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**ORIGINAL ARTICLE**

# TAXONOMIC STUDY ON *PAEONIA* L.,1753 (PAEONIACEAE) FROM IRAQ

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## ABSTRACT

The primary aim of this investigation is to update the taxonomy of the genus *Paeonia* L.,1753 (Paeoniaceae) in Iraq based on morphological characteristics, anatomical features, ecological notes, and geographic distribution using, geographic information systems (GIS). The results showed that the genus in Iraq contains only one subspecies, *P. mascula* subsp. *mascula* (L.) Mill.,1768 a perennial herbs less than 80 cm tall with ascending, cylindrical, glabrous stems, showy flowers, and underground carrot-shaped tuber roots. Anatomical analysis reveals anomocytic stomata with an elliptical or rectangular apparatus, a hypostomatic leaf, a stomatal index of 26.2%, and a stomatal density of 51 per $mm^2$. A cross-section of the leaf blade and midrib shows a bifacial leaf, and the internal leaf blade has a single, sizable, crescent-shaped vascular bundle. The cross-sections of the stem are circular, with many regular vascular bundles, and lack unicellular trichomes. Anticlinal wall patterns are strong and wavy, and the leaf epidermal cell shapes are irregular. Paeonies in Iraq inhabit only high-elevation highlands, thriving in rocky, limestone humus soils on the northern slopes of mountains within open oak forests. Geographic distribution and GIS analysis show the paeony plants grow are found only in two mountainous districts (Amadiya and Rowandouz). For the first time, this investigation in has Iraq documented six more places within the first district and two locations in the latter district. This investigation may lead to a taxonomic key for the wild paeony plants and provide a new perspective on Iraqi peony flora.

Keywords: Amadiya District, GIS *Paeonia*, Gul Bizen, *Paeonia* anatomy, Wild peony.

## INTRODUCTION

*Paeonia* L. (1753) is the only genus in the family Paeoniaceae, order Saxifragales (Hong, 2010, 2011, 2021; APG, 2016; Dong *et al*., 2018; Folk *et al*., 2019). Peonies, or the genus *Paeonia* L., are mainly found in temperate climates in southern Europe, Asia, and western North America. There are 52 recognized taxa in this genus, comprising 36 species, 15 subspecies, and one variation, according to The Plant List Database (2021). *Paeonia* has a complicated scientific categorization, with different sources recognizing different species and

sections. The genus is divided into three primary sections by the majority of references, including Stern (1946), Stearn and Davis (1988), Sang *et al.* (1997), and Hong (2010): Sect. *Moutan* DC. (East Asia), Sect. *Oanepia* Lindley (Mexico and North America), and Sect. *Paeonia* DC. (Which ranges from Spain and North Africa to Japan and China). Finally, Hong (2021) made the latest and most widely accepted scientific classification, according to which, the *Paeonia* infra-generic subdivision comprises two subgenera and seven sections, totaling 34 species. The Peony Society (2023) reports two species of *Paeonia* in Pacific North America, 17 in East and Middle Asia, and 15 in Northwestern Africa, West Asia, and Europe. On the other hand, Zhou *et al.* (2021) suggest a new taxonomic scheme for *Paeonia* L. that consists of seven sections and two subgenera. With eleven species in the Pan-Himalaya and fourteen in the Mediterranean, they identify these two regions as the genus's centers of species diversity.

The taxonomic position of *Paeonia* L. in Iraq is unknown. The existence of *Paeonia kurdistanica* Zoh. in Rowanduz District is stated before but within the Ranunculaceae family, as was mentioned by Al-Rawi (1946). According to an analysis of the most recent scientific papers available, plants of this genus have never been the subject of taxonomic or other scientific investigations in Iraq- the only exception being Townsend (1980), in the flora of Iraq, which described the species *P. mascula* only, based on two specimens collected near Sersang. He detailed the species' habitat, but didn't mention any infraspecific classification of this species. *P. kurdistanica* Zoh. was also retained by him as a synonym.

A perennial herb, *P. mascula* (L.) Miller (Sect. *Corallinae*; Subg. *Paeonia*; Gen. *Paeonia*; Fam. Paeoniaceae) has large, dissected, bi-ternate leaves, tomentose carpels and carrot-shaped roots, and is commonly as "wild peony" or "male peony," (Hong, 2021). This species includes four accepted subspecies: "*P. mascula* subsp. *russoi* (Biv:) Cdlen et HeTy., from central Spain to western Greece; *P. mascula* subsp. *hellenica* Tzanoudakis, reported from southern Greece; *P. mascula* subsp. *triternata* (Pallas ex DC.), reported from Romania, and *P. mascula* (L.) Miller subsp. *Mascula*, reported from Southern Europe to the Caucasus, Northern Iraq, and Iran. " (Cullen and Heywood, 1964; Davis and Cullen, 1965; Mouterde, 1970; Meikle, 1977; Stearn and Davis, 1984; Davis, 1988; Özhatay, 2000; Passalacqua and Bernardo, 2004; Maroofi, 2005; Hong and Wang, 2006; Ünlü, 2010; Orhan *et al.*, 2010; Hong, 2000,2010,20011and 2021; Körüklü, 2012; Assadi, 2016; Mahdavi, 2021; The Peony Society (2023); Fazli *et al.*2023). In Turkey, the term " bear rose" (Guluç, Gülhorç, Ayıgülü, Beargulu, and Beargull) refers to all the aforementioned subspecies of *P. mascula* (Yıldırımlı, 1994; Karaman and Kocabaş, 2001; Doğan, 2008; Fakir *et al.*, 2009; Ugulu *et al*., 2009).

Several plants have been identified and categorized using anatomical features such as stomatal type, size, distribution, epidermal cell shape, and anticlinal wall pattern (Zeng *et al*., 2017). Chauhan and Daniel (2011) ranked the anatomical characteristics of leaves as the second most important feature in taxonomic investigations, behind flowers and fruits. According to Ünlü (2010), particular anatomical features can group the ten taxa of herbaceous peonies that grow in Turkey, but anatomical traits alone cannot distinguish them. Also, according to Gözcü *et al*. (2023), "anatomical characteristics can be valuable for the

taxonomical classification of *Paeonia* species in Turkey." In addition, Jia *et al.* (2022) clarify that "the taxonomic significance of epidermal morphology varies depending on the genus and plant family, with trichomes, anticlinal wall patterns, stomatal shape, and stomatal density potentially playing important roles in the classification of wild tree peonies."

This portion of the study focused on the following aspects: a taxonomic study and survey of *Paeonia* taxa in Iraq's mountainous regions; a morphological study to identify the collected specimens of this genus- including roots, stems, leaves, flowers, fruits, and seeds; and an anatomical study that includes stem, petiole, leaf, and stomata. The researcher will then discuss measurements based on the collected field data and examine the ecological characteristics and geographic distribution of the identified *Paeonia* taxa.

## MATERIALS AND METHODS

**Specimens Identification:** The plant specimens were recognized based on standard identification keys from literature such as Davis and Cullen (1965), Özhatay (2000), and Hong (2010, 2011, 2021).

**Morphological study:** Data for this study were obtained from twenty-five individual field trips conducted in the MAM and MRO districts between March and December of 2022–2023. Using an Olympus dissecting microscope and a PC camera digital microscope, the morphological characteristics (approximately 42 quantitative and qualitative attributes) of all plant parts- including roots, stems, leaves, petioles, flowers (calyx, corolla, stamens, and pistils), fruits, and seeds- were analysed. This analysis was conducted both in the field and in the laboratory of the Forestry Department. Linear measurements were taken using a digital caliper (0 -150 mm). The terminology of this study is based on Guest (1966), and Lawrence (1951).

**Anatomical study:** The researcher collected the required specimens during two field trips conducted during the flowering period (late May/early June) of 2023. Ten peony plants were sampled (with two leaves and two stems/plant) from Gara Mountain and Garok within the MAM district.

Cuticular Structure: For light microscopy (LM) studies, a 1 $cm^2$ piece was cut from the center of 20 leaflets using a basic scalpel. Leaf epidermal layer separation: Sections were dehydrated in 90% ethanol for 24 to 36 hours and then stored in 70% ethanol. Each section was then randomly selected, rinsed with distilled water, dried, and submerged in equal parts glacial acetic acid and hydrogen peroxide. The portions were then incubated at 60 °C for 24 hours, following methods from Ellis (1979) and Devesa *et al.* (1992).

Staining, Mounting, and Microscopic Examination: Safranin-glycerin jelly was used to stain the adaxial and abaxial peels of the softened leaflets. These were mounted on microscopic slides and covered with cover slip. Using an optical microscope of the Zeiss type operating at E40 with a 10X lens, it was prepared for examination of epidermal cells and stomata. Dino-Captures 2.0 version 1.4.0.B, a multifunctional digital microscope, was used

for precise measurements. This work uses terminology from Metcalfe and Chalk (1950), Esau (1965), Radford *et al*. (1974), and Rudall (2020).

Epidermal cells and stomata measurements: Several anatomical features of the leaves were measured in this study, comprising average values derived from thirty observations per parameter. Recorded measurements included the dimensions of abaxial and adaxial epidermal cells. Additionally, the number of epidermal cells per square millimeter ($mm^2$) was used to compute the epidermal cell density. Stomatal dimensions were also measured, focusing on the size and type of the stomata, in accordance with Prabhakar (2004). Stomatal density was resolved as the number of stomata per square millimeter ($mm^2$). Stomatal index (%) was calculated using the formula from Saadu *et al*. (2009) as: Stomatal Index% = {stomatal density / (stomatal density + epidermal cell density)} ×100.

**Preparation of permanent cross sections (leaf blade, petiole, and stem):** Killing and Fixation: fresh parts of leaflets, petioles, and stems, each ranging from from 0.5 to 2 cm length, were stored in 20 ml of FAA solution (formalin: glacial acetic acid: ethyl alcohol 5:5:90) and kept at room temperature for 20 to 24 hours, following Jay (1991).
Washing: Sample were washed twice with 70% ethanol to remove fixation residues and were preserved at the same concentration.

Preparation and staining of cross sections: Using the modified histopathological technique of Bancroft and Gamble (2013), I prepared and stained cross-sections of leaflets, petioles, and stems with hematoxylin and eosin (H&E) as follows: Paraffin was removed from the sections by immersing them in xylene three times, each for 10 minutes. The slide sections were rehydrated by passed through a series of decreasing ethanol concentrations- absolute, 90%, 80%, and 70% - each step lasting five minutes, ending with a wash in distilled water. They were then immersed in Gel's hematoxylin for one to three minutes, after which they were quickly washed with distilled water to remove excess stain. The slides were rinsed under running water until they regained their blue color after treatment with 1% acidic alcohol (1% hydrochloric acid in 70% alcohol) for five minutes. After five minutes of staining in 0.5% eosin, the sections were rinsed in tap water for one to five minutes to remove any remaining stain. The sections were slowly dehydrated in increasing ethanol concentrations (50%, 70%, 80%, 90%, and absolute ethanol) for longer periods (10 minutes per step). They were then perfused in d-limonene twice for 5 minutes per step. The sections were then mounted in dextrin-xylene (D.P.X.) by covering the slides and drying them at room temperature. Any remaining stain on the slides were removed using filter paper, and the sections were ready for microscopic examination.

**Ecology and geographical distribution:** This study was based on information collected from personal field trips in two mountain districts from March to December of 2022–2023, and each location was visited two to three times. The MAM and MRO districts of the Iraqi Kurdistan Region were visited on these field trips, along with literature such as Flora of Iraq (Townsend, 1980). A Geographic Information System (GIS) was used to determine the plants' distribution and frequency. The Global Positioning System (GPS) was used to measure the

plants' altitudes and latitudes, and a Sony digital camera (16 X Megapixels, 10X zoom) was used to take pictures of the plants in their environments.

## RESULTS AND DISCUSSION

**Taxonomy**

***Paeonia mascula*** subsp. ***mascula*** (L.) Mill., 1768

Synonyms: *Paeonia mas* Garsault; Fig. Pl. Anim. Med, t. 435 a (1764); *Paeonia corallina* Retz.; Observ. Bot. 3: 34 (1783); *Paeonia integra* Murray; Commentat. Soc. Regiae Sci. Gött. 7: 92 (1786); *Paeonia officinalis* subsp. *corallina* (Retz.) Fiori; Fl. Italia 1: 527 (1898); *Paeonia kavachensis* Azn.; Magyar Bot. Lap. 16: 7 (1918); *Paeonia corallina* var. *orientalis* J. Thiébaut; in Bull. Soc. Bot. France 81: 114 (1934); *Paeonia kurdistanica* Zohary; Palestine J. Bot. Jerusalem Ser. 2: 155 (1941); *Paeonia arietina* var. *orientalis* (J. Thiébaut) Stern in J. Roy. Hort. Soc. 68: 127 (1943); *Paeonia mascula* subsp. *orientalis* (J. Thiébaut) D.Y. Hong; Acta Phytotax. Sin. 38(4): 382 (2000).

Botanical description: Perennials, roots are carrot-shaped, orange, with tuberous rootstock 1 – 2.5 cm in diameter near the base of the stem (Pl.1A, B), herbaceous plants 25 – 77 cm tall (range 49.8 cm ), with 3.0–5.0 white-purple or purplish scales at the base. One to four aerial stems emerge from the rootstock of each plant. Stems ascending, glabrous, mostly green, sometimes with purple spots or partially purple at the base. Scales are simple, elongated, surrounding the stem, with parallel venation, 5.5 – 15.0 cm in length, with an average of 10.3 cm, and 1.2–2.8 cm in width, with an average of 1.84 cm, where 5.86 is the ratio of scale length to scale width. The stem's height from base to first leaf ranges between 11 and 42 cm, with an average of 26 cm. Its diameter ranges between 0.6 and 1.4 cm, with an average of 0.9 cm. The leaves are alternate and exstipulate. Petioles and petiolules are glabrous, and range in length from 3.5 to 5.0 cm, with an average of 8.4 cm. Lower leaves biternate with three to five leaflets; leaflets/leaf segments range from 9 –18, with an average of 12; rarely less (9) or more 18). Typically, upper leaflets consist of segments: terminal leaflet, glabrous, ovate, obovate or oblong, cuneate at the base, acute at the apex, 7 – 11 cm long, and 3.0–6.5 cm broad. The terminal leaflet length to leaflet width ratio is 1.62. Involucrate bracts ranged from one to three, with the majority being lanceolate or ovate to oblong-ovate, glabrous, and leaf-like. They are 3.5 to 9.0 cm long, with an average of 6.7 cm, and 1.2 to 5.5 cm wide, with an average of 3.5 cm. The ratio of bract length to bract width is two (Pl.1F). Flowers are solitary and terminal, 6.3 – 9.4 cm in diameter with an average of 7.7 cm; the calyx is polysepalous with 3 – 4 sepals, always 4 in decussate arrangement- 2 large and 2 small- all rounded at the apex, green, purple, or purple at the periphery; glabrous, boat-shaped, 1–3.4 cm long with an average of 2.4 cm, 0.6–2.5 cm wide with an average of 1.6 cm; the sepal length to width ratio is 1.49 (H, Pl.1G); the corolla is polypetalous flower with five to nine petals, each limb without a claw, pink, red, and white with a pink tint at the base or rim, oblong, rounded, or toothed at the tip, and measures 4.5 to 5.8 cm in length with an average of 5.1 cm and 2.8 to 4.2 cm in width with an average of 3.4 cm. The ratio of petal length to petal width is 1.49 (Pl.1I, J). The anther is yellow, and has two anther-sacs, is dorsifixed, and dehisces longitudinally, 0.5 – 1.0 cm long, with an average of 0.8 cm; the filaments are purple, filiform shaped, and glabrous, and the stamens are arranged in whorls (Pl.1J, K) and numbering

between 285 and 330, with an average of 310 stamens arranged in whorls; Gynoecium Three to five carpels, usually three, erect, free, and encircled at the base by a depressed fleshy disc, are tomentose; there are no styles, and stigmas are 0.5 to 0.8 cm long with an average of 0.7 cm, purple (Pl.1L, M,); superior ovary, ovoid-shaped, with ovules with marginal placentation (biserrate), 0.8 – 2 cm long with an average of 1.4 cm, 0.5 – 1 cm wide, with an average of 0.8 cm. Fruits are very hairy upon maturity, dehiscent adaxially, ovoid-columnar or irregular, shaped like a jester's hat (Pl.1N), consisting of 2 – 5 follicles, typically 3, 2.8 – 4.1 cm long with an average of 3.4 cm, 0.8 – 2 cm width with an average of 1.5 cm, each follicle holds 11 – 16 seeds, and the average number of seeds per fruit is 39 seeds, however only 8 – 14 of them develop correctly in each fruit, and the percentage of seeds that are rejected varied between 18 and 29 (approximately 67%) (Pl.1O, Q). A suture allows the fruits to open, releasing seeds. Seeds are spherical to ovoid-elongated shape, were red and black when ripe, and measure 0.7 – 1 cm long with an average of 0.8 cm and 0.5 – 0.8 cm wide with an average of 0.6 cm. The ratio of seed length to seed width is 1.4 (Pl.1Q, R, and S), (Appendix 1, 2).

Paeonies plants in Iraq were recognized based on identification keys from standard literature such as Davis and Cullen (1965), Mouterde (1970), Meikle (1977), Stearn and Davis (1984), Davis (1988), Özhatay (2000), and notably newer ones such as Hong (2010, 2011, 2021). Additionally, depending on other evidence was considered, such as Hong's (2000) study, which identified two herbarium specimens: No. 959, collected by R. Wheeler Haines at an elevation of 960 m near Sarseng on May 14, 1957, and another from Turkey, Hakkari, but collected from the distance between Amadiya and Dohuk at an elevation of 1200 m with the number 11678 by K. H. on July 12, 1957. Both specimens were identified as *P. mascula* subsp. *orientalis*, which was later reclassified as a synonym of *P. mascula* subsp. *mascula*. Additionally, Hong and Wang (2006) examined two specimens that were gathered near Sarseng (specimen No. 26370 by E. Chapman on September 26, 1933, at an altitude of 920, and R. Wheeler Haines specimen No. 959 on May 14, 1957), which were adopted by Townsend (1980) to describe the Iraqi paeony as a species (*P. mascula*). However, there are some discrepancies between some of these references, such as Assadi's (2016) study, which indicated that the subspecies in question had two carpels, while this study showed the presence of between two and five carpels. The morphological characteristics of flowers, fruits, leaflets/leaf segments, and lower leaves were of great taxonomic value for isolating and identifying paeony plants that occur in Iraq, because most of the morphological results in this study are consistent with the identification keys of previous research mentioned above, especially Hong's identification key 2021. Accordingly, this morphological investigation indicates that the Iraqi peony, described by Townsend (1980), is the subspecies *P. mascula mascula*, and this subspecies has been described in detail. The study also provides a new perspective on the peony flora of Iraq.

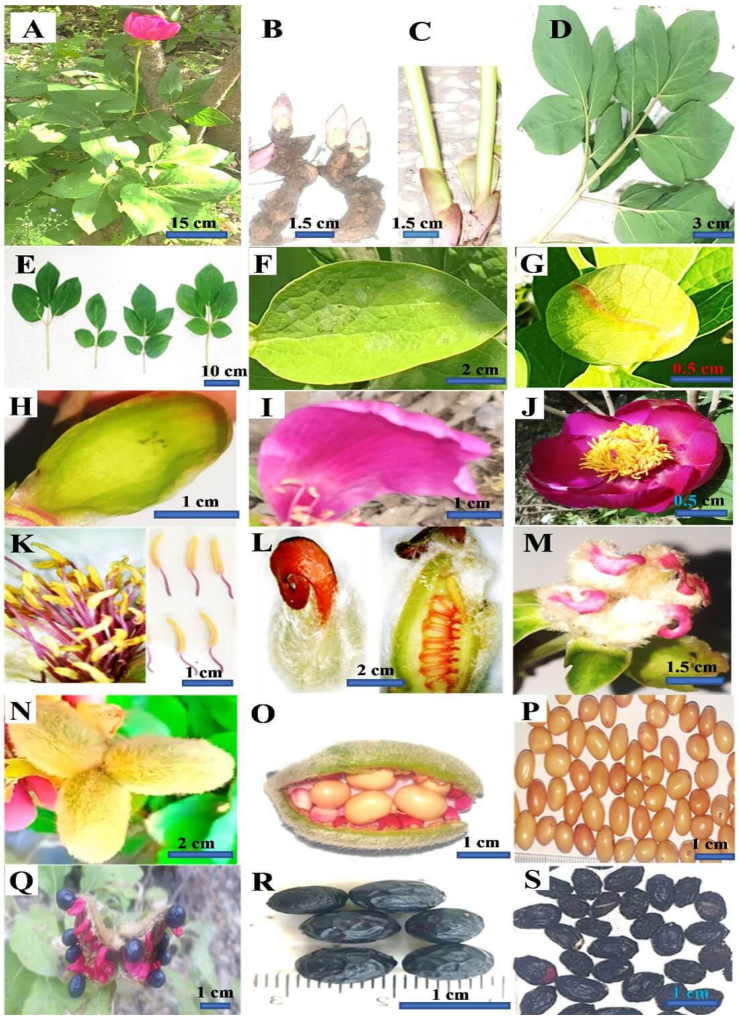



**Plate (1):** Morphological characters in *P. mascula* subsp. *Mascula*; (A) Whole plant, (B) Roots and vegetative buds, (C) Stem and bud scales, (D) Leaf, (E) Leaflets, (F) Bract, (G) Floral bud, (H) Sepal, (I) Petal, (J) Flower, (K) Anthers, (L) Ovary and Stigma, (M) Carpels, (N, O) Unmatured Fruit, (P) Unripe Seeds, (Q) Dispersal matured fruit, (R, S) Ripened seeds.

Identification key to the subspecies of *Paeonia mascula* in Iraq

1. Flowers red or pink, leaves mostly glabrous, leaflets/leaf segments of lower leaves (8) 9 - 18 (19), follicles 3 - 4 cm long. ……..……..……..subsp. ***mascula***
 - Flowers mostly white, leaves always hispid, Leaflets/leaf segments of lower leaves 9 - 11 in number, follicles 4 - 7 cm long……..…… **2**
2. Leaves nearly always hispid, scarcely glabrous below ……subsp. ***russoi***
 - Leaves mostly glabrous, sparsely hispid below ……..……. **3**

3. Leaflets/leaf segments of lower leaves 7 - 11 in number, terminal leaflets 12 -15 × 6 - 9 cm, follicles 4 - 6 cm ……..……..... subsp. ***bodurii***
- Leaflets/leaf segments of lower leaves (9 -) 11 - 14 (-21) in number, terminal leaflets 9 - 13 × 4.5 - 7.5 cm, follicles 5 - 7 cm long…….……..subsp. ***hellenica***

**Anatomical Descriptions**

1. Anticlinal Wall Pattern and Cell Shape in the Leaf Epidermis

Anticlinal wall pattern of the epidermal cells on the adaxial and abaxial surfaces of *P. mascula* subsp. *mascula* is of a strong, wavy type, and the epidermal cells on both adaxial and abaxial surfaces had an irregular form. The results showed that the subsp. *mascula* leaves under study differed in the size of the epidermal cells on the adaxial and abaxial surfaces. In addition, the epidermal cells on the adaxial surfaces were larger than those on the abaxial; their respective sizes are 43.20 × 64.60 µm and 39.37 × 55.72 µm (Pl.2 B, C, D).

The adaxial surface ranged from 108 to 152 cells / $mm^2$, while the abaxial surface ranged from 112 to 158 cells / $mm^2$. Within the taxon under investigation, there was no discernible difference in the number of epidermal cells / $mm^2$ between the two surfaces.

2. Anatomy of the leaflet blade and midrib

Bifacial mesophyll (palisade parenchyma layer on the upper surface and spongy parenchyma layer on the lower surface) was present in the leaves of the subspecies under study. Leaf blade thickness varied from 123 to 167 µm. One or two layers was of tightly packed palisade parenchyma cells with many chloroplasts, averaging 56 µmin thickness, formed the mesophyll. This was succeeded by spongy parenchyma, averaging 78 µm in thickness and containing 4-6 layers (sometimes 3) of loosely arranged spongy cells. In most of the leaves studied, there were few air-lacunae between these cells (Pl. 2B). Blade angle varied from 120 to 140 among the wild peony leaves under study (Pl. 2A). A thin cuticle layer, about 1 µm thick, covered both the upper and lower epidermis. The upper and lower epidermis were nearly identical, except that the upper epidermal cells were larger than the lower ones (Pl. 2A, B). One layer of cells with square, elongated, or rectangular shapes makes up the basic top epidermis; these cells were thick and varied in size, with the upper epidermis having an average thickness of 15.30 µm. Every leaf had a single, sizable, crescent-shaped vascular bundle in the middle of the leaf. The xylem, located on the underside of the leaflet blade, formed part of the midrib vascular bundle, with the phloem situated within the vascular bundle tissue, extending towards the upper surface of the leaflet blade (Pl. 2A). These results are consistent with research by Ünlü (2010) and Gözcü *et al.* (2023), except for the absence of unicellular trichomes are not especially visible in leaves of *P. mascula* subsp. *mascula*.

3. Stomata Complex

According to the results, stomata only appeared on the abaxial epidermis of the wild peony's leaves, which were all hypostomatic (Pl. 2 B, C). Kidney-shaped guard cells encircled the elliptic stomata (Pl.2 C). Also, the abaxial surface of the taxon under study bears a single stoma: anomocytic or irregular-celled type. On the adaxial surface, it lacks stomata (Pl. 2 B, C, D). Within the genus *Paeonia*, the examined taxon's stomata varied in size from about 17 - 22

× 20 - 27µm. According to Saadu *et al.* (2009), the stomata index is 26.2%, and the stomatal density varies between 32 and 69 stomata per square millimeter. The hypostomatic leaves are with anomocytic stomata (a common form for the Ranunculaceae family) and corroborate earlier studies by Ünlü (2010), Jia *et al*. (2022), Watson and Dallwitz (1992), and Avita and Inamdar (1980).

4. Leaf petiole anatomy

The petiole's transverse section, semicircular and concave on the leaf's adaxial surface, reveals that the epidermis had a thin layer of cuticle consisted of a single layer of tiny, square to oblong cells measuring 9–13 µm in thickness. Beneath the epidermis, two layers of angular chlorenchyma cells supported the leaflet (Pl.2 E). In the cross sections of the leaf petiole, the largest vascular bundle, resembling kidneys or beans, was centrally situated, and seven to nine vascular bundles of various sizes were arranged laterally, decreasing in size.

The investigation results decrease laterally; this result agrees with Ünlü (2010) study on *P. mascula* subsp. *mascula,* but the number and shapes of vascular bundles in this study differ from those in the research by Gözcü *et al.* (2023). This discrepancy may be because the latter did not identify the *P. mascula* subspecies, suggesting it may belong to a different subspecies than the one examined here.

5. Stem anatomy

A cuticle is the outermost layer, characterized by its thin and striated texture, measuring approximately 1 µm in thickness. Below the cuticle lies the epidermis, which consists of tightly packed cells that serve as the primary protective barrier for the stem. Directly beneath the epidermis is the cortex, a continuous layer of square to somewhat elongated cells, arranged in several (7–10) rows of chlorenchyma cells, some of which contain starch grains. The vascular cylinder, represented by the phloem and xylem, with the vascular cambium positioned between them, froms a continuous ring. Finally, large parenchymal cells comprise the pith, particularly in the center. These cells' thin walls and interstitial spaces expand toward the center. The stems eventually appear semi-hollow (Pl. 2 F).

Most of the results from this study's stem cross-section conflict with previous findings on *P. mascula*, such as Ünlü (2010) and Gözcü *et al*. (2023) which discovered that the stem cross-section comprises seven or nine vascular bundles, along with trichomes, and resembles a bear's head. In contrast, the current study reveals that the stem cross-sections are round, devoid of trichomes, and contain several regularly arranged vascular bundles.

The results of this study differed from those of the aforementioned studies for several reasons. One explanation for the disparate findings could be that this study used different methodologies and techniques of examinations. Second, the varying ages of the plants may be a factor, as the plant developmental stage influences stem cross-section morphology. Third, this study conducted in a unique environment compared to others; external factors like soil composition, climate, and other environmental pressures may have caused differences in plant architecture. A final explanation is that the samples considered in this study may be from a

new ecotype or subspecies of *P. mascula*, which would explain the discrepancies by exhibiting unique anatomical characteristics not observed in previous studies.

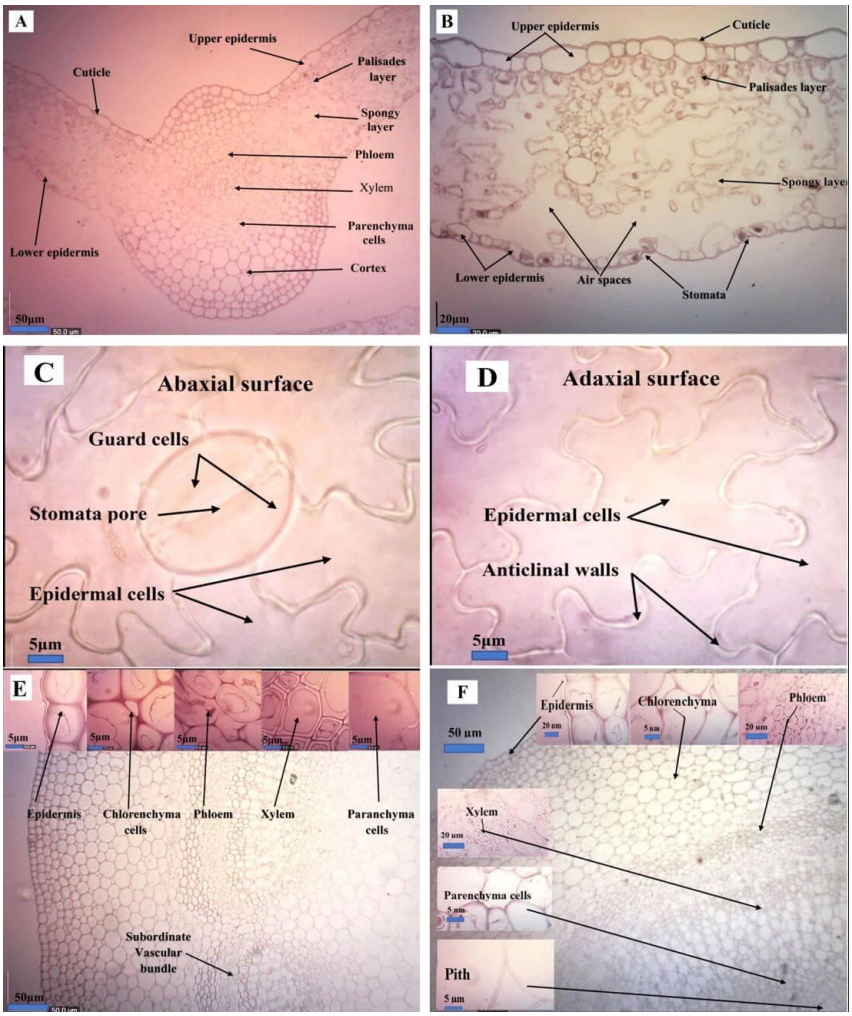



**Plate (2):**Anatomy characteristics of *P. mascula* subsp. *mascula* under a light microscope (LM); (A) Leaflet midrib vein, (B) Leaflet blade, (C) Lower epidermis of the leaflet, (D) Upper epidermis of the leaflet, (E) Leaf petiole, (F) Stem.

**Ecology and geographical distribution**

1. Ecology

The field survey that the members of the *Paeonia* L. are growing in the northwest of Iraq's Kurdistan Region, between longitudes 43°14'20.80.0 " E to 44° 9'41.82.0 " E and latitudes 36°55'7.71.0 "N to 37°15'23.91.0 "N Map 1. Researchers also discovered taxonomic ranks of the genus the northern aspects of mountain environments, particularly in the districts of

Amadiya (MAM) and Rowandouz (MRO), which served as the focal point for the genus's spread in Iraq, as depicted in (Map 1) and the research specified that *Paeonia* L. species are present only in Iraq's highlands, which had a Mediterranean-like environment, with high elevations ranging from 1000 and 1700 meters above sea level and an average annual rainfall of 900 to 1100 mm.

Throughout the field observations, only one subspecies- (*P. mascula* subsp. *mascula*) of the genus *Paeonia* -was recorded in Iraq and called by local people in the Kurdistan Region as Goat Rose (GUL BIZEN). This subspecies grows in populations on northern aspects of mountains, slopes, among rocks, shady cliffs, rocky and limestone soils, and in open areas of oak forests, and associated with Various tree and shrub species including: *Quercus aegilops* L.,1753, *Quercus infectoria* Oliv.,1862, *Quercus libani* Oliv.1862, *Pyrus syriaca* Boiss.,1846, *Prunus macrocarpa* C. A. Mey.,1831, *Rubus sanctus* Schre.,1837, *Rhus coriaria* L.,1753, *Acer monspessulanum* L.1753, *Paliurus spina- Christi* Miller.,1768, *Crataegus azarolus* L.,1753, *Rosa dumalis* subsp. *boissier* (Crepin) Nilssoni, 1984, *Rosa canina* var. *dumetorum* (Thuill.) Desv, 1815, and some herbaceous plants, such as *Fritillaria imperials* L., 1753 (Pl.3).

This study confirmed occasional similarities and differences in the preference of plants for different soil types, where rocky and limestone humus soils were found to support the richest number of plants (Pl.3). These acidic and low salinity soils characterize the mountainous region's soil, as they are rich in organic matter. The wide variation in environmental conditions within the mountainous areas helps meet the conservation needs of different plants of the genus *Paeonia*. Additionally, the high stomatal index observed in the anatomical study suggested that Iraqi paeony plants could perform photosynthesis more effectively and were frequently found in environments with sufficient moisture. According to this study, the mountain districts of MAM and MRO are confirmed habitats for *P. mascula* subsp. *mascula*.

2. Geographical Distribution

Defining the geographic distribution of the species can distinguish them and taxa below any genus. Altitude had a taxonomic role in determining the presence or absence of species, and geographic distribution of the species had a substantial impact on their physical traits. According to the current study, nine previously undocumented areas in Iraq were identified as habitats for wild peonies. Two of these sites are located on Gara Mountain: above Ashawa village and Garok, across from the Sarsang sub-district. The second location, which was situated at 1000 meters above sea level at latitudes 37° 1'37.30.0 " N and longitudes 43°20'46.69.0 "E, hosts a small population of only seven plants, while the first location, located between latitudes 37° 0'19.77.0 "N and longitudes 43°19'22.06.0 " E at elevations ranging from 1450 to 1520 m, contains three populations of 10 to 14 plants each. Also, in Barwari Bala, Hirore village, there were two populations of nine plants each along the Turkish border, found at latitudes 37°15'23.91.0" N and 43°14'20.80.0"E, longitudes at an elevation of 1250m, and a population of roughly twelve plants, at latitudes 36°55'3.23"N and longitudes 43°25'49.40.0"E, at an elevation of 1200m, in Kani Maze village. Also, in Shkafta village (Kure Sher Mountain), close to the Chemanke sub-district, there was a population of roughly 13 plants in latitudes 36°55'7.71.0 "N and 43°27'55.85.0 "E, with longitudes at an elevation of

1100 m. Above Harika village (Heft Tabeq Mountain), there were 14 plants at latitudes 37° 1'32.88.0" N and 43°40'45.66.0 "E, with longitudes at an elevation of 1000 m. Above Merge village (Matin Mountain), there was a population of 21 plants at latitudes 37° 4'21.62.0 " N and 43°41'36.68.0 "E, longitudes at an elevation of 1400m within the MAM district and also within the MRO district in Hasne village near the Barzan sub-district, where a population of approximately 17 plants was recorded at latitudes 36°57'15.07.0 "N and 44° 2'24.26.0 "E, longitudes at an elevation of 1250m, and, finally, in Lere village near Sherwan Mazin sub-district, where a population of 15 plants was recorded at latitudes 36°59'38.85.0 "N and 44° 9'41.82.0 "E, longitudes at an elevation of 1300m, as illustrated in Maps 1, 2. For the first time in Iraq, all the study's locations were considered new local records within the MAM and MRO districts, except for the Garok (across from the Sarsang sub-district) in the MAM district, which was previously reported by Townsend (1980) in Flora of Iraq.

3. Habitats: The study's habitats included oak forests, bushes on hills and meadows, rocky limestone slopes, northern sides, and elevations between 1000 and 1550 meters.

Regarding the distribution of wild peonies in Iraq's geographical districts, the current study verified that they originate only in two districts (MAM and MRO), with the first district serving as the best hub for their spread, and the second district was documented for the first time in Iraq. Furthermore, the second location, Gara Mountain (above Ashawa), had the most plants (42), whereas the first location, Garok (opposite Sersang), had the fewest plants (7). Analysis of environmental data and GIS-based occurrence values (Map 2) showed that Iraqi wild peonies were better suited to higher elevations (over 1400 meters) than lower ones (under 1000 meters) across all study sites. Therefore, the previously listed location (Garok) is unsuitable for this species' growth and reproduction in Iraq. This suggests that lower temperatures and higher humidity are optimal for their growth. The geographic range of wild peonies in Iraq is generally restricted several factors, including their unique ecological needs, isolation from other areas, climate change, competition from other species, and possible reproductive constraints. The conservation of these plant communities requires an understanding of and efforts to preserve their special ecosystems.

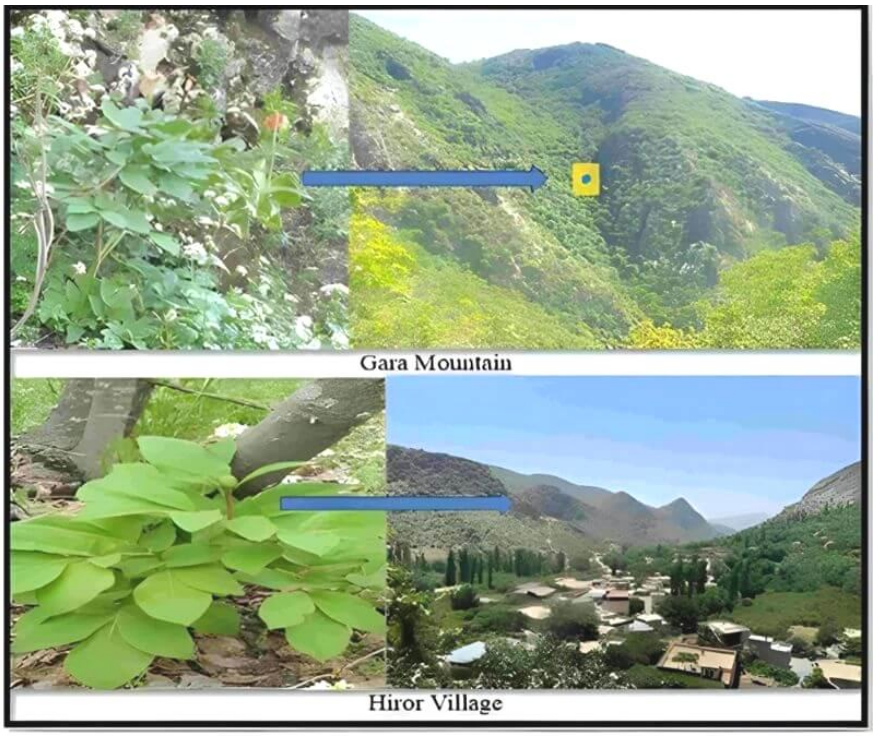
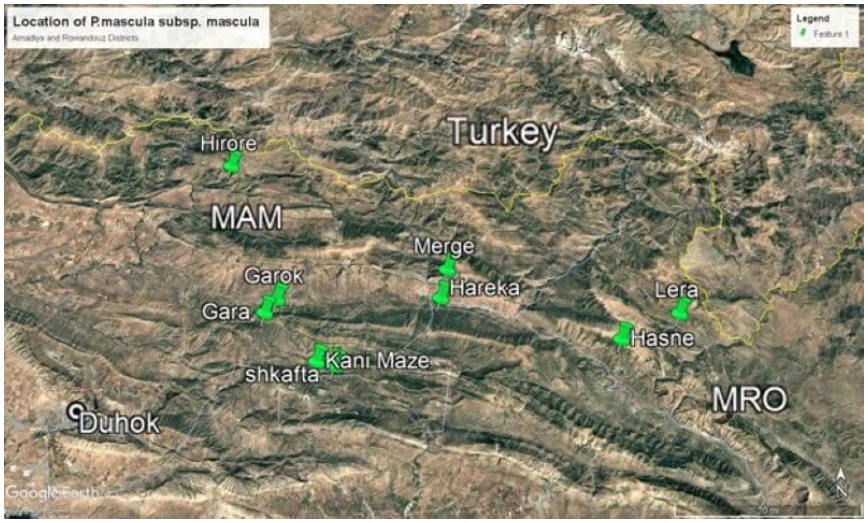
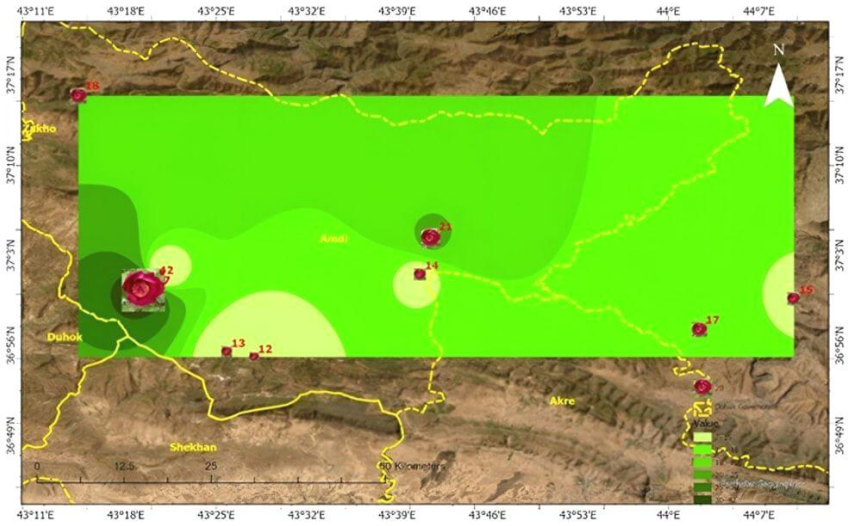



**Plate (3):** Some field photographs of the peony plants and their locations.




**Map (1):** Geographical distribution for *P. mascula* subsp. *mascula* in Iraq.




**Map (2):** The value of the occurrence of *P. mascula* subsp. *mascula* for each location in Iraq.

## CONCLUSIONS

The above observation concludes that, apart from traditional morphological information recorded in the Flora of Iraq, no detailed taxonomic study of the genus *Paeonia* exists in in the country. This gap in knowledge prompted us to conduct this study to update the taxonomic status of the genus in Iraq. A combination of morphological and anatomical characteristics, environmental information, and geographical distribution played an important role in identifying and isolating taxonomic units. The morphological characteristics of flowers, fruits, and leaflets/lower leaf parts were of great taxonomic value for isolating *P. mascula* infraspecific, found in Iraq. Anatomical characteristics confirmed that the leaf was bifacial, hypostomatic, had anomocytic stomata, and the cross-section of the stem was round, without glandular trichomes, and contained many regular vascular bundles. A field survey showed that the plants of the genus gerw in oak forests, meadows, and hills, and on limestone rocky slopes on the north-facing aspects, at altitudes ranging from 1000–1550 m. The species was adapted to low temperatures and high humidity, and is primarily found in the Amadiya and Rawanduz districts within the mountainous districts. For the first time, GIS was used to calculate plant density separately and document the species in several new locations in Iraq. Also, the study provided a new perspective on the peony flora of Iraq.

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CONFLICT OF INTEREST

"The authors declare that they have no conflicts of interest".

LITERATURE CITED

Al-Rawi, A. 1964. Wild plants of Iraq with their distribution. State Board for Agricultural & Water Resources Research, National Herbarium of Iraq, Ministry of Agriculture & Irrigation, Baghdad, 220 pp.

APG (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. [CrossRef]

Assadi, M. 2016. A taxonomic revision of the genus *Paeonia* (Paeoniaceae) in Iran. *The Iranian Journal of Botany*, 22: 75-78. [Click here]

Avita, S. R. and Inamdar, J.A. 1980. Structure and ontogeny of stomata in Ranunculaceae and Paeoniaceae. *Flora*, 170: 354-370. [CrossRef]

Bancroft, J. D. and Gamble, M. 2013. Theory and Practice of Histological Techniques, 7th ed. London: Churchill Livingstone, Elsevier, 604 pp.

Chauhan, D. and Daniel, M. 2011. Foliar micromorphological studies on some members of the family Fabaceae. *International Journal of Pharma and Bio Sciences*, 2 (4): 603-611. [Click here]

Cullen, J. and Heywood, V. H. 1964. *Paeonia*. In Flora Europaea, edited by T. G. Tutin et al., 1: 243-244. Cambridge: Cambridge University Press.

Davis, P. H. 1988. *Paeonia* L. *In*: Davis, P. H., Mill, R. R. and Tan, K. (Eds), Flora of Turkey and the East Aegean Islands, 10 (Supplement 1): 22-23. Edinburgh: Edinburgh University Press.

Davis, P. H. and Cullen, J. 1965. Paeonia L. In Flora of Turkey and the East Aegean Islands, edited by Davis, P. H., 1: 204–206. Edinburgh: Edinburgh University Press.

Devesa, J. A., López, J., Ruiz, T., Ortega-Olivencia, A., Tormo, R., Viera, M. C. and Vázquez, F. M. 1992. Anatomía foliar y palinología de las gramíneas extremeñas. Servicio de publicaciones de la Universidad de Extremadura. Badajoz. [Google Scholar]

Doğan, A. 2008. Plants used as traditional folk medicine of Ovacık (Tunceli) region. Master's thesis, Marmara University, Faculty of Pharmacy, Department of Pharmaceutical Botany, Istanbul, 111 pp.

Dong, W., Xu, C., Wu, P., Cheng, T., Yu, J., Zhou, S. and Hong, D.Y. 2018. Resolving the systematic positions of enigmatic taxa: Manipulating the chloroplast genome data of Saxifragales. *Molecular Phylogenetics and Evolution*, 126: 321-330. [CrossRef]

Ellis, R. 1979. A procedure for standardizing comparative leaf anatomy in the Poaceae. II. The epidermis as seen in surface view. *Bothalia*, 12 (4): 641-671. [CrossRef]

Esau, K. 1965. Plant Anatomy. 2nd ed. New York: John Wiley and Sons, Inc., 63pp.

Fakir, H., Korkmaz, M. and Güler, B. 2009. Medicinal plant diversity of the western Mediterranean region in Turkey. *Journal of Applied Biological Sciences*, 3(2): 30-40. [Click here]

Fazli, M., Ahmadi, N., Kashkooli, A. B., Mozaffarian, V. and Wang, S. 2023. Breeding history, phytochemical properties, and distribution of *Paeonia* spp. in Iran. *Journal of Medicinal Plants and Herbs*, 2: 1-12. [Click here]

Folk, R. A., Stubbs, R. L., Mort, M. E., Cellinese, N., Allen, J. M., Solis, P. S., Soltis, D. E. and Guralnick, R. P. 2019. Rates of niche and phenotype evolution lag behind diversification in temperate radiation. *Proceedings of the National Academy of Sciences*, 116 (22): 10874-10882. [CrossRef]

Gözcü, S., Karakaya, S. and Güvenalp, Z. 2023. Anatomy of *Paeonia mascula* (L.) Mill. (Paeoniaceae). *Pharmata*, 3(4): 95-98. [CrossRef]

Guest, E. 1966. Flora of Iraq (Vol. 1). Ministry of Agriculture, Iraq, 213 pp.

Hong, D. Y. 2000. A subspecies of *Paeonia mascula* (Paeoniaceae) from W. Asia and S.E. Europe. *Acta Phytotaxonomica Sinica*, 38(4): 381-385.

Hong, D. Y. 2010. Peonies of the World: Taxonomy and Phytogeography. Kew Publishing; Missouri Botanical Garden. [Click here]

Hong, D. Y. 2011. Peonies of the World: Polymorphism and diversity. Kew Publishing: Royal Botanic Gardens, Kew, p. XII-XV. [Click here]

Hong, D.Y. 2021. Peonies of the World. Part III: Phylogeny and evolution. Kew Publishing: Royal Botanic Gardens, Kew, p. 215-222. [Click here]

Hong, D. Y. and Wang, X. Q. 2006. The identity of *Paeonia corsica* Sieber ex Tausch (Paeoniaceae) with special reference to its relationship with *P. mascula* (L.) Mill. *Feddes Repertorium: Zeitschrift für Botanische Taxonomie und Geobotanik*, 117(1-2): 65-84.

Jay, A. D. 1991. A simple method for the fixation and staining of plant material for anatomy. *Journal of Biological Education*, 25(3): 179-184.

Jia, W., Wang, Y., Qi, Q., He, S., Mi, Z. and Zhu, X. 2022. Leaf epidermal morphology of ten wild tree peonies in China and its taxonomic significance. *Horticulturae*, 8(6): 502. [CrossRef]

Karaman, Ş. and Kocabaş, Y. Z. 2001. Traditional medicinal plants of K. Maras (Turkey). *The Sciences*, 1(3): 125-128. [CrossRef]

Körüklü, S. T. 2012. Paeoniaceae. *In*: Güner, A., Aslan, S., Ekim, T., Vural, M. and Babaç, M. T. (eds.), List of Turkish Plants (Vascular Plants) (pp. 659–660). Nezahat Gokyigit Botanical Garden and Flora Research Association Publication.

Lawrence, G. H. M. 1951. Taxonomy of vascular plants. The Macmillan Publishing Co., Inc., 823 pp.

Mahdavi Fikjur, A. 2021. Study of botany, phytochemistry, and propagation methods of Iranian Paeonies species. Ph D thesis, Department of Horticultural Sciences, University of Gilan, Iran, 292 pp.

Maroofi, H. 2005. Record of *Paeonia mascula* (Paeoniaceae) from Iran. *The Iranian Journal of Botany*, 11(1): 97-99. [Click here]

Meikle, D. R. 1977. *Paeonia* in Flora of Cyprus (Vol. 1, pp. 68-69). Bentham–Moxon Trust, Royal Botanic Gardens, Kew.

Metcalfe, C. R. and Chalk, L. 1950. Anatomy of the dicotyledons: Leaves, stem, and wood about taxonomy with notes on economic uses. Vol. (1), London, UK: Oxford University Press, 1500 pp.

Mouterde, P. 1970. Nouvelle flore du Liban et de la Syrie. (Vol. 2: 4) Dar El-Machreq Editeurs.

Orhan, İ., Demirci, B., Omar, I., Siddiqui, H., Kaya, E., Choudhary, M. I., Genç Ecevit, G., Özhatay, N., Şener, B. and Başer, K. H. C. 2010. Essential oil compositions and antioxidant properties of the roots of twelve Anatolian *Paeonia* taxa with special reference to chromosome counts. *Pharmaceutical Biology*, 48(1): 10-16. [CrossRef]

Özhatay, N. 2000. *Paeonia* L. *In*: Dayser, A., Özhatay, N., Ekim, T. and Başer, K. H. C. (Eds.), Flora of Turkey and the East Aegean Islands (Vol. 11, Supplement 2, pp. 15-16). Edinburgh University Press, 656 pp.

Passalacqua, N. G. and Bernardo, L. 2004. The genus *Paeonia* L. in Italy: Taxonomic survey and revision. *Webbia*, 59(2): 215-268. [CrossRef]

Prabhakar, M. 2004. Structure, delimitation, nomenclature and classification of stomata. *Acta Botanica Sinica*, 46(2): 242-252. [Click here]

Radford, A. E., Dickson, W. C., Massey, J. R. and Bell, C. R. 1974. Vascular plants are systematic. Harper and Row, 891 pp.

Riedl, H. 1969. Paeoniaceae. *In*: Flora Iranica (Vol. 60, pp. 1–5). Wien, Tehran, Iran.

Rudall, P. J. 2020. Anatomy of flowering plants: An introduction to plant structure and development (4th ed.). Cambridge University Press, 148 pp.

Saadu, R. O., Abdulrahaman, A. A. and Oladele, F. A. 2009. Stomatal complex types and transpiration rates in some tropical tuber species. *African Journal of Plant Science*, 3(5): 107-112.

Sang, T., Crawford, D. J. and Stuessy, T. F. 1997. Chloroplast DNA phylogeny, reticulate evolution, and biogeography of *Paeonia* (Paeoniaceae). *American Journal of Botany*, 84(8): 1120-1120. [CrossRef]

Smith, D. R. 2021. A new 'unified' classification for the genus *Paeonia*. *American Peony Society Bulletin*, 398: 25-40; 399: 33-37.

Stearn, W. T. and Davis, P. H. 1984. Peonies of Greece: A taxonomic and historical survey of the genus *Paeonia* in Greece. Goulandris Natural History Museum, 136pp.

Stern, F. C. 1946. A study of the genus *Paeonia*. The Royal Horticultural Society, London, 155pp.

The Peony Society. 2023. *Paeonia*: Classification and overview of peony species. Accessed March 18, 2025. [Click here]

The Plant List Database. 2021. Version 1.1. Published on the Internet. Accessed June 22, 2021. [Click here]

Townsend, C. C. (Ed.). 1980. *Paeonia* in Flora of Iraq (Vol. 4, pp. 667-669). Baghdad: Baghdad Ministry of Agriculture.

Ugulu, I., Baslar, S., Yorek, N. and Doğan, Y. 2009. The investigation and quantitative ethnobotanical evaluation of medicinal plants used around Izmir Province, Turkey. *Journal of Medicinal Plants Research*, 3(5): 345-367. [CrossRef]

Ünlü, S. 2010. Pharmaceutical botanical investigations on the *Paeonia* L. species in Turkey (Master's thesis, Istanbul University, Institute of Health Science, Department of Pharmaceutical Botany), 89 pp.

Watson, L. and Dallwitz, M. J. 1992. The families of flowering plants: Descriptions, illustrations, identification, and information retrieval (Version November 23, 2024). [Click here]

Yıldırımlı, Ş. 1994. Local names of some plants from Munzur Dağları (Erzincan-Tunceli) and uses of a few of them (II). *Ot Sistematik Botanik Dergisi*, 1(2): 43-46.

Zeng, N., Zhang, J. R. and Chang, Z. Y. 2017. Micromorphological characteristics of leaf epidermis and systematic significance of *Rosa* L. from China. *Guihaia*, 37: 169-185.

Zhou, S. L., Xu, C., Liu, J., Yu, Y., Wu, P. and Cheng, T. 2021. Out of the Pan-Himalaya: Evolutionary history of the Paeoniaceae revealed by phylogenomics. *Journal of Systematics and Evolution*, 59: 1170-1182. [CrossRef]

**Appendix (1):** Morphological qualitative characters of *P. mascula* subsp. *mascula*

| Characters | Taxonomic units |
|---|---|
| | ***P. mascula* subsp. *mascula*** |
| Plant habit | Perennial herb |
| Growth habit | Ascending |
| Root shape | Tuberous, carrot-shaped |
| Terminal leaflet shape | Ovate to obovate or oblong |
| Terminal leaflet apex shape | Acute |
| Terminal leaflet base shape | Cuneate or rounded-cuneate |
| Bract shape | Lanceolate or ovate to oblong-ovate |
| Flower color | Pink or red |
| Sepal shape | Boat-shaped |
| Sepal apex shape | Rounded |
| Sepal color | Green, purple |
| Petal shape | Obovate |
| Petal apex shape | Rounded or teethed |
| Fruit shape | jester's hat-shaped |
| Seed shape | Spherical to ovoid, elongated |
| Seed color | Black |

**Appendix (2):** Morphological quantitative characters of *P. mascula* subsp. *Mascula*.

| Characters | Taxonomic units |
|---|---|
| | ***P. mascula* subsp. *mascula*** |
| Plant tall (cm) | 25.0 – 77.0 (49.8)* |
| Number of scales | 3.0 – 5.0 (4) |
| Bud scales length(cm) | 5.5 – 15.0 (10.3) |
| Bud scales width(cm) | 1.2 – 2.8 (1.8) |
| Ratio of scale length/scale width | 5.86 |
| Stem length(cm) | 11.0– 42.0 (26) |
| Stem diameter(cm) | 0.6 – 1.4 (0.9) |
| Lower leaf length(cm) | 18.0 – 36.0 (25.6) |
| Number of leaflets per lower leaf | 3.0 – 5.0 |

| | |
|---|---|
| Number of leaflets and segments per lower leaf | 9.0 – 18 (12) |
| Terminal leaflet length (cm) | 6.5 – 11 (8.3) |
| Terminal leaflet width (cm) | 3.0 – 6.5 (5.2) |
| Terminal leaflet length/leaflet with ratio | 1.6 |
| Petiole length of lower leaf (cm) | 3.5 – 15.0 (8.4) |
| Number of bracts | 1.0 – 3.0 |
| Bract length (cm) | 3.5 – 9.3 (6.7) |
| Bract width (cm) | 1.2 – 5.5 (3.5) |
| Length/bract width ratio | 2.0 |
| Flower diameter (cm) | 6.3 – 9.4 (7.7) |
| Number of sepals per flower | 3.0 – 4.0 (3.7) |
| Sepal length/sepal width ratio | 1.49 |
| Sepal length (cm) | 1.0 – 3.4 (2.4) |
| Sepal width (cm) | 0.6 – 2.5 (1.6) |
| Number of petals per flower | 5.0 – 9.0 (7.8) |
| Petal length (cm) | 4.5 – 5.8 (5.1) |
| Petal width (cm) | 2.8 – 4.2 (3.4) |
| Petal length/petal width ratio | 1.49 |
| Number of stamens | 285 – 330 (310) |
| Another length (cm) | 0.5 – 1.0 (0.8) |
| Filament length (cm) | 0.8 – 1.7 (1.2) |
| Number of carpels | 2.0 – 5.0 (3) |
| Stigma length (cm) | 0.5 – 0.8 (0.7) |
| Ovary length(cm) | 0.8 – 2 (1.4) |
| Ovary width (cm) | 0.5 – 1.0 (0.8) |
| Follicle length (cm) | 2.8 – 4.1 (3.4) |
| Follicle width (cm) | 0.8 – 2 (1.5) |
| Number of seeds per fruit | 26 – 44 (38) |
| Number of seeds per carpal | 11 – 16 (13) |
| Number of mature seeds per fruit | 8 – 14 (10) |
| Number of aborted seeds per fruit | 18 – 29 (28) |
| Seed length (cm) | 0.7 – 1.0 (0.8) |
| Seed width (cm) | 0.5 – 0.8 (0.6) |
| Seed length/seed width ratio | 1.4 |

* Each value represents an average of 30 reads.

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# دراسة تصنيفية لنبات جنس *Paeonia* L.,1753 (عائلة Paeoniaceae) من العراق

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## الخلاصة

هدفت الدراسة الحالية إلى تحديث تصنيف جنس الفاوانيا *Paeonia* L. 1753 من عائلة Paeoniaceae في العراق استنادًا إلى الخصائص المورفولوجية والتشريحية، بالإضافة إلى الملاحظات البيئية والتوزيع الجغرافي، باستخدام تقنيات نظم المعلومات الجغرافية GIS.

أظهرت نتائج الدراسة أن هذا الجنس تضمن نويعًا واحدًا متمثلاً بـ *P. mascula* subsp. *mascula* (L.) Mill.,1768 ، وهو نبات معمر يصل ارتفاعه إلى أقل من 80 سنتيمترًا، ويتميز بسيقان صاعدة وأسطوانية، و خالية من الشعيرات، و زهور بارزة، بالإضافة إلى جذور تأخذ شكل الجزر.

كما كشفت التحليلات التشريحية عن وجود ثغور من النوع الشاذ Anomocytic ذات شكل بيضوي أو أهليليجي على السطح السفلي للورقة، حيث بلغ مؤشر الثغور 26.2% مع كثافة تصل إلى 51 ثغرة لكل مليليمتر مربع. في المقابل، كانت أنماط جدران خلايا البشرة الورقية قوية ومتموجة، بينما ظهرت أشكالها بشكل غير منتظم. أظهرت المقاطع العرضية للأوراق والعروق الوسطية أن الورقة تتميز بكونها ثنائية الوجه، حيث يحتوي الجزء الداخلي على حزمة وعائية كبيرة تأخذ شكل الهلال. أما المقاطع العرضية للسيقان، فكانت دائرية الشكل وتحتوي على عدد من الحزم الوعائية المنتظمة، مع عدم وجود شعيرات أحادية الخلية.

تنمو الفاوانيا في العراق حصراً في المناطق الجبلية، حيث تزدهر في التربة الحجرية الجيرية الغنية بالدبال على المنحدرات الشمالية داخل غابات البلوط المفتوحة. وقد أظهرت نتائج التوزيع الجغرافي وتحليل نظم المعلومات الجغرافية انتشارها في مقاطعتي العمادية وروانduz، ولأول مرة، وثّق هذا التحقيق في العراق ستة أماكن أخرى ضمن المقاطعة الأولى وموقعين في المقاطعة الثانية. من المتوقع أن تسهم هذه الدراسة في إعداد مفتاح تشخيصي لنباتات الفاوانيا البرية، وتقديم رؤية جديدة حول هذه النباتات في العراق.