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Anatomical, morphological and palynological study on Turkish endemic *Fritillaria baskilensis* (Liliaceae)

Abstract

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Fritillaria baskilensis Behçet (Liliaceae) was described as a new species in 1998 from Turkey. It grows in Elazığ-Baskil province (Şelil Dağı) in East Anatolia and known only from one locality. In this study, endemic *F. baskilensis* is presented with anatomical, morphological and palynological features. Plant samples have been collected from the type locality. The most important features that distinguish this species from other are: a shorter stem, smaller perianth and exerted stamens. In addition to the morphological features described in the flora of Turkey, fruit and seed characteristics are also given. The anatomical and palynological features of *F. baskilensis* are reported for the first time in this study. For anatomical studies cross-sections of the root, stem and leaves and surface sections of the leaves of *F. baskilensis* have been investigated. It has been determined that pollen type is monosulcate, pollen shape is subprolate, ornamentation is reticulate in investigated species.

Although threat category of the species is given as Endangered (EN) in the Red Data Book of Turkish Plants, its category could be reclassified as Critically Endangered (CR) according to our field observations.

Introduction

The genus *Fritillaria* L. belongs to family *Liliaceae*, has about 165 taxa worldwide and is represented by 38 species and 6 subspecies of which 27 (% 71) are endemic to Turkey (Tekşen 2008). It has 25 taxa in Greece (Rix 2001), 22 in Russia (Lozina-Lozinskaya 1968) and 18 in Iran (Rechinger 1990). *F. baskilensis* was described as a species nova in 1998 and has very limited distribution at Baskil -Elazığ in Eastern Anatolia of Turkey (Behçet 1998).

There are some studies of the anatomical, morphological and palynological characteristics of some species belonging to the genus *Fritillaria* in Turkey (Pehlivan 2002; Özler 2007; Alan 2008). However, there has been no investigation of *F. baskilensis* species as yet. In this study, the morphological, anatomical and palynological features of *F. baskilensis* were studied in order to provide more detailed descriptions of the species. It was performed on the cross-section of the root, stem, leaves and surface sections of the leaves for anatomical investigations and given their results.

Material and methods

Plant materials have been collected from the type locality in Elazığ (Baskil) in Turkey. Specimens for morphological studies were dried according to standart herbarium techniques and have been stored at the Yüzüncü Yıl University Science and Art Faculty Herbarium (VANF). Identification was made according to flora of Turkey (Özhatay 2000; Rix 1984) and herbarium samples. Fresh samples were used for morphological measurements.

The materials necessary for anatomical studies have been collected from natural habitat and preserved in 70 % alcohol. For anatomical analysis, cross-section of root, stem and leaves, and superficial sections of upper and lower leaf surface were used. For cross-sections study, were used method of parafin (Kandemir & al. 2008) and sections were taken by microtome, surface sections of leaves taken free-hand. These section were stained with safranin and fast green and fixed with entellan (Vardar 1987). Photographs of them were taken with an Nikon Coolpix 5000 digital camera.

The pollen morphology of the taxon in the study was investigated by lightmicroscope. In the light microscope investigations, the pollen obtained from the samples were set according to the method of preparation described by Wodehouse (1935).The terminology used is mainly from Faegri and Iversen (1975).

Results

Morphological properties

Bulb globose to 1.5 cm diameter. Stem erect, 9-12 cm, smooth. Leaves 4-5, alternate lower leaves subopposite, broadly elliptic lanceolate, acute, 25-50 × 4-15 mm, glabrous, upper leaves linear or linear-lanceolate. Flowers always solitary. Perigon narrowly campanulate, dark purplish brown inner and outer side, usually with glaucous bloom; outer segments ovate to narrowly ovate, acute, 0.8-1.3 × 0.3-0.4 cm, inner lanceolate, 0.8-1.2 × 0.2-0.4 cm broad, sometimes obtuse. Filament 10-15 mm, slender, papillose, anthers 3-4 mm, usually purplish. Style 10-16 mm, smooth or sparsely papillose, slender, stigma entire. In addition to the morphological features described in the flora of Turkey, fruit characteristics are capsule 17-20 × 10-12 mm, obovat to oblong, unwinged, and seed 4-4.5 × 3-4 mm, flat, triangular ovate, winged, wing c. 0.5 mm, testa pale brown, reticulate (Fig. 1).

Examined specimens: (Type locality) Turkey. B7 Elazığ: Baskil, Yukarı Kuluşığı village, Selil mountain, Yukarı mahalle, stony places, 1300 m, 19.04.2009, S.M. Pinar, MP 2756.

Flowering period: March-May.

Distribution in Turkey: East Anatolia.

Anatomical properties

For the anatomical investigations, samples were taken from the plants' root, stem, and leaves.

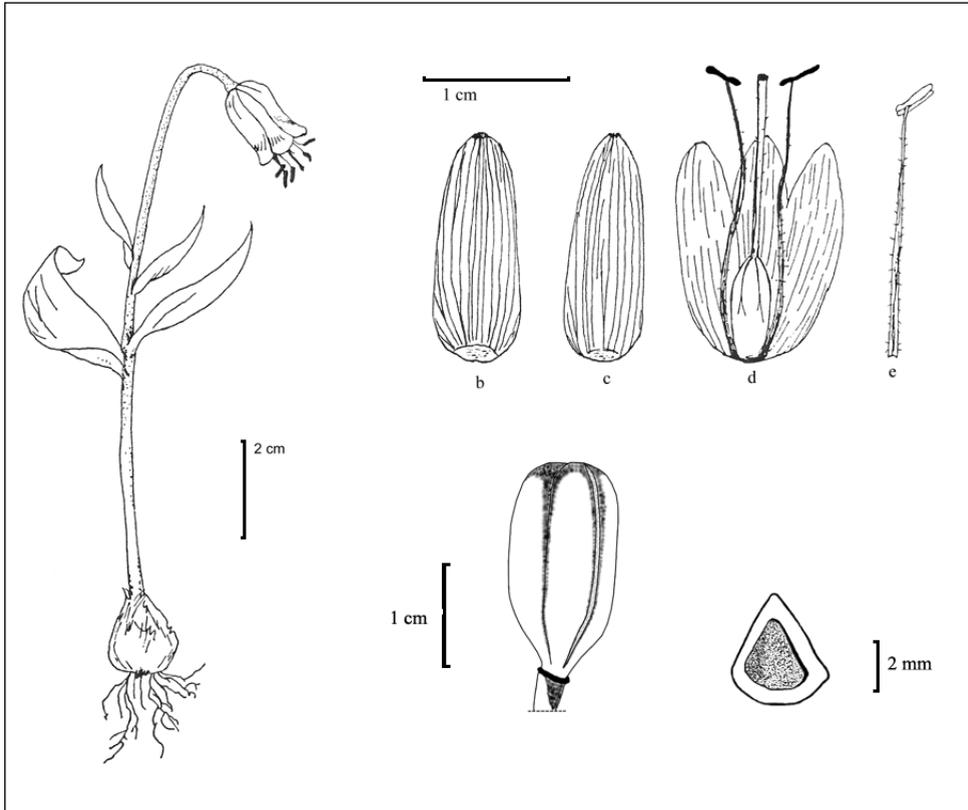


Fig. 1. **a.** habit **b.** outer tepal **c.** inner tepal **d.** flower dissected, **e.** stamen, **f.** fruit, **g.** seed.

Root

Transverse section taken from middle part of the root were observed as follows (Fig. 2A). The epidermis is composed of almost square cells. The cortex is 4-5 layered and consist of parenchyma. These parenchyma cells are irregular or oval thin walled. The single-layered endodermis consists of three thick-walled cells. The direction of these thicknesses are the cortex side. The pricycle is single layered and thin walled. The number of xylem ridges are 3 and opposite the phloem. The center of vascular cylinder is composed of 1 metaxylem.

Stem

Transverse section taken from the middle part of stem were observed as follows (Fig. 2B). The epidermis is composed of small orbicular cells and infrequently bears stomata. The cortex comprises parenchyma and sclerenchyma. The 3-5 layered parenchyma consists of oval or orbicular cells and is outer side of cortex. The sclerenchyma is 4-5 layered and inner side of cortex. The vasculer bundles are more numerous in the vascular cylinder.

Leaf

Transverse section of the lamina and the midrib and surface preparations of both epidermises revealed the following elements (Fig. 2C-E). In transverse section, the upper and lower epidermises comprise uniseriate, almost square and orbicular cells. The upper epidermises cells are larger than lower epidermises cells. Both epidermises are covered with almost thick cuticle. The stomata occur on the surface of both sides, being more abundant on the lower surface. They are located on the same level and contact with four neighboring cells. The leaf is isolateral, mesophyll consists of 8-10 layered cells, oval or slightly elongated. Vascular bundles are uniseriate and different size in the mesophyll cells.

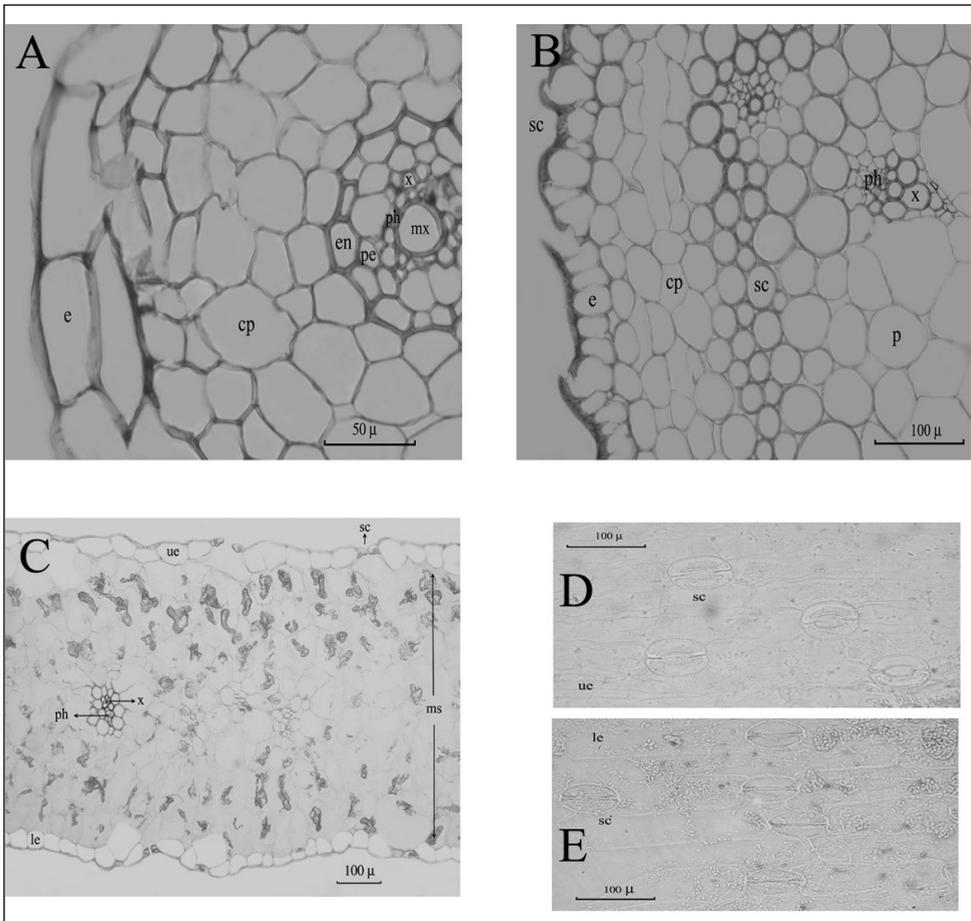


Fig. 2. *Fritillaria baskilensis* Behçet. **A**, cross section of root; **B**, stem; **C**, leaf; **D**, **E**, Upper and lower surface-section of leaf. **e**:epidermis, **cp**: cortex parenchyma, **en**: endodermis, **pe**: pericycle, **x**: xylem, **ph**: phloem, **mx**: metaxylem, **sc**: stoma cell, **scl**: sclerenchyma, **pi**: pith, **ue**: upper epidermis, **le**: lower epidermis, **ms**: mesophyll.

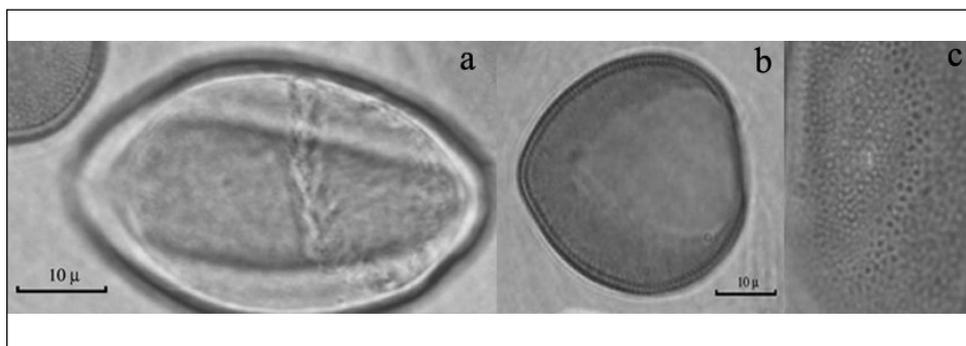


Fig. 3. Pollen morphology **a.** equatorial view; **b.** polar view; **c.** ornamentation

Palynological properties

Pollen grains of *Fritillaria baskilensis* are monad, heteropolar, monosulcate, prolate in shape (A/B:1,49), 47.68 µm in polar diameter (P) and 31.88 µm in equatorial diameter (E), sulcus 40,28 µm length and 19.43 µm width, exine surface reticulate. Pollen grain in equatorial view, polar view and exine surface ornamentation are shown in Fig. 3.

Discussion

F. baskilensis is a local endemic species to Turkey, which belongs to the family *Liliaceae* (Behçet 1998). It grows only in the type locality (Behçet 1999a, 1999b). There have been no previous morphological, anatomical and palynological studies of the *F. baskilensis*. In this study, *F. baskilensis* collected from Elazığ-Baskil were investigated in terms of anatomical, morphological and palynological properties. In conclusion the morphological properties of *F. baskilensis* have generally been matched with published in the Flora of Turkey (Özhatay 2000). In addition to the morphological features described in the flora of Turkey, fruit and seed characteristics and sizes have been reported here for the first time. Anatomical traits and pollen features were determined as important for the genus. Most of the anatomical properties of *F. baskilensis* resemble the general characteristic of monocotyledons.

The species grows on stony places, at 1200–1300 m. IUCN category is suggested EN (Endangered) to *F. baskilensis* in *Red Data Book of Turkish Plants* (Ekim & al. 2000). According to our field observations, this species is found in one locality (criterion B2 ab[i,ii]). (IUCN 2001). This species is under extinction risk due to the threat of erosion. Taken these data into consideration, we think that this species should be classified as CR (Critically Endangered).

This species closely related to *Fritillaria armena* Boiss. and *Fritillaria caucasica* Adams. The most important features that distinguish this species from other species are, it has got a shorter stem, smaller perianth and exerted stamens. We continue to study on this subject.

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