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# MORPHOLOGICAL AND ANATOMICAL STUDY OF THE FLORAL PARTS OF LILY (*LILIUM CANDIDUM* L.) CULTIVATED IN IRAQ

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## SUMMARY

Lily (*Lilium candidum* L.) is an herbaceous, bulbous perennial plant belonging to the family Liliaceae. Studying floral parts of the *Lilium candidum* had samples collected from different gardens in Baghdad City, Iraq. The Flora of Turkey helped identify the measurements of the floral parts studied. The results found that flowers form funnel shapes, with snow-white colored petals with pink spots in the middle. Flowers are fragrant, with actinomorphic symmetry. Flowers comprising six petals had a cyclic arrangement in biseriate perianth. Petals were lanceolate-linear to lanceolate-shaped and six stamens were opposite with petals and free, and the anthers were versatile that open longitudinally. The cross-section shape of the stigma was triangular, consisting of epidermis with one row of globular cells surrounded by cuticles. The cortex comprises two main types of cells, the collenchyma cells found below epidermis, and chlorenchyma. The vascular bundles closed in three collaterals, and each tissue corner arrangement consisted of xylem and phloem covered by bundle cup fibers at the phloem side. Anthers take on cordate shape in cross section, and the epidermis consists of one row with globular cells surrounded by cuticle. The cortex cell has two main types of cells. In the first type, the two layers of collenchyma cells appear below the epidermis, while the second type of cortex was the parenchymal cells. The pollen grains were golden-yellow, ellipsoid size, shaped in polar and equatorial views, with several apertures and reticulated exine sculpturing.

**Keywords:** Lily (*L. candidum* L.), Liliaceae, floral parts, petals, stamens, stigma

**Key findings:** Lily (*L. candidum* L.) plant samples collected had their floral parts assessed. *Lilium candidum* is famous for being edible and medicinal functions based on its biochemical composition and pharmacological effects.

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## INTRODUCTION

Lily (*Lilium candidum* L.) has been cultivated since ancient times, for at least 3000 years, and has had great symbolic values since then for various cultures in different regions (Ikinci et al., 2006). Historical markers referring to *Lilium* L. showed a growth of white Lilies in the ancient Crete civilization in Knossos, 1000 BC (Wilson and Mathew*,* 1981*).* The species of *Lilium* referred to the Sumerian plates that dates back to 5000 years ago. History also showed lily grasslands surrounded the city of Susa in Iran, and this city received its name after the plant, as well as, Egyptians utilized lilies as a wreath in ceremonies (Uzun, 1984*).*

In Taiwan, both the flower and bulbs served as food, along with other related species (Dimpoulos *et al.,* 2013). France has also adopted the symbol of the lily, used as a decorative symbol (Fitzgerald, 2010). *Lilium candidum,* an herbaceous, bulbous perennial plant of the family Liliaceae, has some saponins isolated by the ethanol extract from bulbs and flowers (Haladova *et al.,* 2011). The said species extract is beneficial for public medicine to treat burns, sores, and wounds (Kopaskova *et al.,* 2012).

*Lilium candidum* also has the names Madonna lily or white lily, from the Liliaceae family, one of the largest families of monocot plants (Tutin, 1984). It is native to the Balkans and the Middle East and spread to other parts of Europe, including France, Ukraine, Italy, North Africa, the Canary Islands, Mexico, and some other regions. It is susceptible to several viral diseases common to lilies, especially to *Botrytis* fungus; however, growing plants must be from seeds instead of bulblets to avoid virus problems (Davis, 1988; Danin, 2004).

Some studies centered intimately concerning Liliaceae taxa (Kameshwari, 2011; Masoumi, 2012). Moreover, the pollen study showed that in the genus *Lilium,* some features and carbohydrate content of pollens supply important information (Kosenko, 1999; Muratovic *et al.,* 2010; Pupuleku *et al.,* 2010). However, as per our best knowledge, there are no archives on pollen morphology and lilies distribution in Iraq. Likewise, Kim and Lee (1990) and Kaviani *et al.* (2008) also mentioned that the characters of anatomy have major taxonomic worth in the *Lilium* systematic.

No study existed about the anatomy and morphology of *L. candidum*, with no archives on pollen morphology and lilies distribution. The *L. candidum* recorded for the first time in Baghdad, Iraq, investigated its anatomical and morphological characteristics. The pollen features are notable as major taxonomic values, and have served in the classification of the genera (Ceter *et al.,* 2013). The current study sheds light on the morphological study of perianth leaves and anatomy of some reproductive parts, viz., anther and stigma.

## MATERIALS AND METHODS

The collection of plant samples came from different gardens of Baghdad- AL-Adamiyah, Iraq, and reached scrutiny for further identification using the Flora of Turkey (Davis, 1988). The samples, placed in containers, received 70% ethanol alcohol. The cross-sections preparation of the reproductive parts, including pistils and stamens continued by hand sectioning, according to Al-Hadeethi *et al.* (2020), with some modifications, according to Özen *et al.* (2012). At the beginning, cutting samples into small pieces had a length ranging from five to seven cm, and then placed in 5% sodium hypochlorite for five minutes to get rid of chlorophyll pigments. Then, the cut parts by hand sectioning with a sharp blade proceeded to transfer into a glass slide with a cover, then, covered with Canadian balsam for permanent preparation. The prepared slides incurred examination under the usual KRÜSS microscope and photographed with the camera installed on the microscope.

The pollen study had the pollens prepared by the acetolysis method, as described by Erdtman (1960). The observations and measurements continued by light microscopes (LM). For LM analysis, the acetolysed pollens, placed in a small vial received 5–7 drops of silicone oil, with the samples mounted on glass slide, sealed with

paraffin, and investigated under a light microscope. The measurements of polar axis (P), equatorial axis (E), and exine thickness of pollens used 10 reading for each specimen. The terminology and pollen size was mainly dependent on the methodology used by Walker and Doyle (1976).

## RESULTS AND DISCUSSION

Based on the Flora of Turkey, the Lily (*L. candidum*) blooms during May. The flowers of *L. candidum* are funnel formed, snow-white shaded with pink color in the middle of the petal, fragrant, and with actinomorphic symmetry (Davis, 1988). The 2–10 flowers were evident, and the pedicles arise from bract axils. On average, the pedicles measured about 3.03 cm, while the average for the bract was 1.2–2.99 cm, respectively.

The flower's corolla comprised six petals, which were petaloid and bundled in two rings. Moreover, the petals were lanceolate-linear to lanceolate-shaped. The stamens' count was six, opposite the petals and free. The size of the filaments was 44.6–55.5 mm. The pistils from gynoecium consist of triangular stigma, and the styles were cylindrical and stamens comprised anthers and filaments. Anthers were versatile and parallel, opening longitudinally, and, on average, the anthers' size was 9.3–12.5 mm. The measurements of the floral parts appear in Figure 1 and Table 1. The present results were analogous to past findings (Fahn, 1990).

**Table 1.** Measurements of flower parts of *L. candidum.*

| Part of plant | Measurements |
|---|---|
| Pedicle Length (cm) | 1.5-4.8 (3.03) |
| Bract Length (cm) | 2.2-4.1 (2.99) |
| Bract Width (cm) | 0.5-1.8 (1.2) |
| Outer Petal Length (mm) | 35-69 (53) |
| Outer Petal Width (mm) | 6-21 (10.9) |
| Inner Petal Length (mm) | 47-70 (59) |
| Inner Petal Width (mm) | 12-22 (18.6) |
| Anther Length (mm) | 6-11 (8) |
| Filament Length (mm) | 30-59 (48) |
| Ovarian Length (mm) | 8-15 (11) |
| Style Length (mm) | 44-64 (52) |


**Figure 1**. Flower shape of the *L. candidum.*

The cross-section shape of the stigma was triangular. Its first layer has the epidermis, consisting of one row of globular cells. Its thickness reached 33.3 µm, with the epidermis surrounded by the cuticle, followed by the cortex, which consisted of two main types of cells. The first type has two layers of collenchyma cells found below the epidermis, and its thickness was 52.5 µm. These results were also consistent with past findings of Fahn (1990). The collenchyma cells provide mechanical support to herbaceous plants in the developmental period (Vardar and Dersleri 1982a, b; Yentür and Anatomisi, 1995).

The second type of cortex was the chlorenchyma cells that contain various chloroplasts essential in photosynthesis and food making processes (Figure 2 A, B). The vascular bundles of the stigma appeared in three collaterals, with closed arrangements in the corner of the tissue. Each one consisted of a xylem and phloem covered by a bundle cup fiber at the phloem side, and its thickness was 120.8 µm (Figure 2C). The pith in the center was hollow and free of tissue, with its type were parenchyma cells (Figure 2B).

The cross-section shape of anther was the cordate shape; its first layer was the epidermis that comprised one row of globular cells, with thickness reaching 29.5 µm. The epidermis has cuticle surroundings, followed by the cortex, which consists of two main types of cells. The first type was the two layers of collenchyma cells found below the epidermis, and its thickness was 41.5 µm. The second type of cortex was the parenchyma cells (Figure 3D). The vascular bundles of one anther with cordate shape are in the central, collateral, and closed, consisting of xylem and phloem covered by a bundle cup fiber at the phloem side, with its thickness reaching 111.5 µm (Figure 3 E). These results agree with studies based on the anatomical features of the genus *Lilium* L. (Kim and Lee, 1990).

The pollens were golden-yellow, ellipsoid, monosulcate, elliptical in polar view, and oblate. The average of the polar axis was 35.76 µm, and the average of the equatorial axis was 53.86 µm, with medium size, oblate shape, and reticulated exine sculpturing (Figure 4, Table 2). These results align with past studies based on the pollen grain features in two species of *Lilium* (Muratovic *et al.,* 2010).

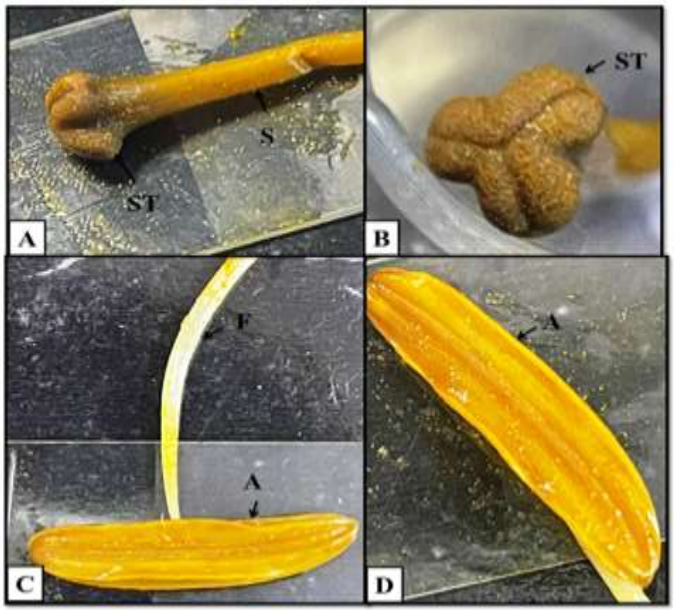


**Figure 2.** Shape of the floral parts of the *L. candidum.* A: pistil stigma and style, B: stigma, C: stamen anther and filament, D: anther, S = style, ST = stigma, A = anther, and F = filament.

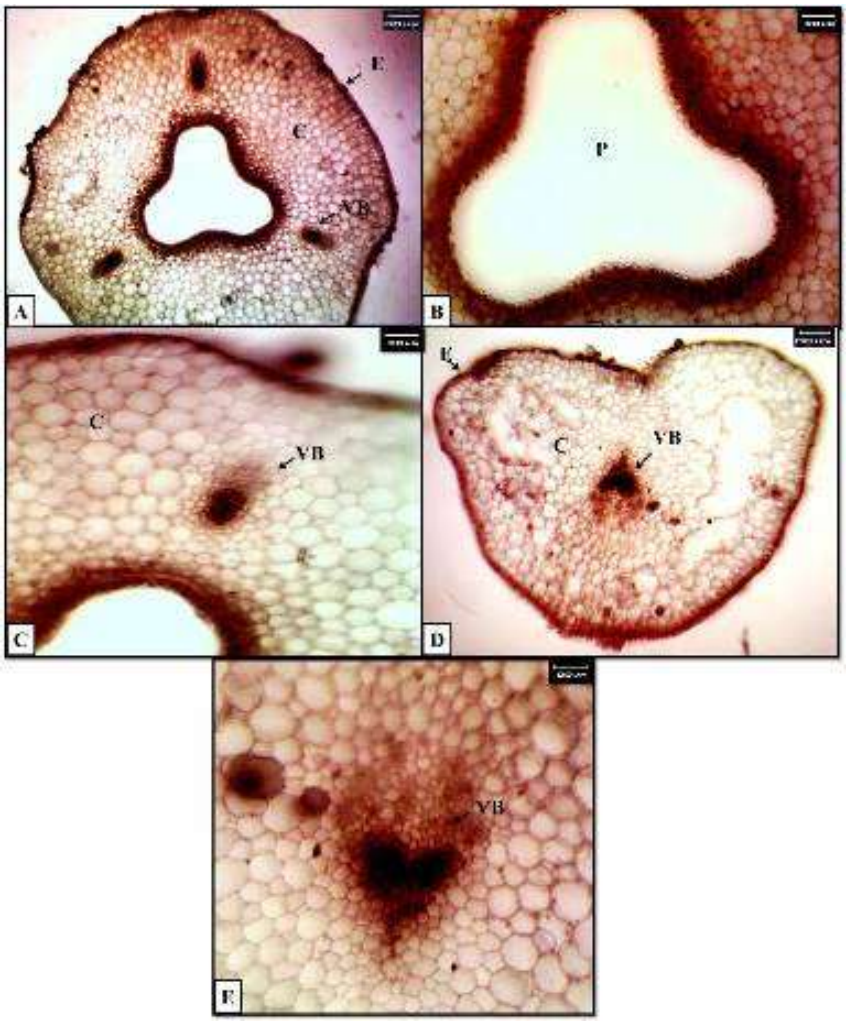


**Figure 3.** Cross section of the flower parts of the *L. candidum.* A: cross section of stigma, B: cross section of stigma, C: cross section of stigma to appear the vascular bundle shape, D: cross section of anther, E: shape of vascular bundle in anther; E = epidermis, C = cortex, VB = vascular bundles, and P = pith, at 40× magnification.

**Table 2.** Measurements of pollen grains of *L. candidum* (in µm).

| Polar axis | Equatorial axis | P/E | Shape | Size | Exine sculpturing |
|---|---|---|---|---|---|
| 33.6-45.4 (35.76) | 47.2-63.7 (53.86) | 0.66 | Oblate | Medium | Reticulate |

## CONCLUSIONS

This study revealed that anatomy and morphology of the reproductive parts of Lily (*Lilium candidum*) occurred considerably significant, being carried out for the first time in Baghdad, Iraq. The different anatomical and morphological characteristics bore intensive scrutiny, and in addition to ecological data, it will contribute substantially to facilitating cultivation of the said species.

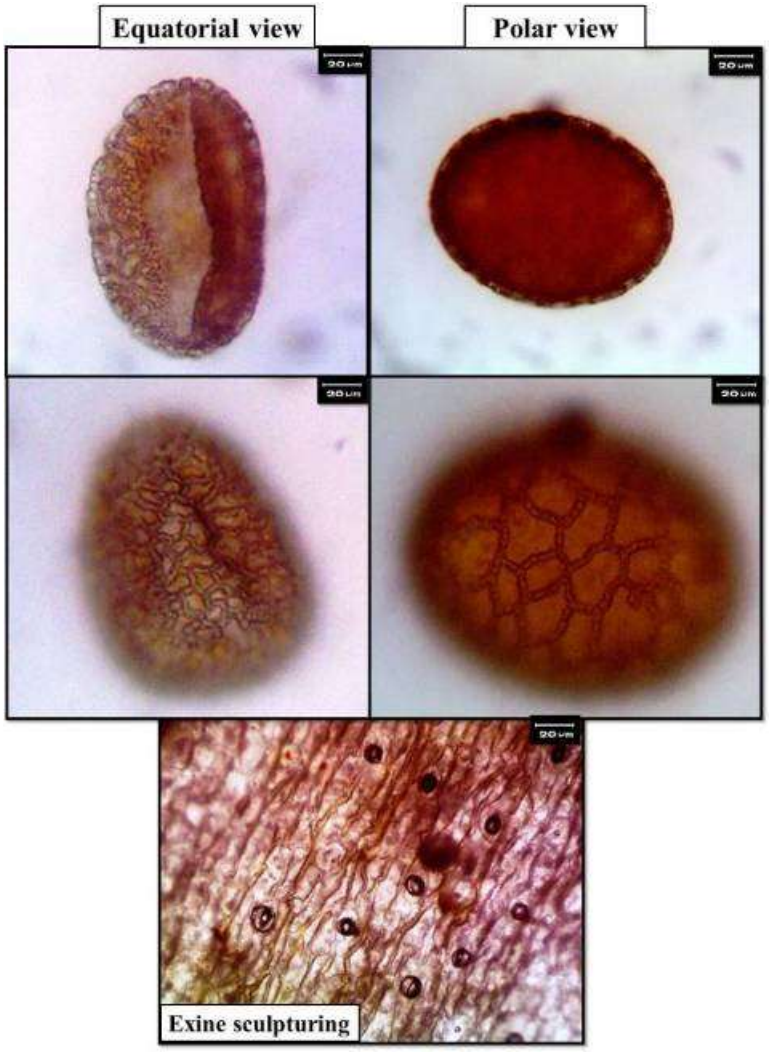


**Figure 4**. Pollen grains shape of the *L. candidum* at 40× magnification.

## REFERENCES


Al-Hadeethi MA, AL-Taie AT, Ali JK (2020). Anatomical study of *Combretum indicum* L. DeFilipps cultivated in Iraq. *Sys. Rev. Pharm.* 11(8): 736–741.

Ceter T, Ekici M, Pınar NM, Ozbek F (2013). Pollen morphology of *Astragalus* L. section *Hololeuce* Bunge (Fabaceae) in Turkey. *Acta Bot. Gallica* 160: 43–52.

Danin A (2004). Distribution Atlas of Plants in the Flora Palaestina Area. *Proc. Isr. Acad. Sci*. 1–517.

Davis PH (1988). Flora of Turkey and East Aegean Island, 1–9, Edinburg University Press, Edinburg.

Dimpoulos P, Raus T, Bergmeier E, Constantinidis T, Iatrou G, Kokkini S, Strid A, Tzanoudakis D (2013). Vascular Plants of Greece: An Annotated Checklist, Botanic Gardens and Botanical Museum Berlin-Dahlem, *HBS*. 1–372.

Erdtman G (1960). The Acetolysis Method (A revised description). *Sven. Bot. Tidskr*. 54(4): 561–564.

Fahn A (1990). Plant Anatomy. Linacra House, Jordan Hill, OX28 DP, A Division of Reed Educational and Professional Publishing Ltd. Oxford, England.

Fitzgerald KT (2010). Lily toxicity in the cat. *Anim Med*. 25 (4): 213–217.

Haladova M, Mucaji P, Budesinsky M, Vokac K, Cvacka J, Grancai D, Eisenreichova E (2011). Spirostanol saponins from the bulbs of *Lilium candidum*. *Chem. Nat. Compd*. 46(6): 1004–1005.

Ikinci N, Oberprieler C, Güner A (2006). On the origin of European Lilies: Phylogenetic analysis of *Lilium* section Liriotypus (Liliaceae) using sequences of the nuclear ribosomal transcribed spacers. *Willdenowia* 36: 647–565.

Kameshwari MNS (2011). Pollen morphology in some members of Liliaceae. *Int. J. Eng. Sci. Technol*. 3(5): 3825–3830.

Kaviani B, Dehkaei MNP, Darabi AH, Rafizadeh A, Rahmati B (2008). The anatomical properties of endemic *Lilium ledebourii* (Baker) Bioss. (Liliaceae) species. *Int. J. Bot.* 4: 62–66.

Kim YS, Lee WB (1990). A study of anatomical characters on the genus *Lilium* L. in Korea. *Korean J. Plant Taxon*. 20: 179–189.

Kopaskova M, Hadjo L, Yankulova B, Jovtchev G, Galova E, Sevcovicova A, Mucaji P, Miadokova E, Bryant P, Chankova S (2012). Extract of *Lillium candidum* L. can modulate the genotoxicity of the antibiotic zeocin. *Molecules* 17(1): 80–97.

Kosenko VN (1999). Contributions to the pollen morphology and taxonomy of the Liliaceae. *Grana* 38: 20–30.

Masoumi SM (2012). Pollen morphology of *Erythronium* L. (Liliaceae) and its systematic relationships. *J. Basic. Appl. Sci. Res*. 2 (2): 1833–1838.

Muratovic E, Bogunic F, Šoljan D, Martin J (2010). Stomata and pollen grain characteristics of two endemic lilies: *Lilium bosniacum* and *L. carniolicum* (Liliaceae). *Phytol. Balcan.* 16: 285–292.

Özen F, Temeltaş H, Aksoy Ö (2012). The anatomy and morphology of the medicinal plant, *Lilium candidum* L. (Liliaceae), distributed in Marmara Region of Turkey. *Pak. J. Bot.* 44(4): 1185–1192.

Pupuleku B, Kapidani G, Kallajxhiu N, Naqellari P, Turku S (2010). Palynological studies of pollen grains of Albania's endemic plant *Festucopsis serpentini* (C.E. Hubbard) Melderis and *Lilium martagon* L. in three different habitats. *Nat. Montenegrina* 9: 431–440.

Tutin TG (1984). Flora Europaea. Cambridge University Press. (eds.) 5: 1–452.

Uzun G (1984). Zambak Yetiştiriciliği, Tarımsal Araştırmaları Destekleme ve Geliştirme Vakfı, Yalova. *Ç.Ü.Ziraat Fakültesi Yıllığı*. 12: 1–4.

Vardar Y, Dersleri B (1982a). (Hücre veDokular) Ege Üniversitesi Fen Fak. Kitaplar Serisi No: 29, *E.Ü. Basımevi, İzmir*.

Vardar Y, Dersleri B (1982b). Organlar - Ege Üniversitesi Fen Fak.Kitaplar Serisi *E.Ü.Basımevi, İzmir*. No: 26.

Walker JW, Doyle JA (1976). The basis of Angiosperm phylogeny: Palynology. *Ann. Mol. Bot. Gard*. 62: 666–723.

Wilson HF, Mathew B (1981). Bulbs – The bulbous plants of Europe and their allies. William Collins Sons & Co. Ltd., pp. 329–550.

Yentür S, Anatomisi B (1995). İstanbul Üniversitesi Yayınları, Sayı: 3308, *Fen Fak.Yayın* No: 227.