International Journal of Nature and Life Sciences

IJNLS

https://dergipark.org.tr/tr/pub/ijnls

e-ISSN: 2602-2397 https://doi.org/10.47947/ijnls.1679651

Research Article

Fritillaria avzemiae (Liliaceae), A New Species From Eastern Anatolia, Türkiye

Veysel Sonay[1], Mehmet Maruf Balos[2]*, Muhammed Yalçın[3], Mustafa Keskin[4], Mehtap Tekşen[5]

[1] Sarıcan Town, Subaşı Neighborhood, Elazığ, Türkiye; https://orcid.org/0000-0001-8523-5113

[2] Mehmet Güneş Anatolian High School, Zeytindalı Education Campus, Haliliye, Şanlıurfa, Türkiye; https://orcid.org/0000-0002-9590-5237.

[3] Eren Şahin Eronat Vocational and Technical Anatolian High School, Neighborhood 580th Street Site. No:10, Kayapınar, Diyarbakır, Türkiye; https://orcid.org/0009-0007-8553-494X

[4] Marmara University, Institute of Pure and Applied Sciences, Biology Program, Göztepe Campus, Kadıköy, İstanbul, Türkiye; https://orcid.org/0000-0003-2454-1891

[5] Aksaray University, Department of Biology, Faculty of Science and Literature, Aksaray, Türkiye; https://orcid.org/0000-0003-0191-4229

*** Corresponding author:** mbalos@gmail.com

Received: April 19, 2025

Accepted: April 30, 2025

Online Published: May 5, 2025

Abstract: *Fritillaria avzemiae* Sonay, Balos, M. Keskin & Tekşen, sp. nov. (Liliaceae) is described as a new species from Elazığ and Diyarbakır Province, eastern Turkey. *Fritillaria avzemiae* is close to *F. pinardii*, and *F. avromanica*. But differs from them by several morphological characters, such as stem, leaves, perigone, outer and inner tepal, style and ovary. Diagnostic characteristics, a description, images, and a conservation assessment are provided.

Keywords: Anatolia, Çüngüş, Diyarbakır, Hazardağı, Elazığ, Sivrice, Taxonomy.

Citation: Sonay, V., Balos, M. M., Yalçın, M., Keskin, M., Tekşen, M. (2025). *Fritillaria avzemiae* (Liliaceae), a new species from Eastern Anatolia, Türkiye. International Journal of Nature and Life Sciences, 9 (1), 38-48.

1. Introduction

The genus *Fritillaria* Linnaeus (1753: 303), which is the second largest genus in the Liliaceae family with approximately 170 species of geophytic perennials occurring in most temperate regions of the Northern Hemisphere, from North America, through Europe, the Mediterranean region, Central Asia, China and Japan (Day et al., 2014; Kamari et al., 2017; Rix, 2019; Balos et al., 2024; Tel, 2024; WCSP, 2025).

Türkiye is a country where *Fritillaria* has the highest number of species and endemic species in the world (Tekşen, 2022). Three regions with significant diversity stand out in the distribution of the genus: California (21 species, 1 variety), China (24 species, 2 varieties), and SW Asia–E Mediterranean, mainly Türkiye (55 species/31 endemic), Greece (26 species, 5 subspecies), and Iran (26 species) (Losina-Losinskaya, 1968; Kamari, 1991; Xinqi and Mordak, 2000; Hill, 2014; Advay et al., 2015; Sharifi-Tehrani and Advay, 2015; Samaropoulou et al., 2016; 2020; 2022; Peruzzi, 2016; Kamari et al., 2017; Kiani et al., 2017; Tekşen, 2018; Yıldırım and Tekşen, 2021; Advay et al., 2022; 2024; Eker and Tekşen, 2023; Advay and Tekşen, 2023; Sonay et al., 2023; Eker and Balos, 2023; Tekşen et al., 2024; Advay 2024; Advay and Rix, 2024; Balos et al., 2024; Tekşen et al., 2024; and Tel, 2024)

There are a number of phylogenetic studies of *Fritillaria* (Rønsted et al., 2005; Çelebi et al., 2008; Türktaş et al., 2012; Karakaş et al., 2013, Hao et al., 2013; Khourang et al., 2014; Sharifi-Tehrani and Advay,

2015). However, the phylogenetic relationships in the subgenera of Fritillaria are not completely resolved. (Fay and Chase, 2000; Kiani et al., 2017). Some studies on nectar morphology (Khaniki and Persson, 1997; Roguz et al., 2018), pollen (Özler and Pehlivan, 2007; Tekşen et al., 2010; Hosseini, 2018), leaf surface (Wang et al., 2009), fruit and seed micromorphology (Khaniki, 2003; Samaropoulou et al., 2019a), karyology (Kamari, 1984; 1991; Zaharof, 1989; Khaniki, 2002a; 2002b; 2002c; 2005; Peruzzi et al., 2009; Jafari et al., 2014; Samaropoulou et al., 2016; 2019a; Ahmadi-Roshan et al., 2016), and anatomy (Namazi et al., 2017) help species distinction (Yıldırım and Tekşen, 2021; Tekşen 2022).

The most significant taxonomic studies on Fritillaria species in Türkiye were provided by Rix (1984) and Tekşen (2012; 2018). The high species and endemic species richness of *Fritillaria* shows that Türkiye is the main diversity center of this genus (Rix, 2001; Day, et al., 2014; Kiani et al., 2017).

The proposed new species was collected by the first author during a botanical trip to the Hazar Mountains of Sivrice district of Elazığ in May 2023 and April 2025. It was collected by the third author from Çüngüş district of Diyarbakır province. As a result of the examination of the collected samples, it was concluded that the species was a new one not identified in the literature and was written by the authors. Together with these species, the number of *Fritillaria* species growing in Türkiye has increased to 56, 32 of which are endemic.

2. Materials and Methods

About 20 specimens were collected from Sivrice/Elazığ and Çüngüş/Diyarbakır province in this article and stored in the HARRAN and HUEH herbarium. The collected specimens were glued two per cardboard and given HARRAN and HUEH herbarium number. In addition, a large number of specimens were examined live in the field.

All relevant national floras, revisions and studies of the genus *Fritillaria* were checked (Boissier, 1882; Post and Dinsmore, 1933; Losina-Losinskaja, 1968; Rix, 1974; 1975; 1977; 1980; 1984; 2001; Wendelbo, 1985; Rechinger, 1990; Xinqi and Mordak, 2000; Tekşen and Aytaç, 2011; Tekşen, 2018; Samaropoulou et al., 2016; 2019a; 2019b; 2022; Yıldırımlı et al., 2019; Yıldırım and Tekşen, 2021; Advay et al., 2015; 2022; 2024; Advay and Tekşen, 2023; Eker and Tekşen, 2023; Sonay et al., 2023, Tekşen, 2023; Eker and Balos, 2023, Advay, 2024, Advay and Rix, 2024; Advay et al., 2022; 2024; Balos et al., 2024; Tekşen et al., 2024; Duman and Tekşen, 2024; Tel, 2024).

The habitat and general view of *F. avzemiae* are shown in Figure 1. Qualitative and quantitative morphological characters used for identification in offered new Fritillaria species were analyzed with a stereo-binocular microscope on fresh material (Fig. 2). Obtained findings were compared with related species in Table 1. Distribution map of compared taxa is provided in Figure 3. The names of the species were checked from using the IPNI database (IPNI, 2025). Threat category assessment of the new species was made according to IUCN criteria (IUCN 2024). Collected specimens are housed at HARRAN (Harran University Faculty of Arts and Sciences Herbarium) and HUEH (Harran University Faculty of Pharmacy Herbarium) (herbarium acronym according to Index Herbariorum, https://sweetgum.nybg.org/science/ih/) herbariums. The identification key in 'Flora of Turkey and the East Aegean Islands' (Rix 1984), and 'Illustrated Flora of Turkey' (Tekşen, 2018) were used for the identification of the collected samples. Morphological data of all related species were derived from (Tekşen and Aytaç, 2011; Tekşen 2018).

3. Results and discussion

***Fritillaria avzemiae* Sonay, Balos, M. Keskin &Tekşen, sp. nov.** (Fig. 1–3, Table 1).

Type:— TÜRKİYE. Elazığ, Sivrice district, stony and rocky areas near the hill, near Başkaynak village, 1570–1600 m, 06.04.2025, M. Balos 5626 and V. Sonay (Holotype HAUH!, isotype HARRAN!, HAUH!); ibid, 9.05.2023, M. Balos 5643 (Paratype HAUH!); Diyarbakır, Çüngüş district, Mt Bosman, stony and rocky areas near the hill, near Koçören village, 2200 m, 6.05.2024, M. Balos 5604 and M. Yalçın (Paratype HAUH!).

Diagnose: —Related to *F. avromanica* by 3.5–7 cm long × 0.6–2 cm wide broadly ovate, eliptic ovate, acute or acuminate lowest leaves (not 3.4 –11 cm long × 2–4.5 cm wide, suboposite or alternate, ovate, obovate or lanceolate, acute); oblong, lanceolate, caudate median leaves (not lanceolate, linear-lanceolate, acuminate); lanceolate to linear–lanceolate bract (not linear); waxy, purplish–brown, with a middle yellowish–

green stripe extending towards the tips, yellow at the apical (inner tepal) perigone (not purple with green or yellow stripes inside and outside perigon);

14–24 mm long inner and outer tepal (not 17.9–20 mm longinner tepal, 13.6–28.2 mm long outer tepall; 1.5–3.5 mm long x 0.5–1.5 mm wide, oblong or linear-lanceolate, yellowish green nectary (not 3–3.8 mm long × 1.5 mm wide, linear, linear-lanceolate, green); 5–12 mm long, greenish-yellow filamet (not 5.2–7 mm long, yellow); slightly tripartite stigma (not clavate).

Description: —Perennial, bulbous plant. **Bulb** 10×15 mm long × 12×18 mm wide, globose or ovoid, **bulblets** 1–3 (–4), 3–8 mm globose or ovoid, tunica thin brownish. **Stem** 5–17 cm long, erect to semi-erect, smooth. **Leaves** 4–5(–6) including bracteal leaves, sessile, undulate, waxy, glaucous, subopposite; **lower leaves** 3.5–7 cm long × 0.6–2 cm wide, broadly ovate, eliptic ovate, acute or acuminate; **median leaves** 3.0–6.5 × 0.4–1.0 cm oblong, lanceolate, caudate, **the uppermost leaves** 1–2 (–3), 1.8–4.5 cm long × 0.3–1.0 cm wide, lanceolate linear–lanceolate, acuminate. **Flowers** 1–2 (–4). **Perigon** narrowly campanulate, narrow mouthed, waxy, purplish–brown, with a middle yellowish–green stripe extending towards the tips, yellow at the apical (inner tepal), not tessellated; **outer tepals** 14–24 mm long × 4.5–6.5 mm wide; lanceolate to linearlanceolate, obtuse; **inner tepals** 14–24 mm long × 5–7 mm wide, linear to linearlanceolate, obtuse, tip yellow, greenish-yellow; **nectaries** 1.5–3.5 mm long × 0.5–1.5 wide mm, yellowish green, ovate to linear, placed at tepal base. **Filaments** 5–12 mm; greenish–yellow thin, enlarged to base, papillose; **anthers** 5–8 mm long, oblong, yellow; style 5.0–9.0 mm long × 2 –3 mm wide, very short 3-lobed, maximum 0.5 mm, densely papillose. **Ovary** 4.5–11.0 mm long × 1.5–2.5 mm wide, pale green; **stigma** flat. **Capsule** 37–43 mm long × 10–12 mm wide, obovoid–oblong, cuneate; **seeds** 3.5–4.5 mm long x 2.5–3.5 mm wide (semi-mature), flat, obovoid, triangulated (Table 1).

Etymology:— The species name was given in honor of the first author's daughter, Avzem Sonay, who was born in the same year that the photographs of the species were taken.

Vernacular name:—A local name for the proposed species could not be identified. For this reason, the name “Sarıkız lalesi” is assigned as a new Turkish scientific name according to the current guidelines (Menemen et al., 2016).

Distribution and habitat:—*Fritillaria avzemiae* is a endemic species restricted to Sivrice in Elazığ and Çüngüş in Diyarbakır province, eastern Anatolia. It is an element of Irano–Turanian phytogeographical region (Davis 1971). It grows stony and rocky areas near the hill, northern slopes 1570-2200 m a.s.l. (Fig. 1). Species growing nearby are *Allium pseudoampeloprasum* L., *Astragalus gummifer* Labill., *Lamium amplexicaule* L., *Tulipa armena* Boiss., *Corydalis oppositifolia* DC., *Acantholimon acerosum* (Willd.) Boiss., *Euphorbia denticulata* Lam., *Ranunculus kotschyi* Boiss., *Scilla armena* Grossh., *Umbilicus luteus* (Huds.) Webb & Berthel. and kindly Poaceae herbs.

Phenology:—The first sighting of *F. avzemiae* was in April. After a very short flowering period, it enters the fruiting period in May and June.

Conservation status:— Less than 200 mature individuals were observed at the type locality of *F. avzemiae*, which covers (area of occupancy-AOO) an area of less than 2000 km2 (criteria B2). There is a serious grazing effect on the population, which may lead to a reduction in the number of individuals in the near future. Therefore, due to its restricted population, a single locality, and estimated decrease in the area of occupancy, habitat quality and number of mature individuals, the species may be classified as "Vulnerable" (VU) (criteria B2ab [i, ii, v]) (IUCN 2024).

Taxonomic Relationships:— *Fritillaria avzemiae* is close to *F. pinardii* Boiss. (1846:106), and *F. avromanica* Advay & Teksen (2015:527). All these species belong to subgen. *Fritillaria*, but differs from them by several morphological characters, such as stem, leaves, perigone, outer and inner tepal, style and ovary (see Figs. 1–3 and Table 1).

Figure 1. *Fritillaria avzemiae sp. nov*. (A) Habitat at Çüngüş-Mt. Bosman; (B) Habitat at Sivrice-Mt. Hazar; (C-H) Habits; (I-J) Early period fruit

Figure 2. *Fritillaria avzemiae sp. nov.* (A-B) Collected specimen in the herbaria; (C) Bulb; (D-G) Flower; (H) Outer tepal; (I) Inner tepal; (J) Interior of inner-outher-inner tepal; (K-L) Pistil and stamens; (M) Style; (N-O) Capsule; (P-Q) Seed.

Table 1. Distinguishing characters among *Fritillaria avzemiae*, *F. avromanica* and *F. pinardii* and (Tekşen and Aytaç, 2011, Tekşen, 2018).

		F. avzemiae	***F. avromanica***	***F. pinardii***
Bulb (long mm x wide mm)		10–15 × 12–18 mm, globose or ovoid	10.6 – 37.3 × 10.7 – 35 mm, globular	5–12 × 7–20 mm, globular to ovoid
Bulblet		1–3 (–4)	1–3	1 to many
Stem		5–17 cm long, smooth	7.4–20 cm, smooth	4–20 cm, papillose to smooth at base
Leaves	Number	4–5 (–6)	3–6 (–9)	3–8 (–13)
	Lowest leaves	3.5–7 cm long × 0.6–2 cm wide	3.4 –11 cm long × 2–4.5 cm wide	2.2–9.7 cm long × 0.4–2.4 cm wide
	Type	broadly ovate, eliptic ovate, acute or acuminate	suboposite or alternate, ovate, obovate or lanceolate, acute	narrowly lanceolate or ovoid
	Median leaves	3–6.5 cm long × 0.4–1 cm wide	1.8–3.7 cm long × 0.2–0.7 cm wide	1.4–6.5 cm long × 0.15–0.9 cm wide
	Type	oblong, lanceolate, caudate	lanceolate, linear-lanceolate, acuminate	linear to narrowly lanceolate
Bract	Number	1–2 (-3)	2 –3 (–6)	1
	Uppermost leaves	1.8–4.5 cm long × 0.3–1.0 cm wide,	1.5–3.9 × 0.1–0.5 cm	1.1–6 × 0.1–0.4 cm
	Type	lanceolate to linear–lanceolate	linear	linear
Flowers	Number	1–2 (–4)	1–3	1-2 (-4)
	Color	waxy, purplish–brown, with a middle yellowish–green stripe extending towards the tips, yellow at the apical (inner tepal)	purple with green or yellow stripes inside and outside	waxy, purple outside, yellow tips, yellowish-orange or greenish-yellow or greenish inside, rarely yellow inside and outside
	Inner tepal	14–24 mm long × 5–7 mm wide, linear to linear lanceolate, obtuse	17.9–20 mm long × 4.5–6.5 mm wide, oblanceolate, obtuse, ciliate tufted at apex	9–26 mm long × 3–8 mm wide, narrowly oblanceolate to obovoid, obtuse
	Outer tepal	14–24 mm long × 4.5–6.5 mm wide, lanceolate to linearlanceolate, obtuse	13.6–28.2 mm long × 3.3–6.8 mm wide, lanceolate, acute, ciliate-tufted at apex	9–26 mm long × 3–8.5 mm wide, lanceolate to ovoid-lanceolate, acute to obtuse
Nectary		1.5–3.5 mm long x 0.5–1.5 mm wide, oblong or linear-lanceolate, yellowish green, placed at tepal base	3–3.8 mm long × 1.5 mm wide, linear, linear-lanceolate, green, placed 1 mm above tepal base	1.5–6 × 0.5–1.5 mm, linear to lanceolate, green, 0.5–1 mm above the tepal base
Flament		5–12 mm long, greenish-yellow	5.2–7 mm long, yellow	6–11 mm, yellow
Anthers		5–8 mm long; oblong, yellow	5.2–8.4 mm long, oblong, apiculate, yellow during early anthesis but then blackish, basifixed	2–7 mm long, rectangular, with a pointed tip, yellow
Style		5–9 mm long x 2–3 mm wide, very short 3-lobed, maximum 0.5 mm, densely papillose	5. 7–9 mm wide, 3–lobed, lobes 1 mm, papillose	6.5–10 mm, lobed or not, papillose
Stigma		flat	clavate	flat
Capsule		37–43 mm long × 10–12 mm wide, obovoid-wide club, cuneate	25–47 × 15–21 mm, cylindrical, truncate at apex, cuneate at base, not winged	11–32 × 10–15 mm, obovoid to oblong
Seed		3.5–4.5 mm long x 2.5–3.5 mm wide, flat, obovoid, triangulated.	6.4–9.0 × 5.4–8.7 mm, flat, obovate; testa brown, reticulate-faveolate	3–7 × 2.5–5 mm, obovoid to obovoid-rounded

Figure 3. (A-C) Habit of *F. avzemiae;* (D-E) Habit of *F . pinardii.* (F) Habit of *F . avromanica* (Photos by E. Eker, D-E; M. Advay, F).

Conflicts of Interests
Authors declare that there is no conflict of interests

Financial Disclosure
Author declare no financial support.

Statement contribution of the authors
This study's experimentation, analysis and writing, etc. all steps were made equally by the authors.

Acknowledgements: We thank Erkan Gürbüz and Yavuz Öz for their assistance in the field.

References

1. Advay, M., & Rix, E. M. (2024). *Fritillaria shahuensis* (Liliaceae), a new species from western Iran. Phytotaxa, 662 (3), 279–286. https://doi.org/10.11646/phytotaxa.662.3.7
2. Advay, M. (2024). *Fritillaria marivanensis* (Liliaceae), a new species from western Iran. Phytotaxa, 675 (3), 292–300. https://doi.org/10.11646/phytotaxa.675.3.8
3. Advay, M., & Tekşen, M. (2023). *Fritillaria shehbazii* and *F. selenica* (Liliaceae), two new species from Iran. Nordic Journal of Botany, 2023 (7), e03929. https://doi.org/10.1111/njb.03929

4. Advay, M., Rix, E. M., & Tekşen, M. (2022). *Fritillaria kordestanica* (Liliaceae) is a new species from western Iran. Phytotaxa, 554 (1), 70–76. https://doi.org/10.11646/phytotaxa.554.1.5
5. Advay, M., Tekşen, M., & Maroofi, H. (2015). *Fritillaria avromanica* sp. nov. (Liliaceae) from Iran and notes on *F. melananthera* in Turkey. Nordic Journal of Botany, 33, 526–531. https://doi.org/10.1111/njb.00780
6. Advay, M., Tekşen, M., & Soleimani, F. (2024). *Fritillaria pavehensis* (Liliaceae), a new species from western Iran. Annales Botany Fennici, 61, 51–66. https://doi.org/10.5735/085.061.0109
7. Ahmadi-Roshan, M., Karimzadeh, G., Babaei, A., & Jafari, H. (2016). Karyological studies of Fritillaria (Liliaceae) species from Iran. Cytologia, 81, 133–141. https://doi.org/10.1508/cytologia.81.133
8. Balos, M. M., Çeçen, C., Tekşen, M., Yıldırım, H., & Sonay, V. (2024). *Fritillaria yalcinii* (Liliaceae), a new species from southeastern Turkey. Nordic Journal of Botany, 2024 (5), e04220.
9. Boissier, P.E. (1882). *Flora Orientalis* 5. Basel, Geneva, 880 pp. https://doi.org/10.5962/bhl.title.20323
10. Çelebi, A., Tekşen, M., Açık, L., & Aytaç, Z. (2008). Taxonomic relationships in genus *Fritillaria* (Liliaceae): Evidence from RAPDPCR and SDS-PAGE of seed proteins. Acta Botanica Hungarica, 50, 325–343. https://doi.org/10.1556/ABot.50.2008.3-4.11
11. Davis, P. H. (1971). Distribution patterns in Anatolia with particular reference to endemism. In: Davis, P. H., Harper, P. C. & Hedge, I. C. (Eds.) *Plant life in South-West Asia*, 15–27. The Botanical Society of Edinburgh.
12. Day, P. D., Berger, M., Hill, L., Fay, M. F., Leitch, A. R., Leitch, I. J., & Kelly, L. J. (2014). Evolutionary relationships in the medicinally important genus *Fritillaria* L. (Liliaceae). Molecular Phylogenetics and Evolution, 80, 11–19.
13. Duman, H., & Tekşen, M. (2024). *Fritillaria ozgeana* (Liliaceae), a new yellow-flowered species from SW Anatolia, Turkey. In Annales Botanici Fennici, 61 (1), 189-198). https://doi.org/10.5735/085.061.0127
14. Eker, İ. & Tekşen, M. (2023). *Fritillaria umitkaplanii* (Liliaceae), a new species from south Anatolia. Nordic Journal of Botany, 2023 (2), e03803. https://doi.org/10.1111/njb.03803
15. Eker, İ., & Balos, M. M. (2023). *Fritillaria ecerii* (Liliaceae), a new species from southeastern Anatolia, Turkey. Annales Botanici Fennici, 60 (1), 231-236. https://doi.org/10.5735/085.060.0135
16. Fay, M. F., & Chase, M. W. (2000). Modern Concepts of Liliaceae with a Focus on the Relationships of *Fritillaria*. Curtis's Botanical Magazine 17, 146–149. https://doi.org/10.1111/1467-8748.00258
17. Hao, D.-D., Gu, X.-J., Xiao, P.-G., & Peng, Y. (2013) Phytochemical and biological research of *Fritillaria* medicinal resources. Chinese Journal of Natural Medicine, 11, 330–344. https://doi.org/10.1016/S1875-5364(13)60050-3
18. Hosseini, S. (2018). Pollen morphology of some *Fritillaria* L. species (Liliaceae) from Iran. Pakistan Journal of Botany, 50, 2311–2315. https.//doi.org/10.5962/bhl.title.37656
19. IPNI, (2025). International Plant Names Index. Published on the Internet http://www.ipni.org, The Royal Botanic Gardens, Kew. Harvard University Herbaria & Libraries and Australian National Botanic Gardens, retrieved from: http://www.ipni.org (accessed 15 April 2025).
20. IUCN, (2024). Red List Guidance Documents- IUCN standards and Petitions Committee. Guidelines for Using the IUCN Red List Categories and Criteria. Version 2024. 16 (March 2024). Prepared by the Standards and Petitions Committee. Downloadable from https://www.iucnredlist.org/documents/RedListGuidelines.pdf. (accessed 15 April 2025).
21. Jafari, H., Babaei, A., Karimzadeh, G., & Ahmadi-Roshan, M. (2014). Cytogenetic study on some *Fritillaria* species of Iran. *Plant* Systematics and Evolution, 300, 1373–1383. https://doi.org/10.1007/s00606-013-0968-6
22. Kamari, G. (1984). Caryosystematic studies of *Fritillaria* L. (Liliaceae) in Greece. 1. Webbia 38, 723–731. https://10.1080/00837792.1984.10670343
23. Kamari, G. (1991). The genus *Fritillaria* L. in Greece: taxonomy and karyology. Botanika Chronika, 10, 253–270.
24. Kamari, G., Zahos, A., & Siagou, I. (2017). A new yellow-flowered *Fritillaria* species (Liliaceae) from Mt. Tisseon, continental Greece and its taxonomic relationships. Phytotaxa, 328, 227–242. https://doi.org/10.11646/phytotaxa.328.3.2

25. Karakaş M. Ö., Türktaş, M., Aslay, M., & Kaya, E. (2013). Evaluation of the genetic relationship between *Fritillaria* species from Turkey's flora using fluorescent-based AFLP. Turkish Journal of Biology, 37, 273–279. https://doi.org/10.3906/biy-1207-62
26. Khaniki, G. B., & Persson, K. (1997). Nectary morphology in southwest Asian *Fritillaria* (Liliaceae). Nordic Journal of Botany, 17, 579–611. https://doi.org/10.1111/j.1756-1051.1997.tb00355.x
27. Khaniki, G. B. (2002a). Chromosome number of *Fritillaria* subgenera *Petilium* and *Theresia* (Liliaceae). Nucleus, 45, 6–11.
28. Khaniki, G. B. (2002b). Chromosome number of all Iranian species of *Fritillaria* caucasica group (Liliaceae). Nucleus, 45, 103–108.
29. Khaniki, G. B. (2002c). Chromosome number of Iranian species of *Fritillaria* crassifolia group (Liliaceae). Nucleus, 45, 109–113.
30. Khaniki, G. B. (2003). Fruit and seed morphology in Iranian species of *Fritillaria* subgenus *Fritillaria* (Liliaceae). Pakistan Journal of Botany 35, 313–322.
31. Khaniki, G. B. (2005). Giemsa C-banding studies on interphase nuclei of Iranian species of *Fritillaria* and *Rhinopetalum* (Liliaceae). Proceedings of the National Academy Sciences India Section B, 75, 294–304.
32. Khourang, M., Babaei, A., Sefidkon, F., Naghavi, M. R., Asgari, D., & Potter, D. (2014). Phylogenetic relationship in *Fritillaria* spp. of Iran inferred from ribosomal ITS and chloroplast trnL-trnF sequence data. Biochemical Systematics and Ecology, 57, 451–457. https://doi.org/10.1016/j.bse.2014.10.001
33. Kiani, M., Mohammadi, S., Babaei, A., Sefidkon, F., Naghavi, M. R., Ranjbar, M., Razavi, S. S., Saeidi, K., Jafari, H., Asgari, D., & Potter, D. (2017). Iran supports a great share of biodiversity and floristic endemism for *Fritillaria* spp. (Liliaceae): a review. Plant Diversity, 39, 245–262.
34. Linnaeus, C. (1753). *Species Plantarum* 1. Laurentius Salvius, Holmiae, 1200 pp.
35. Losina-Losinskaja, A. (1968). *Fritillaria* L. In: Komarov, V. L. (Ed.), *Flora of the USSR* 4. Israel Program for Scientific Translations, Israel, pp. 232–246.
36. Menemen, Y., Aytaç, Z., & Kandemir, A. (2016). Türkçe Bilimsel Bitki Adlandırma Yönergesi. Bağbahçe Bilim Dergisi, 3, 1–3.
37. Namazi, F., Sharifi-Tehrani, M. & Shabani, L. (2017). Anatomical study on *Fritillaria* species in Iran. Bangladesh Journal of Botany, 46 (1), 93–101.
38. Özler, H., & Pehlivan, S. (2007). Comparison of pollen morphological structures of some taxa belonging to *Asparagus* L. and *Fritillaria* L. (Liliaceae) from Turkey. Bangladesh Journal of Botany, 36, 111–120. https://doi.org/10.3329/bjb.v36i2.1498
39. Peruzzi, L. (2016). A new infrafamilial taxonomic setting for Liliaceae, with a key to genera and tribes. Plant Biosystems, 150, 1341–1347.
40. Peruzzi, L., Leitch, I. J., & Caparelli, K. F. (2009). Chromosome diversity and evolution in Liliaceae. Annals of Botany, 103, 459–475. https://doi.org/10.1093/aob/mcn230
41. Post, G. E., & Dinsmore, J. E. (1933). *Flora of Syria, Palestine and Sinai* 2, 639. Beirut, Lebanon: American Press.
42. Rechinger, K. H. (1990). *Fritillaria* L. In: Rechinger, K. H. (eds), *Flora Iranica* 165, 61–76. Akademische Druck-und Verlagsanstalt, Graz,
43. Rix, E. M. (1971). Three New *Fritillaries* From Eastern Turkey. Notes from the Royal Botanic Garden, 31, 125–129. https://doi.org/10.2307/4102882
44. Rix, E. M. (1974). Notes on *Fritillaria* (Liliaceae) in the eastern Mediterranean region. I & II. Kew Bulletin, 29, 647–654. https://doi.org/10.2307/4108130
45. Rix, E. M. (1975). Notes on *Fritillaria* (Liliaceae) in the eastem Mediterranean region. III. Kew Bulletin, 30, 153–162.
46. Rix, E. M. (2019). *Fritillaria forbesii* (Liliaceae). *Curtis's Botanical Magazine* 36: 95–105. https://doi.org/10.1111/curt.12278
47. Rix, E. M. (1977). *Fritillaria* in Iran. Iran Journal of Botany, 1, 75–95.
48. Rix, E. M. (1980). *Fritillaria* L. In: Tutin, T. G., Heywood, V. H., Burges, N. A., Moore, D. M., Valentine, D. H., Walters, S. M. & Webb, D. A. (Eds.) Flora Europaea 5, 31–34. Cambridge; Cambridge University Press.
49. Rix, E. M. (1984). *Fritillaria* L. In: Davis, P. H. (Ed.) *Flora of Turkey and the East Aegean Islands* 8, 284–302. Edinburgh; Edinburgh University Press.

50. Rix, E. M. (2001). *Fritillaria*. A revised classification. The *Fritillaria* Group of the Alpine Garden Society, United Kingdom.
51. Roguz, K., Bajguz, A., Gołebiewska, A., Chmur, M., Hill, L., Kalinowski, P., Schönenberger, J., Stpiczyńska, M., & Zych, M. (2018). Functional Diversity of Nectary Structure And Nectar Composition in The Genus *Fritillaria* (Liliaceae). Frontiers in Plant Science, 9, 1246. https://doi.org/10.3389/fpls.2018.01246
52. Rønsted, N., Law, S., Thornton, H., Fay, M. F., & Chase, M. W. (2005). Molecular phylogenetic evidence for the monophyly of *Fritillaria* and *Lilium* (Liliaceae; Liliales) and the infrageneric classification of *Fritillaria*. Molecular Phylogenetics and Evolution*, 35* (3), 509-527. https://doi.org/10.1016/j.ympev.2004.12.023
53. Samaropoulou, S., Bareka, P., & Kamari, G. (2016). Karyomorphometric analysis of *Fritillaria* montana group in Greece. *Comparative* Cytogenetics, 10, 679–695. https://doi.org/10.3897/CompCytogen.v10i4.10156
54. Samaropoulou, S., Bareka, P., & Kamari, G. (2019a). Hybridization and karyotype variability of three endemic *Fritillaria* L. (Liliaceae) in Argolis Peninsula (Greece). *Plant Biosystems,* 154, 348–360. https://doi.org/10.1080/11263504.2019.1612478
55. Samaropoulou, S., Bareka, P., Bouranis, D. L., & Kamari, G. (2019b). Seed morphology in the genus *Fritillaria* (Liliaceae) from Greece and its taxonomic significance. Phytotaxa, 416, 223–237. https://doi.org/10.11646/phytotaxa.416.4.1
56. Samaropoulou, S., Bareka, P., Bouranis, D. L. & Kamari, G. (2022). Studies on the pollen morphology of *Fritillaria* L. (Liliaceae) taxa from Greece. Plant Biosystems, 156, 947–958. https://doi.org/10.1080/11263504.2021.1985000
57. Sharifi-Tehrani, M., & Advay, M. (2015). Assessment of relationships between Iranian *Fritillaria* (Liliaceae) species using chloroplast trnH-psbA sequences and morphological characters. Journal of Genetic Resources, 1, 89–100. https://doi.org/10.22080/JGR.2015.1168
58. Sonay, V., Tekşen, M., Yıldırım, H., Balos, M. M., & Akan, H. (2023). *Fritillaria karakocanensis* (Liliaceae), a new species of the *F. crassifolia* group from Anatolia (Turkey). Nordic Journal of Botany, 2023, e03903. https://doi.org/10.1111/njb.03903
59. Tekşen, M., & Aytaç, Z. (2011). The revision of the genus *Fritillaria* L. (Liliaceae) in the Mediterranean region (Turkey). Turkish Journal of Botany, 35, 447–478. https://doi.org/10.3906/bot-0812-9
60. Tekşen, M. (2018). *Fritillaria* L. In: Güner, A., Kandemir, A., Menemen, Y., Yıldırım, H., Aslan, S., Ekşi, G., Güner, I. & Çimen, A. Ö. (Eds.) *Resimli Türkiye Florası*, Vol. 2, 800–876 . Istanbul; ANG Vakfı Nezahat Gökyiğit Botanik Bahçesi Yayınları.
61. Tekşen, M. (2023) Doğadan herbaryuma: *Fritillaria* L. (Liliaceae). Herbarium Turcicum, 2, 1-15. https://doi.org/10.26650/HT.2022.1158469
62. Tekşen, M., Aytac, Z., & Pınar, N. M. (2010). Pollen morphology of the genus *Fritillaria* L. (Liliaceae) in Turkey. Turkish Journal of Botany 34(5), 397–416. https://doi.org/10.3906/bot-0907-93
63. Tekşen, M., Çimen, A. Ö., & Yıldırım, H. (2024). *Fritillaria nevzatcaglari* (Liliaceae), a new species from southern Anatolia, Turkey. Annales Botanici Fennici, 61 (1), 41-46. https://doi.org/10.5735/085.061.0107
64. Tel, A. Z. (2024). *Fritillaria arzuae* (Liliaceae), a new Species from Turkey. Annales Botanici Fennici, 61 (1), 289-296. https://doi.org/10.5735/085.061.0140
65. Türktaş, M., Aslay, M., Kaya, E., & Ertugrul, F. (2012). Molecular characterization of phylogenetic relationships in *Fritillaria* species inferred from chloroplast *trn*L-*trn*F sequences. Turkish Journal of Biology, 36, 552–560. https://doi.org/10.3906/biy-1201-30
66. Wang, Q., Zhou, S. D., Deng, X. Y., Zhieng, Q. & He, X. J. (2009). Comparative morphology of the leaf epidermis in *Fritillaria* (Liliaceae) from China. Botanical Journal of Linnean Society, 160, 93–109. https://doi.org/10.1111/j.1095-8339.2009.00855.x
67. WCSP (2025). *World Checklist of Selected Plant Families.* Facilitated by the Royal Botanic Gardens, Kew. Available from: http://apps.kew.org/wcsp/ (accessed 30 June 2023)
68. Wendelbo, P. (1985). *Fritillaria* L. In: Townsend, C. C. & Guest, E. (Eds.) *Flora of Iraq* 8, 76–82. Baghdad: The Whitefriars Press.
69. Xinqi, C., & Mordak, H. V. (2000). *Fritillaria* L. In: Wu, Z. Y. & Raven, P. H. (Eds.) *Flora of China* 24, 127–133. St. Louis, Missouri, USA; Science Press: Beijing, China and Missouri Botanical Garden Press.
70. Yıldırım, H., & Tekşen, M. (2021). *Fritillaria arsusiana* (Lilieae, Liliaceae), a new species from southern Anatolia. *Phytotaxa* 502, 149–159.

71. Yıldırımlı, Ş., Kılıç, Ö., & Demirpolat, A. (2019) A new unexpected species of *Fritillatia*, *F. gencensis* (Liliaceae) from Genç, Bingöl, Turkey. Ot Sistematik Botanik Dergisi, 26 (1), 1–11.

72. Zaharof, E. (1989). Karyological studies of twelve *Fritillaria* species from Greece. Caryologia, 42, 91–102. https://doi.org/10.1080/00087114.1989.10796956