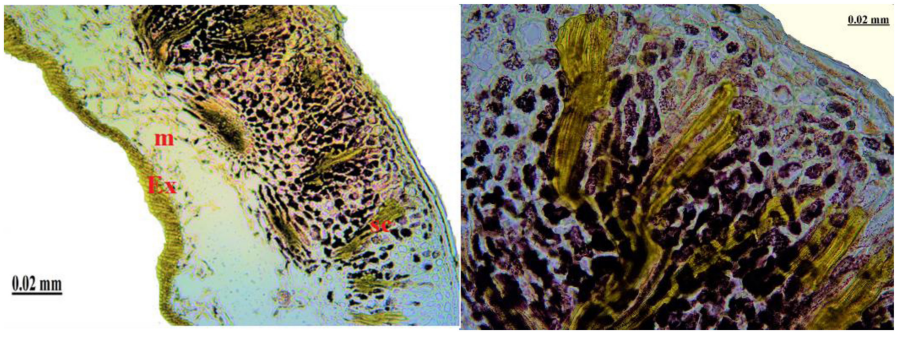

Figure 6. The anatomy of fruit. Ex, exocarp; M, mesocarp; Sc, stone cell.

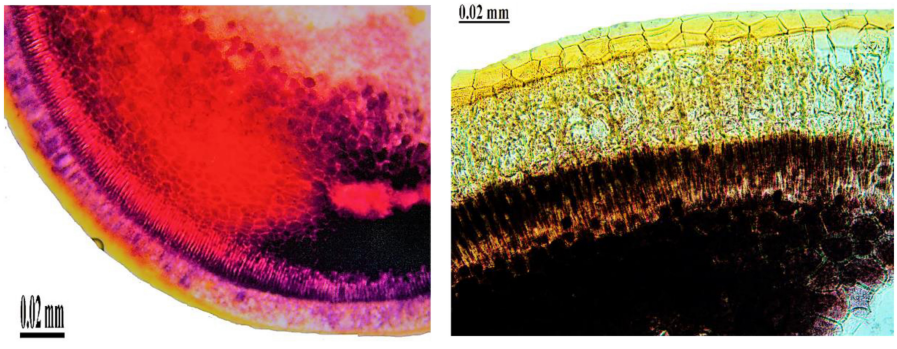

Figure 7. The anatomy of seed.

of a drug plant at both the macroscopic (morphological) and microscopic (anatomical) levels is crucial for establishing its botanical identity, ensuring the quality of herbal preparations, and establishing pharmacognostic standards. Higher plants possess various morphological organs, including roots, stems, leaves, flowers, and fruits. Some of these organs may undergo modifications to fulfill diverse functions. During analysis, factors such as the shape, size, and form, along with the color, texture, fracture characteristics, and features of the cut surface of these major organs and associated minor structures are carefully considered to establish the plant's identity and quality.[7]

The comparative examination of plant structure and anatomy has always been fundamental to plant systematics, aiming to unravel the intricacies of plant diversity, phylogeny, and evolution. The latter half of the 20th century witnessed an intriguing era during which systematics and structural studies greatly benefited from the emergence of novel techniques and methodologies.[8]

Anatomical studies in plants are of significant importance in understanding their structure, function, and overall biology. In summary, anatomical studies in plants are fundamental to numerous scientific disciplines, ranging from taxonomy and evolution to ecology, medicine, and agriculture. This comprehensive knowledge provides valuable insights into the complexity and diversity of the plant kingdom and informs various aspects of human life and the environment.

This study provides a detailed description of the anatomical properties of *P. mascula*. The findings suggest that the observed anatomical diversity could be beneficial in taxonomical classification. Our study provided a comprehensive anatomical characterization of various plant parts of *P. mascula*. We identified distinctive features such as bifacial leaf arrangement, stomata on the lower leaf epidermis, unicellular trichomes, druses in the leaf and stem, starch-bearing parenchyma in the pericarp, and druses in the seeds. These findings contribute to a better understanding of *P. mascula*'s anatomical diversity and may prove valuable in its taxonomical classification.

Ethics Committee Approval: Ethical approval was not required as there were no animal or human studies conducted.

Peer-review: Externally peer reviewed.

Author Contributions: Concept – S.G., S.K.; Design – S.G., S.K.; Supervision – S.K., Z.G.; Resources – S.G., S.K., Z.G.; Materials – S.G., S.K., Z.G.; Data Collection and/or Processing – S.G., S.K.; Analysis and/or Interpretation – S.G., S.K.; Literature Search – S.G., S.K.; Writing Manuscript – S.G., S.K.; Other – S.G., S.K., Z.G.

Declaration of Interests: The authors declare that they have no competing interest.

Funding: We would like to express the gratitude to the Scientific and Technological Research Council of Turkey (TÜBİTAK) for their support of this study under project number 119Z585.

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