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## A new *Fritillaria* species from Mediterranean region of Turkey; *Fritillaria asumaniae*

### Abstract

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*Fritillaria asumaniae* R. Wallis, R. B. Wallis & N. Özhatay from Antalya province, situated in the Mediterranean region of Turkey is described as a new species. Approximately 20 species of the genus *Fritillaria* occur in Mediterranean region of Turkey, nearly 50% of which are endemic. In habit and shape of the perigone, the new species is reminiscent of *F. forbesii* Baker, a Turkish endemic species distributed around Muğla province and *F. elwesii* Boiss. scattered throughout SW Turkey and Aegean Islands. It differs from *F. forbesii* in its very dark brownish or blackish flowers, anthers and pollen grains. It also differs from *F. elwesii* in its undivided style, lack of green fascia on the perigone segments, the dark colored pollen grains and absence of bulbils. Description of the new species, taxonomic relationships, anther and pollen grain characteristics with color photographs are given.

*Key words:* *Fritillaria*, SEM, Mediterranean, Turkey.

### Introduction

Approximately 156 taxa of the genus *Fritillaria* are accepted worldwide (Rix 2001). In Turkey the genus is represented by 35 species and 6 subspecies totaling 41 taxa, of which 16 are endemic. 15 new species have been collected for the first time in Turkey and their type specimens preserved therein (Rix 1984; Özhatay 2000; Tekşen 2012). The Mediterranean region is a particularly important area for the genus in Turkey (Fig. 1). Herein we describe a further new taxon from the region: *Fritillaria asumaniae*.

Whilst walking in the forest in the foothills of Tahtalı Dağ, near Antalya, on November 8th 2008, R. & R. B. Wallis noticed a large number of *Fritillaria* capsules in the dense undergrowth. Enquiries made of others who had been there before, informed us that the flowers were predominantly black and that, in spite of the colour, this could be a disjunct site for *F. forbesii*. Further investigation on April 7th 2011, whilst the plants were in flower, made us realise that there were significant differences from the latter and that we had found an undescribed species growing

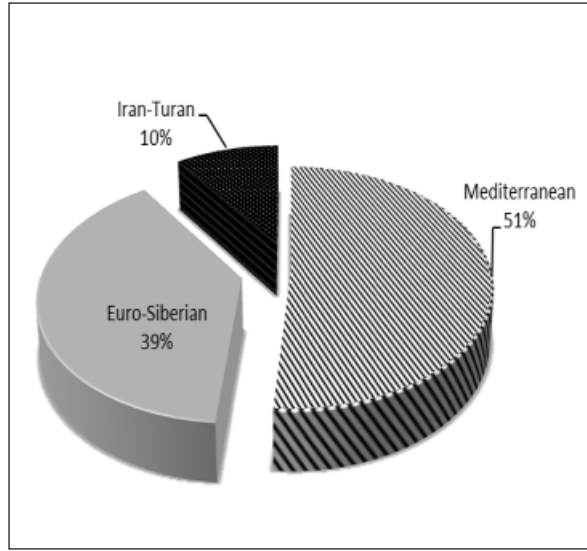


Fig. 1. The distribution of *Fritillaria* species within the three floristic region of Turkey (Tekşen 2012).

within a km of a popular tourist resort. It is widespread in and around the Olimpos Beydağları National Park and along the Lycian Way and it is a surprise that it has not been reported before.

### Materials and methods

The specimens were collected during flowering time and were checked with the relevant literature (Tutin 1980; Rix 1984, 2001; Townsend 1985; Rechinger 1990; Özhatay 2000; Wallis & Wallis 2003; Tekşen & Aytaç 2008; 2011; Tekşen 2012) and compared with the herbarium specimens in ISTE (Istanbul University, Faculty of Pharmacy Herbarium).

Other examined species kept in ISTE:

***F. forbesii***; C2 Muğla, Babadağ, Fethiye-Ölüdeniz, Ocakköy, *Pinus brutia* forest, limestone rocks, 500 m, 19.03. 1992, N. Özhatay, A. Byfield, S. Atay (ISTE 64040)!

***F. elwesii***; C3 Antalya: Manavgat-Topraktepe, near Taşkesiği, 100 m, 30.03.1975, T. Baytop (ISTE 31386)!, around Akseki, 04.1987, A. Attila. (ISTE 57760)!

Pollen samples were taken from herbarium materials for palynological studies. Pollen grains of specimens for LM investigations were prepared according to the method proposed by Wodehouse (1935) in Istanbul University, Faculty of Pharmacy, and Department of Pharmaceutical Botany and coated with gold for scanning electron microscope (SEM) studies. The SEM micrographs were taken with a JEOL 6510-LV JSM microscope. The descriptive terminology of Faegri and Iversen (1992) was used. The general pollen description was based on the SEM investigation.

*Fritillaria asumaniae* R. Wallis, R. B. Wallis & N. Özhatay, **sp. nov.** — Fig. 2, 3.

**Type:** C3 Antalya. Kemer, west of Göynük, forest in deep leaf soil amongst limestone rocks under tall pine woodland, 250 m. 29.iii.2012, *N. Özhatay and A. Kavgacı* (Holotype: ISTE 106610!).

Other examined specimen C3 Antalya, Kemer, Tahtalıdağ, Peynirlik-Kızıllan 800-1600 m, 04.05.1979, *H. Peşmen 4628, A. Güner* (ISTE 52595)!

**Etymology:** The species is named after Asuman Baytop (1920 – 2015) who was a well known Turkish botanist and sadly passed away this year.

Bulb spherical without bulbils. Stem 25-60 cm smooth. Leaves glaucous, 4-5 (7), alternate, linear-lanceolate, lowest  $9.5 \times 1.2$  cm, with a single bract leaf,  $4.5 \times 0.3$  cm. Leaves on unflowered bulbs ovate-lanceolate up to  $6.5 \times 3.5$  cm. Flowers single, narrowly conical, segments dark brown-black with occasional small light spots, sometimes with a yellowish distal margin, untessellated,  $20 \times 8$  mm. Nectary indistinct, greenish, at the base of the perigone,  $3-4 \times 2$  mm. Filaments greenish white, 10 mm. Anthers dark brown. Style clavate, trifurcate, undivided,  $8 \times 1.5$  mm papillose. Capsule unwinged.

Growing in partial to deep shade of large *Pinus brutia* Ten. trees, in deep leaf mould soil amongst limestone rocks. 225-500 m.

**Ecology and distribution:** *Fritillaria asumaniae* is quite a tall (up to 60cm) compared to other species probably because of its environment of tall undergrowth under the shade of pine trees in Antalya Province (Fig. 4). It shares this environment with beautiful mature trees of *Arbutus andrachne* L. and several species of deciduous shrubs which are only just coming into leaf when the new species is flowering. The area has a number of orchids of which we only noted *Orchis anatolica* Boiss. in flower at the same time. There are also a large number of *Cyclamen graecum* subsp. *anatolicum* Ietsw. and *Galanthus peshmenii* A.P. Davis & C.D. Brickell which occupy the lower and the upper forest respectively and both of which overlap the altitude range of *F. asumaniae*.

*Fritillaria asumaniae* shows little variation and about half of the flowers observed are entirely dark brown with small white dots and the other half have a small yellow mark in the centre of the tip of both inner and outer tepals. After considerable searching we found just one specimen, amongst approximately 100 others, with dingy yellow flowers.

Anther and pollen morphology of the new species was compared with *F. forbesii* and *F. elwesii* (Fig. 3). The general description can be given as follows:

The anthers of *F. elwesii* are  $5-8 \times 0.9-1$  mm and those of *F. forbesii* are  $4-8 \times 0.8-0.9$  mm, whereas *F. asumaniae* has the smallest anthers among the three species ( $4-6 \times 0.9-1$  mm). Those of all the investigated species are apiculate at apex. The inner and outer surfaces are fossulate, with irregular grooves.

The main features of the investigated pollen are summarised in Table 1. *Size and shape:* The shape of pollen grains in the investigated *Fritillaria* is radially symmetrical, heteropolar, prolate according to the LA/SA ratio. The long axis (LA)  $42.46-56.31$   $\mu\text{m}$  and short axis (SA)  $30.46-41.85$   $\mu\text{m}$  based on LM. *F. asumaniae* has the largest pollen grain. *Aperture:* All the investigated pollen grains are operculate, monosulcate. *Fritillari forbe-*



Fig. 2. *Fritillaria asumaniae*: A) Perigone, B) In the field.

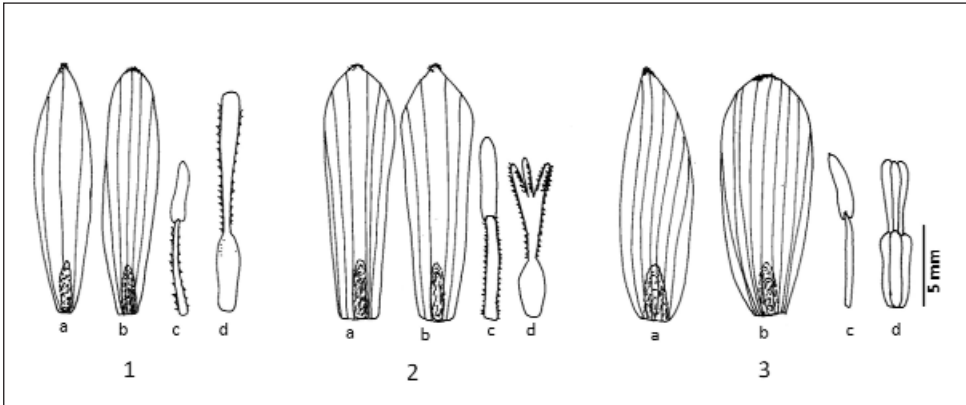


Fig. 3. The main morphological features of *Fritillaria forbesii* (1), *F. elwesii* (2), *F. asumaniae* (3): a. Outer tepals; b. Inner tepals; c. Stamen; d. Pistil.

*sii* has the longest and the widest sulcus, its length is 41.54  $\mu\text{m}$  and its width is 10.77  $\mu\text{m}$  based on LM. The sulcus membrane is verrucate in all three *Fritillaria* species investigated. *Exine, intine*; The exine is tectate and 1.08-1.69  $\mu\text{m}$  thick. Intine thickness ranges from 0.91 to 1.24  $\mu\text{m}$ . The thickest exine and intine are observed on the new species, *F. asumaniae*. The ornamentation is reticulate, rugulate-reticulate, reticulate-perforate. Reticulate-perforate sculpturing is observed in *F. forbesii*, rugulate-reticulate sculpturing is observed in *F. elwesii* and reticulate sculpturing is observed in the new species.

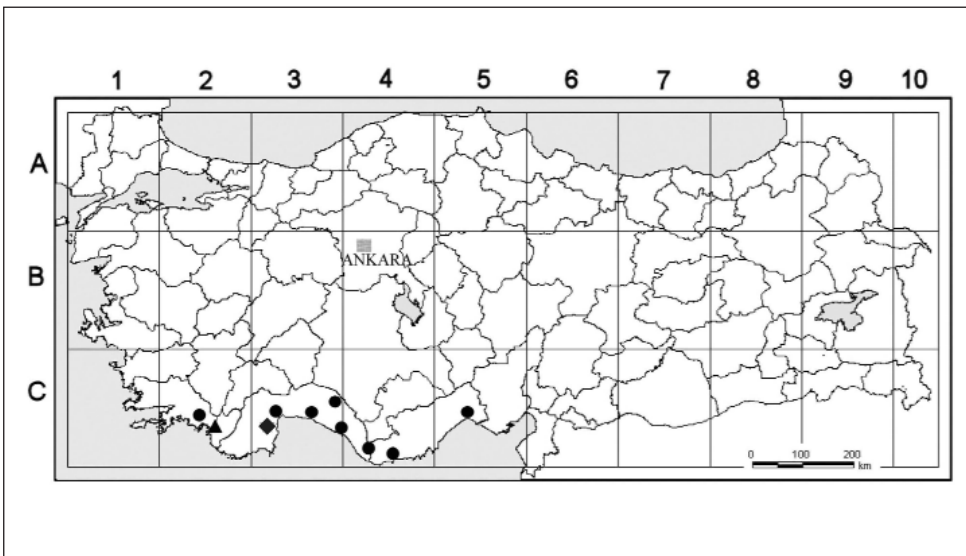


Fig. 4. Distribution of *F. forbesii*▲, *F. elwesii* ●, *F. asumaniae* ◆.

Table 1. Pollen morphological parameters of *Fritillaria forbesii*, *F. ehwestii* and *F. asumaniae* (values in  $\mu\text{m}$ , sd; standard deviation).

	Long axis (L.A) mean $\pm$ sd	Short axis (S.A) mean	L.A/S.A ratio, shape	Exine		Intine	Aperture type	Sulcus		
				thickness	ornamentation			length mean	width mean	ornamentation
<i>F. forbesii</i>	47.38 $\pm$ 1,39	32.01 $\pm$ 1,56	1.48 prolate	1.08 $\pm$ 0.25	reticulate-perforate	0.91 $\pm$ 0.23	Monosulcate	41.54 $\pm$ 1,97	10.77 $\pm$ 1,42	Verrucate
<i>F. ehwestii</i>	42.46 $\pm$ 1,24	30.46 $\pm$ 1,14	1.39 prolate	1.23 $\pm$ 0.21	rugulate-reticulate	0.92 $\pm$ 0.20	Monosulcate	24.62 $\pm$ 1,63	09.23 $\pm$ 0,98	Verrucate
<i>F. asumanae</i>	56.31 $\pm$ 1,28	41.85 $\pm$ 1,43	1.35 prolate	1.69 $\pm$ 0.16	reticulate	1.24 $\pm$ 0.24	Monosulcate	55.38 $\pm$ 1,81	06.15 $\pm$ 0,78	Verrucate



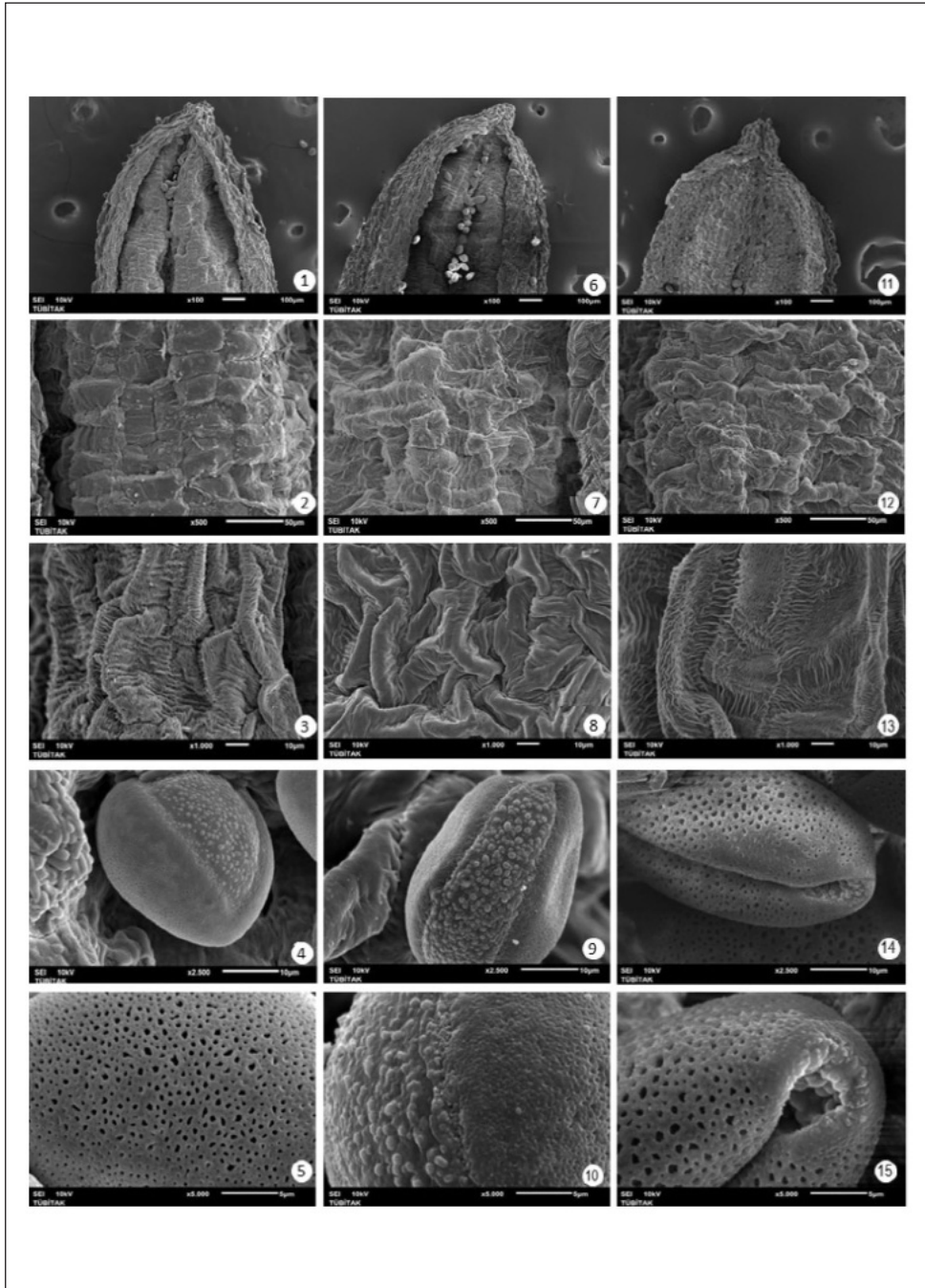


Fig. 5. Scanning electron micrographs of anthers (SEM  $\times$  100, 500, 1000) and pollen grains (SEM  $\times$  2500, 5000): 1-5. *F. elwesii*, 6-10. *F. forbesii*, 11-15. *F. asumaniae*. Anther apex (1, 6, 11), inner surface of anther (2, 7, 12), outer surface of anther (3, 8, 13), pollen grains (4, 9, 14), exine surfaces (5, 10, 15).

## Discussion and Conclusions

*Fritillaria asumaniae* differs from *F. forbesii* Baker in several respects. With just the single exception described above, the flowers are very dark brown (greenish yellow in *F. forbesii*). The anthers and pollen are dark brown (yellow in *F. forbesii*). The stigma is markedly clavate and becomes very thick (1.5 mm) (linear and less than 1 mm in *F. forbesii*). The stem leaves are more than 10 mm wide (less than 5 mm wide in *F. forbesii*), a feature which is even more marked in the single leaves of unflowering seedlings (*F. asumaniae* = 35 mm, *F. forbesii* = 4 mm). *Fritillaria forbesii* is found on Baba Dağ and adjacent mountains, some 120 km to the west and has not been found in the intervening area.

According to Tekşen & al. (2010), *Fritillaria* species were divided into 7 pollen types according to sulcus membrane (psilate, verrucate, verrucate-granulate, granulate, granulate-striate, rugulate, gemmate). Pollen grains of *F. asumaniae* and *F. forbesii* are type II, but the pollen of *F. elwesii*'s is of type I.

Several other species of *Fritillaria* are known in the general area of Olimpos Beydağları National Park. *Fritillaria acmopetala* Boiss. is common especially on the south and east sides of the Tahtali Dağ ridge but differs in that it has narrower leaves and broader flowers. Plants named *F. lycica* were collected and described by Boissier nearby but it is clear that this is just a small form of *F. acmopetala* and is not the same as *F. asumaniae* (Baker 1874; Stapf 1928), *F. asumaniae* is easily separated from *F. acmopetala* by the shape of the flowers which is narrowly conical (campanulate with rounded shoulders in *F. acmopetala*) and particularly, by the stigma which is narrow and divided into three clear branches of at least 3 mm long in *F. acmopetala* and thickly clavate and undivided in *F. asumaniae*.

The difference between *F. asumaniae* and *F. elwesii* Boiss. is less straightforward and requires a combination of characters to be determined in order to distinguish the two species. The type locality of *F. elwesii* in the Dalaman River basin is 160 km to the south west and since it occurs near Kaş and throughout the southern Taurus mountains, one might expect it also to occur in Tahtali Dağ region, although it has never been reported there. Like *F. acmopetala*, *F. elwesii* usually has a divided stigma, lacking in *F. asumaniae*. However, in some specimens found near near Kaş, the stigma is undivided (E.M. Rix personal communication). It is however narrower than that of *F. asumaniae*. *Fritillaria elwesii* generally has flowers with marked green fascia (absent in *F. asumaniae*). Both species have brown anthers but the pollen is yellow in *F. elwesii* and brown in *F. asumaniae*. Moreover the inner segments are markedly broader than the outer segments in *F. elwesii*, yet similar or only slightly broader in *F. asumaniae*. *Fritillaria elwesii* is often a prolific producer of bulbils which result in quite large colonies of leaves whereas we have not observed bulbils on plants of *F. asumaniae*.

There is also one report of *F. latakiensis* Rix (Rix 1984) from near Kaş but again, although superficially similar to *F. asumaniae* it has a narrow, divided style.

For these reasons we consider *F. asumaniae* to be a new species and a surprising new addition to the flora of Turkey. *F. asumaniae* has been seen in several places in the forests of Tahtali Dağ where it flowers in March and early April.



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