Libyan Journal of Medical and Applied Sciences LJMAS
Online ISSN: 3006-1113
Volume 3, Issue 4, 2025, Page No: 108-114
Website: https://ljmas.com/index.php/journal/index

First Documentation of the *Lilium candidum L* in Libya and Its Implications for Mediterranean Flora

Gabrel F. Imhmd [1 *], Abdullah A. Shnabo [2], Khaled M. Elmeer [3]
[1] Department of Horticulture, Faculty of Agriculture, Omar Al-Mukhtar University, Al-Bayda, Libya
[2] Director of the Gubah-Antiquities office, Green Mountain, Libya. Department of Antiquities, Libya
[3] Libyan Authority for Scientific Research, Tripoli, Libya
[*]*Corresponding author: elmeer@gmail.com*

Received: October 03, 2025 Accepted: December 12, 2025 Published: December 16, 2025

Cite this article as: G, F, Imhmd., A, A, Shnabo., K, M, Elmeer. (2025). First Documentation of the *Lilium candidum L* in Libya and Its Implications for Mediterranean Flora. Libyan Journal of Medical and Applied Sciences (LJMAS). 2025;3(4):108-114.

Abstract:
Lilium candidum L. (*Liliaceae*), is a culturally and biologically significant Mediterranean geophyte whose natural distribution has long been debated due to millennia of cultivation and subsequent naturalization. While native populations are well documented in the eastern Mediterranean, no species of *Lilium* has previously been confirmed from Libya, leaving a notable gap in the southern Mediterranean range of the genus. This study reports the first scientifically validated record of *L. candidum* from Libya, discovered in the Green Mountain (Jabal al-Akhdar) region at Ras Al-Hilal. Field observations were initially made in 2019, followed by detailed morphological and taxonomic investigations in 2025. The population occurs on north facing calcareous slopes within a Mediterranean montane habitat, consistent with the known ecological preferences of the species, and in proximity to an archaeological site dated to the sixth century BCE. Morphological analyses of vegetative and floral traits including bulb structure, stem height, leaf arrangement, flower size, tepal dimensions, and stamen morphology show complete agreement with authoritative descriptions of *L. candidum* from the Mediterranean Basin. Comparative assessment using standard floras and herbarium references confirms the taxonomic identity of the Libyan population. This finding extends the documented southern limit of *Lilium*, represents a significant addition to the Libyan flora, and raises biogeographic questions regarding relictual persistence versus ancient or recent human mediated dispersal. The record underscores the importance of continued botanical exploration in North Africa and highlights the need for further ecological and molecular studies to clarify the origin and conservation status of this population.

Keywords: *Lilium Candidum*, Madonna lily, Libya, Green Mountain, New Record, Mediterranean Flora, Biogeography.

أول توثيق علمي لنبات الزنبق الأبيض *Lilium candidum L.* في ليبيا وتداعياته على فلورا البحر الأبيض المتوسط

جبريل امحمد[1*]، عبدالله اشنابو[2]، خالد المير[3]
[1] قسم البستنة، كلية الزراعة، جامعة عمر المختار، البيضاء، ليبيا
[2] مكتب آثار القبة، الهيئة العامة للآثار، الجبل الأخضر، ليبيا
[3] الهيئة الليبية للبحث العلمي، طرابلس، ليبيا

الملخص
يُعدّ الزنبق الأبيض *Lilium candidum L* من الفصيلة الزنبقية نباتًا متوسطيًا ذا أهمية ثقافية وبيولوجية، وقد ظلّ توزيعه الطبيعي موضع نقاش طويل نظرًا لزراعته على مدى آلاف السنين، وبينما تُوثّق مجموعاته الأصلية جيدًا في شرق البحر الأبيض المتوسط، لم يُؤكّد وجود أي نوع من أنواع الزنبق في ليبيا سابقًا، مما يُخلّف فجوة ملحوظة في نطاق انتشار هذا الجنس في جنوب البحر الأبيض المتوسط. تُقدّم هذه الدراسة أول سجلّ مُوثّق علميًا للزنبق الأبيض في ليبيا، حيث اكتُشف في منطقة رأس الهلال في الجبل الأخضر، وقد تمت الملاحظات الميدانية الأولية في عام 2019، تلتها دراسات مورفولوجية

وتصنيفية مُفصّلة في عام 2025. ينمو هذا النبات على منحدرات كلسية مُواجهة للشمال ضمن بيئة جبلية متوسطية، بما يتوافق مع التفضيلات البيئية المعروفة لهذا النوع، وبالقرب من موقع أثري يعود تاريخه إلى القرن السادس قبل الميلاد. أظهرت التحليلات المورفولوجية للصفات الخضرية والزهرية، بما في ذلك بنية البصلة، طول الساق، ترتيب الأوراق، حجم الزهرة، أبعاد البتلات، وشكل الأسدية، توافقًا تامًا مع الأوصاف الموثوقة لنبات الزنبق الأبيض *Lilium candidum* في حوض البحر الأبيض المتوسط. وأكد التقييم المقارن باستخدام المراجع النباتية القياسية ومجموعات النباتات المحفوظة في المعشبة الهوية التصنيفية للسلالة الليبية. يُوسع هذا الاكتشاف النطاق الجنوبي الموثق لجنس الزنبق، ويمثل إضافة هامة إلى النباتات الليبية، ويطرح تساؤلات جغرافية حيوية حول استمرارية هذا النوع من النباتات، مقابل انتشاره القديم أو الحديث بوساطة الإنسان. ويؤكد هذا السجل أهمية مواصلة الاستكشاف النباتي في شمال إفريقيا، ويُبرز الحاجة إلى مزيد من الدراسات البيئية والجزيئية لتوضيح أصل هذه السلالة وحالة حفظها.

الكلمات المفتاحية: الزنبق الأبيض، فلورا ليبيا، الجبل الأخضر، تسجيل جديد، نباتات متوسطية، الجغرافيا الحيوية.

Introduction

The genus *Lilium* L. (*Liliaceae*) comprises approximately 100 bulbous perennial species distributed across temperate regions of the Northern Hemisphere, occupying diverse ecological niches and exhibiting considerable morphological variation [1,2]. *L. candidum*., commonly known as the Madonna lily, is among the most ancient and culturally significant species of the genus, valued for its ornamental, medicinal, and symbolic importance for millennia [3,4].

L. candidum is native to the eastern Mediterranean Basin, with wild populations historically documented in Greece, southwestern Turkey, Lebanon, Syria, and northern Palestine [5,6,7]. Extensive cultivation over centuries has led to widespread naturalization, complicating the delineation of its precise native range. According to Plants of the World Online (POWO), the species is considered native to southern North Macedonia, southwestern Turkey, and Lebanon, while other Mediterranean occurrences are treated as introduced or naturalized [8,9]. The species typically inhabits calcareous slopes, open woodlands, and rocky hillsides under Mediterranean climatic conditions [10].

In North Africa, *L. candidum* has generally been regarded as an introduced taxon, with records from Algeria and Tunisia restricted to cultivated or semi-naturalized populations [11,12]. A recent discovery in Morocco, at Jbel Sidi Ali El Jouzi, represents the first confirmed naturalized population of the species on the continent [13]. Despite this finding, no species of *Lilium* have previously been documented from Libya [14,15,16], representing a notable gap in the known southern Mediterranean distribution of the genus.

Here, we report the first confirmed record of *L. candidum* from Libya, discovered in the Green Mountain (Jabal al-Akhdar) region. The population was initially observed in May 2019, with comprehensive morphological and taxonomic investigations conducted in 2025. It occurs within a montane Mediterranean habitat consistent with the species' ecological requirements, in proximity to an archaeological site dated to the sixth century BCE (Figure 2). This finding extends the documented southern limit of *L. candidum* and constitutes a significant addition to the Libyan flora, potentially reflecting either relict Mediterranean floristic elements or historical human-mediated dispersal.This record highlights the importance of continued botanical exploration in understudied regions of North Africa, where complex topography and localized microclimates may support previously overlooked plant populations. It further underscores the need for expanded research on the biogeography, ecology, and conservation of Mediterranean geophytes. If persistent, this population warrants formal inclusion in Libya's national floristic inventory.

The objectives of this study are threefold: (i) to document and describe the morphological characteristics of the *L. candidum* population in its natural Libyan habitat; (ii) to compare these traits with regional and international floristic references to confirm taxonomic identity using established identification keys; and (iii) to provide the first scientifically validated record of *L. candidum* for the flora of Libya.

Materials and Methods

Study Site and Sampling: Field surveys were conducted at Ras Al-Hilal in the Green Mountain (Jabal al-Akhdar) region of northeastern Libya (32°47′32″ N, 22°19′50″ E; Figure 1), where a population of *L. candidum* was recorded in May 2025. The site is characterized by Mediterranean montane vegetation on north-facing slopes at approximately 205 m above sea level (Figure 2). These slopes provide mesic and shaded conditions conducive to the establishment of the species. Sampling was conducted during peak flowering to enable accurate morphological assessment and documentation.

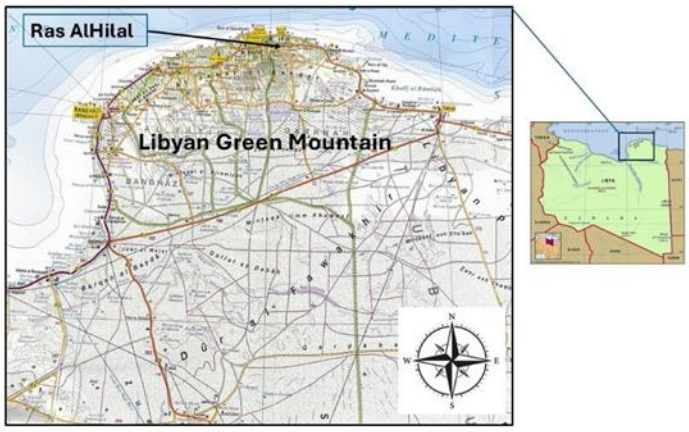

Figure 1. Sampling site in Ras Al Hilal, Green Mountain region, Libya.

Field Documentation: Plants were photographed in situ using a Nikon D750 digital single-lens reflex (DSLR) camera (24.3 MP) equipped with a 105 mm macro lens. Multiple images were taken from different angles to document vegetative and reproductive structures. Photographs were captured in both RAW and high-resolution JPEG formats for archival purposes and subsequent morphological analysis.

Figure 2. The archaeological site in the Ras Al Hilal area where the *L. candidum* plant was discovered nearby.

Morphological Analysis: Morphological measurements followed standard protocols for Liliaceae using digital calipers and precision rulers. Recorded characters included plant height, number of leaves per stem, leaf dimensions (length and width), flower dimensions (length and diameter), perianth segment size, and bulb diameter. Floral structures were examined under a stereomicroscope (×10 magnification) to assess diagnostic characters. Measurements were taken from mature, flowering individuals.

Specimen Preparation and Preservation: Representative specimens were collected with minimal disturbance to the population, pressed, dried, and mounted on herbarium sheets with complete collection metadata, including date, locality, habitat description, and collector information. Bulbs were photographed in situ and preserved in 70% ethanol for potential future anatomical or molecular investigations.

Taxonomic Identification: Taxonomic identification of *L. candidum* was confirmed through comparison with standard floristic treatments and digital images of herbarium specimens obtained from The Plant List, IPNI, JSTOR Global Plants, SEINet, Reflora Virtual Herbarium, and World Flora Online (WFO). Images of the type specimen housed at LINN and the original protologue by Linnaeus were also consulted. Nomenclature followed the International Code of Nomenclature for algae, fungi, and plants (ICN) and *Flora of Turkey* [17].

Results

Morphological examination of the Libyan specimens revealed characters consistent with *L. candidum* as described in authoritative floristic treatments. Comparative analysis with published morphological data from Mediterranean populations confirmed taxonomic identity across all diagnostic traits (Table 1).

Table 1. Morphological characterization of *Lilium candidum* from Ras Al-Hilal, Libya, compared with published descriptions.

Morphological Trait	Wild Specimen (Ras Al-Hilal, Libya)	Reference Description (Global Floras)	Similarity Notes
Stem height	72-82 cm	50–150 cm (Davis, 1984)	Within range
Leaf length	8-15cm	4-21(Özen et al, 2012)	Fully consistent
Leaf arrangement	Alternate, spiral; lanceolate, dark green	Alternate, spiral; lanceolate, dark green (Özen et al, 2012)	Identical
Flower colour	Pure white	Pure white (Davis, 1984)	Identical
Flower length	8cm	8.1cm (Kamalashree, and Nayaka, 2023)	Identical
Petal length	6.5 cm	3.5–6.9 (Al-Shami, et al., 2024)	Within range
Stamen	5cm	3-5.9 cm (Özen et al, 2012)	Identical
Anther	1 cm	0.9-1.1 (Davis, 1984)	Identical
Flowering period	Late April – Early May	May (Davis, 1984)	Slightly earlier in Libyan specimen
Fragrance	Strong, pleasant	Strong, pleasant (Özen et al, 2012)	Identical
Bulb texture and colour	Fleshy yellowish white	Fleshy, yellowish white (Özen et al, 2012)	Identical
Bulb length	3.5	1.2-7.6 (Özen et al, 2012)	Within range
Bulb diameter	2.5	0.8-2 (Özen et al, 2012)	Within range
Habitat	Calcareous coastal habitat (Ras Al-Hilal)	Coastal to lower mountain slopes in temperate regions	

Bulb morphology was characteristic of the species. Bulbs were fleshy and yellowish-white in color, matching published descriptions [6]. Bulb dimensions measured 3.5 cm in length and 2.5 cm in diameter (Figure 3), falling within the documented ranges of 1.2–7.6 cm in length and 0.8–2.0 cm in diameter [6].

Figure 3. Morphology and Size Measurements of the *L candidum* Bulb discovered nearby Ras Al Hilal.

Stem height in the Libyan population ranged from 72 to 82 cm (Figure 4), within the previously reported range of 50–150 cm [17]. Leaves measured 8–15 cm in length, corresponding to the documented range of 4–21 cm [6]. Leaf arrangement was alternate and spiral, with lanceolate, dark green blades consistent with reference descriptions [6].

Figure 4. Stem of *L. candidum* plant discovered nearby Ras Al Hilal area.

Floral morphology showed complete agreement with diagnostic characters of L. candidum. Flowers were pure white (Figure 5) and measured approximately 8 cm in length, comparable to previously reported values of 8.1 cm [18]. Individual tepals measured 6.5 cm, within the documented range of 3.5–6.9 cm [19]. Stamens measured approximately 5 cm in length, with anthers averaging 1 cm (Figure 6), consistent with published ranges of 3.0–5.9 cm and 0.9–1.1 cm, respectively [6,17]. Flowers exhibited a characteristic strong, pleasant fragrance [6].

Figure 5. Flowers of *L. candidum* plant discovered nearby Ras Al Hilal area.

Figure 6. Measurements of *L candidum* Floral Organs: Whole Flower, Individual Tepals, and Stamens.

Flowering in the Libyan population occurred from late April to early May, slightly earlier than the typical flowering period reported for eastern Mediterranean populations [17]. This shift in phenology may reflect local microclimatic conditions or latitudinal influences.

The population was located in a calcareous coastal habitat at Ras Al-Hilal in the Jabal al-Akhdar region, consistent with the species' preference for calcareous substrates in coastal to lower montane Mediterranean environments. All morphological characters examined corresponded closely with published descriptions of *L. candidum* throughout its known distribution, confirming this as the first verified record of the species in Libya.

Discussion

Morphological Identity and Mediterranean Affinities

The morphological characteristics of the wild *L. candidum* specimens recorded from Ras Al-Hilal in the Green Mountain (Jabal al-Akhdar) region of Libya show strong concordance with authenticated Mediterranean populations, thereby confirming species identity. All key diagnostic characters correspond closely with descriptions provided in *Flora of Turkey* [17] and other regional studies from the eastern Mediterranean.

Vegetative traits observed in the Libyan population, including stem heights of 72–82 cm and alternate, lanceolate leaves measuring 8–15 cm in length, fall well within the documented ranges for Mediterranean populations. Stem heights of 43–150 cm (mean 88 cm) and leaf dimensions of 4–21.5 cm have been reported for Turkish populations, encompassing the measurements recorded in the present study [6]. The spiral leaf arrangement observed in the Libyan specimens further supports species identification, as this trait is regarded as a stable diagnostic character throughout the species' range [20].

Floral morphology provides the most definitive evidence for taxonomic confirmation. The presence of pure white flowers approximately 8 cm in length, with individual tepals measuring 6.5 cm, corresponds closely with the characteristic *L. candidum* phenotype documented across the Mediterranean region [3,21]. Stamens consisting of filaments approximately 50 mm long and yellow anthers measuring about 10 mm fall squarely within the ranges reported for Turkish populations (filaments 45–57 mm; anthers 9–11 mm) [17] and broader Mediterranean datasets (filaments 30–59 mm; anthers 6–11 mm) [6]. The consistent observation of a strong, pleasant floral fragrance further supports alignment with established species descriptions.

Flowering in the Libyan population occurred from late April to early May, slightly earlier than the typical May–June phenology reported for eastern Mediterranean populations [17]. This temporal shift is likely attributable to local climatic conditions, particularly the influence of coastal Mediterranean microclimates in North Africa.

Bulb morphology also conformed to species-level expectations. Bulbs were white, fleshy, and measured approximately 3.5 × 2.5 cm (Fig. 3), consistent with published descriptions across the species' distribution [6]. The occurrence of the population on calcareous coastal substrates aligns with the documented ecological preferences of *L. candidum* for well-drained limestone soils in coastal to lower montane Mediterranean environments [17,21].

Biogeographic Significance

This discovery represents the first confirmed record of Lilium in Libya, extending the genus's documented southern Mediterranean limit and filling a notable floristic gap [14,16]. While *L. candidum* is native to the Balkans, Greece, Turkey, and the Levant [8,22], North African populations have generally been considered introduced or naturalized [11]. Recent documentation of naturalized populations in Morocco [13] and the present Libyan record suggest that the species has a broader North African distribution than previously recognized.

The proximity of the Libyan population to a 6th-century BCE archaeological site raises questions about its origin. Three hypotheses may explain its presence: (1) a relictual native population persisting in suitable montane Mediterranean habitat; (2) ancient human-mediated introduction associated with the species' millennia-long cultivation; or (3) more recent naturalization from cultivated stock. The calcareous substrates of the Green Mountain region provide optimal conditions consistent with native populations elsewhere, and the area's documented role as a Mediterranean floristic refugium [13] supports the possibility of native status. However, distinguishing native from naturalized populations remains challenging given *L. candidum's* extensive cultivation since antiquity [3,6].

Conservation and Research Priorities

This discovery underscores the botanical significance of Libya's Green Mountain region and highlights the need for continued exploration in understudied North African areas, where topographic and microclimatic complexity may support overlooked populations [4]. The population warrants inclusion in Libya's national floristic inventory and should be monitored to assess persistence and demographic trends.

Molecular phylogenetic analyses comparing Libyan specimens with Mediterranean populations would clarify biogeographic relationships and determine whether this population represents a distinct genetic lineage meriting conservation priority. Such studies could also illuminate Mediterranean geophyte biogeography and the role of human-mediated dispersal in shaping North African flora. Given the species' cultural and horticultural significance [1,2], understanding the origin and genetic distinctiveness of peripheral populations contributes both to conservation biology and to our knowledge of ancient Mediterranean plant-human interactions.

The congruence of morphological, ecological, and phenological traits with authenticated *L. candidum* populations, together with the presence of suitable habitat conditions, provides robust evidence for species identification and establishes this iconic Mediterranean lily as a documented component of the Libyan flora.

Conclusion

This study reports the first confirmed record of *L. candidum* L. for the flora of Libya, discovered in the calcareous montane habitat of Ras Al-Hilal, Green Mountain (Jabal al-Akhdar). Comprehensive morphological analysis demonstrates that the population exhibits diagnostic characteristics consistent with authenticated Mediterranean populations, including vegetative traits (stem height 72–82 cm; lanceolate leaves 8–15 cm), floral morphology (pure white flowers with stamens 5 cm long and yellow anthers 1 cm in length), and ecological requirements (calcareous substrates under Mediterranean climatic conditions). This discovery extends the documented southern limit of *Lilium* in the Mediterranean Basin and fills a significant gap in the floristic knowledge of North Africa.

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

References

1. Van Tuyl, J.M., Arens, P., Shahin, A., Marasek-Ciołakowska, A., Barba-Gonzalez, R., Kim, H.T. and Lim, K.B., 2018. *Lilium*. In Ornamental Crops (pp. 481-512). Cham: Springer International Publishing.
2. Basit, A. and Lim, K.B., 2025. Recent approaches towards characterization, genetic, and genomic perspectives of genus Lilium. Genetic Resources and Crop Evolution, 72(1), pp.1-28.
3. Zaccai, M., Yarmolinsky, L., Khalfin, B., Budovsky, A., Gorelick, J., Dahan, A. and Ben-Shabat, S., 2020. Medicinal properties of *Lilium candidum* L. and its phytochemicals. Plants, 9(8), p.959.
4. Tang, Y., Liu, Y., Luo, K., Xu, L., Yang, P. and Ming, J., 2022. Potential applications of lilium plants in cosmetics: A comprehensive review based on research papers and patents. Antioxidants, 11(8), p.1458.
5. Polunin, O., 1987. Lily. Flowers of Greece and the Balkans, a field guide. Oxford University Press, Oxford, New York, pp.1619-1920.
6. Özen, F.A.Z.I.L., Temeltaş, H.A.C.I. and Aksoy, Ö.Z.L.E.M., 2012. The anatomy and morphology of the medicinal plant, *Lilium candidum* L.(*Liliaceae*), distributed in Marmara region of Turkey. Pak. J. Bot, 44(4), pp.1185-1192.
7. Mouterde, P., 1966. New flora of Lebanon and Syria. Ed de L'imprimerie Catholique Beyrouth: Bey routh, Lebanon. 563p.
8. POWO (2024), Plants of the World Online, *Lilium candidum* L. Royal Botanic Gardens, Kew. Retrieved from https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:537512-1.
9. Blamey, M., Grey-Wilson, C., 1993. *Lilium candidum*. In: Grey-Wilson, C. (ed.). Mediterranean Wild Flowers. Harper Collins Publishing: London, UK. pp. 475–476.
10. Pignatti, S., Guarino, R., & La Rosa, M. (2017). Flora d'Italia, ed. 2, 3. Milano: Edagricole.
11. Govaerts, R.H., 2018. 101 Nomenclatural corrections in preparation for the Plants of the World Online (POWO). Skvortsovia, 4(3), pp.74-99.
12. Elliott, A., Hyam, R., Watson, M., Wrankmore, E., Hartley, H., Krieger, J., Gandhi, K., Acuña, R., Almeida, R.F.D., Amorim, G. and Anderson, G., 2025. World Flora Online Plant List June 2025.
13. Chriqui, A., Benkhnigue, O., Mouniane, Y., El-Khadir, I., Boudik, S., Taleb, M.S. and Hmouni, D., 2025. *Lilium Candidum L.*(*Liliaceae*), a New Exotic Species Reported in the Jbel Sidi Ali El Jawzi (Prerif, Morocco).
14. Jafri, S. M. H., & El-Gadi, A. (1976–1983). Flora of Libya. Tripoli: Al-Fateh University.
15. Erteeb, F.B. and Sharashi, O., 2015. New records for the flora of Libya. The Libyan Journal of Science, 18(1), pp.1-14.
16. Essokne, R.A., Mahklouf, M.H. and Isweiri, H.F., 2024. Index to New updated names of the Flora of Libya, Volume 2. Journal of Basic and Applied Sciences - Faculty of Science - University of Misurata, (17), pp.70-78.
17. Davis, P.H. (ed.) (1984). Flora of Turkey and the East Aegean Islands 8: 1-632. Edinburgh University Press, Edinburgh.
18. Kamalashree, S. And Nayaka, K.S., 2023. Studies On Effects Of Different Sources And Levels Of Calcium On Growth, Flowering, Quality And Yield In Asiatic Lily (*Lilium* spp.) (Doctoral dissertation, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga).
19. Al-Shami, S.S.D., Al-Taie, A.T., Al-Hadeethi, M.A.H. and Hasan, S.A.R., 2024. Morphological and anatomical study of the floral parts of lily (*Lilium candidum L.*).
20. Güven, S., Okur, S., Demirel, M.S., Arslan, D., & Malyer, H. (2014). Pollen morphology and anatomical features of Lilium (*Liliaceae*) taxa from Turkey. Biologia, 69(9), 1122-1133.
21. Kandeler, R., & Ullrich, W.R. (2009). Symbolism of plants: examples from European-Mediterranean culture presented with biology and history of art. Journal of Experimental Botany, 60(7), 1893-1907.
22. Dimopoulos, P., Raus, T., Bergmeier, E., Constantinidis, T., Iatrou, G., Kokkini, S., Strid, A. and Tzanoudakis, D., 2013. Vascular plants of Greece: an annotated checklist.