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HASAN AKAN

İSMAİL EKER

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## Some Morphological and Anatomical Investigations on Autumn Species of *Crocus* L. Occurring in Şanlıurfa

Hasan AKAN, İsmail EKER  
Harran University, Art & Science Faculty, Biology Department, Şanlıurfa - TURKEY

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**Abstract:** Some morphological and anatomical characteristics of *Crocus pallasii* Goldb. subsp. *turcicus* B.Mathew and *Crocus cancellatus* Herbert subsp. *damascenus* (Herbert) B.Mathew, which flower in autumn, were investigated.

Detailed descriptions of these two taxa of *Crocus* L., which occur in Şanlıurfa, are provided and their morphological characters are compared with those given in the Flora of Turkey.

The specimens were collected from different parts of Şanlıurfa within C7 of the grid system; their habitat and population status were also determined. Their anatomical structure are illustrated.

**Key Words:** *Crocus*, Şanlıurfa, Turkey.

### Şanlıurfa'da Yayılış Gösteren Sonbahar Çiğdemleri (*Crocus* L.) Üzerinde Morfolojik ve Anatomik Bir Araştırma

**Özet:** Bu çalışmada; Şanlıurfa'da yayılış gösteren ve sonbaharda çiçeklenen *Crocus pallasii* Goldb. subsp. *turcicus* B.Mathew ve *Crocus cancellatus* Herbert subsp. *damascenus* (Herbert) B.Mathew taksonlarının morfolojik ve anatomik özellikleri incelenmiştir.

Bu taksonların detaylı deskripsiyonları verilmiş olup, incelenen morfolojik karakterler Türkiye Florası ile karşılaştırılmıştır.

Şanlıurfa; Grid sistemine göre C7 karesinde yer almakta olup bitki örnekleri çalışma alanının farklı lokalitelerinden toplanmıştır. Habitatları ve popülasyon durumları da gözlemlenmiştir. Ayrıca, taksonların anatomik yapıları resimlendirilmiştir.

**Anahtar Sözcükler:** *Crocus*, Şanlıurfa, Türkiye

### Introduction

*Iridaceae* is represented by six genera in the "Flora of Turkey": *Iris* L., *Hermodactylus* Mill., *Gynandris* Parl., *Crocus* L., *Romulea* Maratti and *Gladiolus* L. (Davis, 1984).

*Crocus* is distributed mainly in the Mediterranean region and includes 80 species worldwide. There are 63 taxa (including subsp. and var.) of *Crocus* in Turkey. Thirty-one of these are endemics for Turkey (Davis, 1984; Davis et al., 1988; Güner et al., 2000).

This research was carried out to determine the morphological and anatomical characteristics of some taxa of *Crocus*, namely *Crocus pallasii* Goldb. subsp.

*turcicus* B.Mathew and *Crocus cancellatus* Herbert subsp. *damascenus* (Herbert) B.Mathew, both autumn-flowering taxa occurring in Şanlıurfa. Three taxa of *Crocus* occur in Şanlıurfa, two of them flowering in autumn and one in early spring, *Crocus leichtlinii* (D.Dewar) Bowles.

Şanlıurfa is in the centre of the South-eastern Anatolia Project (GAP) and natural habitats have been destroyed by the construction of dams and tunnels for the irrigation of plains. Therefore, the biological diversity, especially that of endemic plants, has been affected by this project. After the construction of dams, the populations of the rarer plants should be examined scientifically and new reports prepared for the conservation of plant species.

In Turkey, the genus *Crocus* has 63 taxa, five of which occur in South-eastern Anatolia. Among these, *Crocus biflorus* Miller subsp. *pseudonubigena* B.Mathew and *C. leichtlinii* are endemics and known only from the neighbourhood of the type localities (Mathew, 1984, 1988, 2000).

Close to our research area, a chorological study of geophytes of *Iridaceae* in the Diyarbakır region and Karacadağ mountain was carried out by Malyer (1982). The other studies related to *Crocus* in different parts of Turkey were carried out by Pasche (1994), Kerndorff & Pasche (1994, 1996, 1997) and Mathew (1984, 1988, 1995).

In the present study, detailed descriptions of the morphological and anatomical characteristics of *Crocus pallasii* subsp. *turcicus* and *Crocus cancellatus* subsp. *damascenus* are given, with observations of their populations.

## Materials and Methods

Specimens were gathered in autumn from different parts of Şanlıurfa, which is located in the C7 square. A collector's number was given and the specimens were dried according to standard herbarium methods. The specimens are kept in the herbarium of Harran University, Şanlıurfa. The Flora of Turkey and the East Aegean Islands (Davis, 1984) was used to identify them.

For anatomical analysis, specimens collected from the field were preserved in labelled bottles in 70% alcohol. Some of the samples were selected and cross-sections were taken from the stem (scape) and leaves by microtome and the paraffin method was used; permanent preparations were made using Entellan (Algan, 1981; İnce, 1989). Their photographs were taken with a Zeiss-Germany Axioplan Universal microscope. The anatomical structure of the stem and leaves of these taxa are described for the first time in this paper, but some studies have been carried out by Kandemir et al. (2000), Kandemir & Engin (1998), Çoşkunçelebi & Beyazoğlu (1999), Uysal (1992), Küçükler (1990) and Koca (1996) on different genera belonging to *Iridaceae* and *Liliaceae*.

## Findings

In our research area, there are two species of *Crocus* flowering in autumn. The two species can be distinguished by the following key.

1. Style more than 3-branched or with subdivided branches, usually yellow or orange, the tunic of corm with thick reticulate fibres, . . . . . *C. cancellatus*

1. Style clearly 3-branched, branches undivided, usually deep red, the tunic fibres of corm filiform, . . . . . *C. pallasii*

### Morphological Characteristics

1. *Crocus cancellatus* Herbert in Bot. Mag. 67: sub t.3864 (1841).

subsp. *damascenus* (Herbert) B.Mathew, The *Crocus* 68 (1982).

Syn. *C. damascenus* Herbert in Bot. Reg. 31:37, f.1, Misc. 1 (1845); *C. dianthus* C.Koch in Linnaea 21:634 (1848)

Plants 10-25 cm tall. Corm 0.9-3 x 0.8-2.5 cm; corm tunic reticulate and robust, coarsely netted fibres, tunic with rings at base. Leaves 2-10, hysteranthous or rarely with tips just visible, 2-3 mm broad, greenish. Bracteole present, subequal to or much smaller than bract. Perianth tube 5-9 cm long; throat of perianth usually pale yellow, glabrous. Scape 1.5-5 cm long, 1-flowered; segments 2.4-4.8 x 0.7-1 cm, bluntly acuminate, lilac-blue or lilac-white, veined. Stamens 3, filaments 2-7 mm, pale yellow or white, glabrous, anthers 12-21 mm, yellow. Pistil orange, rarely yellow, 1.6-3 cm long; style dividing into several slender branches, style longer than stamens or sometimes equal. Fruit capsule, cylindric, 15-26 mm long, above ground level. Seeds numerous, brownish, 3 mm long.

Fl.: Sept.-Oct.

Habitat: Rocky slopes, forest clearings, rocky steppe, macchie, 50-2400 m.

Vernacular name: Çiğdem, çiydem, pivog.

Phytogeographic region: Irano-Turanian element.

Distribution in the world of the species: Greece, N. Iraq, E. Iran, Yugoslavia, W. Syria, Turkey.

Distribution in Turkey of the subspecies: Sivas, Kahramanmaraş, Malatya, Bitlis, Muş, Van, Konya, Gaziantep, Adana, Hatay, Şanlıurfa, Diyarbakır, Hakkari.

Type: [Syria] ex montibus aridis calcareis prope Damascus, Vice-Consul et Damascus [T.S.Jago]

Examined specimens:

C7 Şanlıurfa: NW of Şanlıurfa, Direkli Hills, E & N slope, around Huzurevi, rocky steppe, 600-800 m, 20.x.2001, *İ.Eker* 5.

C7 Şanlıurfa: N of Şanlıurfa, Kaşmer mountain, N slopes, district of Uyuzpınar village, rocky slopes, 600-850 m, 15.xi.2001, *Akan & İ.Eker* 9.

2. *Crocus pallasii* Goldb. In Mem. Soc. Not. Mosc. 5:157 (1817).

subsp. *turcicus* B.Mathew in Pl. Syst. Evol. 128:98 (1977).

Plants 10-22 cm tall. Corm 0.7-2 x 1-2.4 cm; tunic fibrous, with rings at base. Leaves 4-22, hysteranthous but visible at late flowering, 0.5-1.5 mm broad, narrowly linear, greenish. Bracteole present, much smaller than bract. Scape 1.5-7 cm long, 1-flowered. Perianth tube 5-12 cm long; throat of perianth usually lilac or pale yellow, glabrous; segments 2.4-4.8 x 0.6-1 cm, acute or acuminate, rarely obtuse, obovate or oblanceolate, lilac-pale blue. filaments 5-6 mm, pale yellow or white, glabrous, anthers 1-2 cm, yellow. Pistil dividing into 3 red branches, 0.8-1 cm long; style shorter than stamens. Fruit capsule, cylindric, at ground level. Seeds numerous, 3-4 mm long.

Fl.: Sept.-Nov.

Habitat: Rocky slopes, forest clearings, in shrubs, rocky steppe, 70-2000 m.

Vernacular name: Çiğdem, çiydem, pivog.

Phytogeographic region: Irano-Turanian.

Distribution in the world: NE Iraq, Syria, Lebanon Turkey.

Distribution in Turkey: Elazığ, Gaziantep, Mardin, Şanlıurfa, Diyarbakır.

Type: Turkey C6 Gaziantep: Urfa to Gaziantep road, 22 km from Gaziantep, 800 m, 3 xi 1973, T.Baytop & Mathew (ISTE 27025) (holo.K, iso.ISTE).

Examined specimens

C7 Şanlıurfa: NW of Şanlıurfa, Direkli Hills, E slope, around Huzurevi, rocky steppe, 600-800 m, 20.x.2001, *İ.Eker* 1.

C7 Şanlıurfa: N of Şanlıurfa, Kaşmer mountain, N slopes, district of Uyuzpınar village, rocky slopes, 600-850 m, 15.xi.2001, *Akan & İ.Eker* 10.

## Anatomical Characteristics

### 1. *Crocus cancellatus* subsp. *damascenus*

#### Stem (Scape) (Figure 1).

Cross-sections from the stem of this taxon show that the cuticle is the outer layer. The epidermis is under the cuticle and has isodiametric cells. The epidermis is without hairs. Parenchyma cells are oval or hexagonal and are under the epidermis. Vascular bundles are numerous and scattered. The xylem members are more visible. In the centre, there is a pith which consists of parenchymatic cells.

#### Leaf (Figure 2)

In the cross-section of the leaves, the cuticle is on the outer layer and it was determined that the upper and lower epidermis layers are similar. Epidermis cells are isodiametric and are oval. It was found that the palisade parenchymatic cells are arranged in columns and made up of 4-5 layers, with chloroplasts in abundance. There are spongy parenchymatic cells, in 3-4 layers, under the parenchymatic cells. Among the parenchymatic cells, there are large and rarely small vascular bundles; both on the upper and lower side of leaves, there are amaryllis-type stomata.

### 2. *Crocus pallasii* subsp. *turcicus*

#### Stem (Scape) (Figure 3).

Cross-sections from the stem of this taxon show that the cuticle is on the outer layer. The epidermis is under the cuticle and has isodiametric cells. The epidermis is without hairs. Parenchyma cells are oval to hexagonal and are under the epidermis. Vascular bundles are numerous and more scattered. The xylem members are more visible. In the centre, there is a pith which consists of parenchymatic cells.

#### Leaf (Figure 4)

In the cross-section of the leaves, the cuticle is the outer layer and it was determined that the upper and lower epidermis layers are similar. Epidermis cells are isodiametric and oval. It was found that the palisade parenchymatic cells are arranged in columns and made up of 4-5 layers with chloroplasts in abundance. There are spongy parenchamatic cells, in 3-4 layers, under the parenchymatic cells. Among the parenchymatic cells, there are large and rarely small and scattered vascular bundles; both on the upper and lower side of the leaves, there are amaryllis-type stomata.

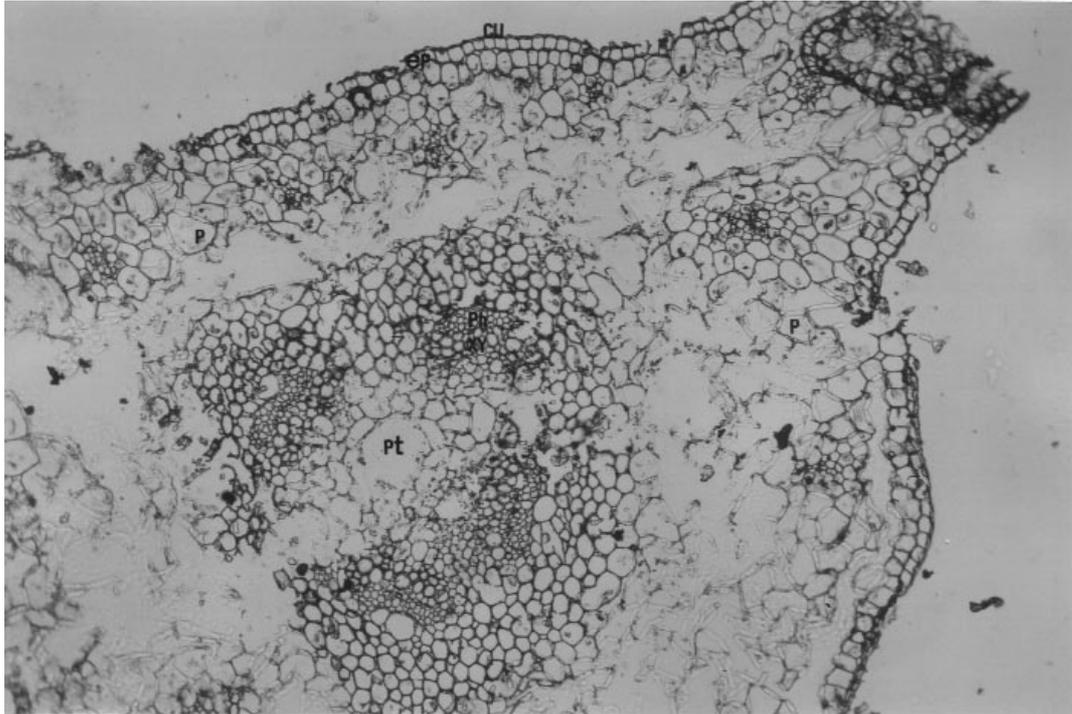


Figure 1. Cross-section of stem of *Crocus cancellatus* Herbert subsp. *damascenus* (Herbert) B. Mathew (10 x 10)  
cu: cuticle, ep: epidermis, ph: phloem, p: parenchyma, pt: pith, xy: xylem.

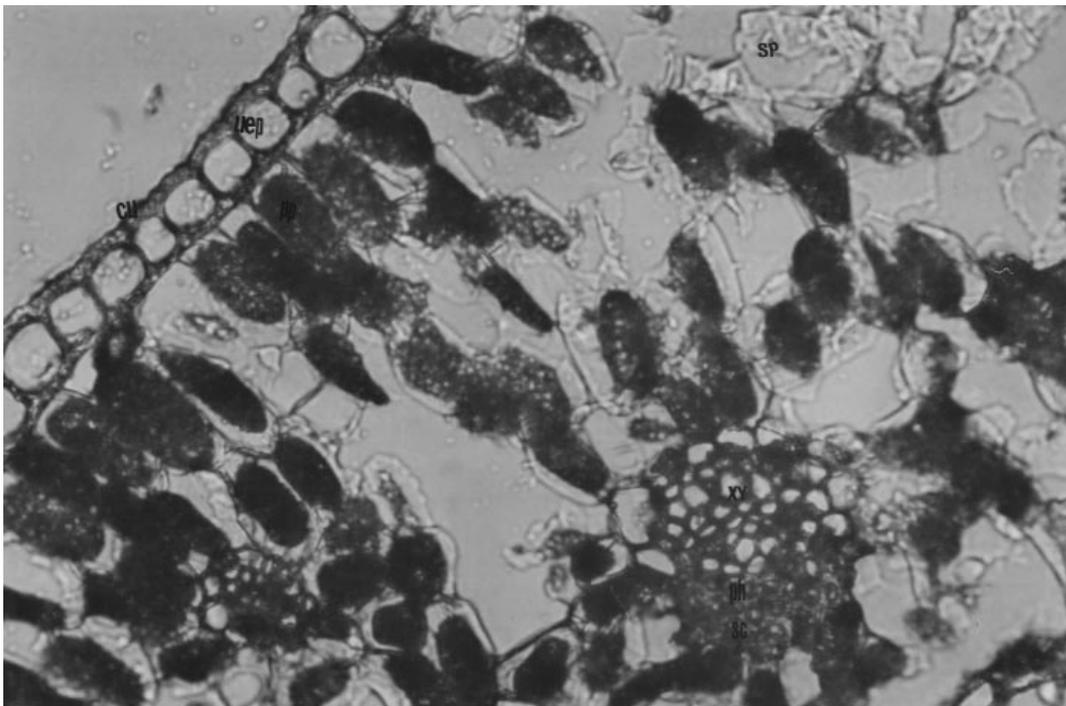


Figure 2. Cross-section of leaf of *Crocus cancellatus* Herbert subsp. *damascenus* (Herbert) B. Mathew (10 x 40)  
cu: cuticle, uep: upper epiderma, pp: palisade parenchymatic cells, sc: schlerencymatic cells, ph: phloem, xy: xylem sp: spongy parenchymatic cells.

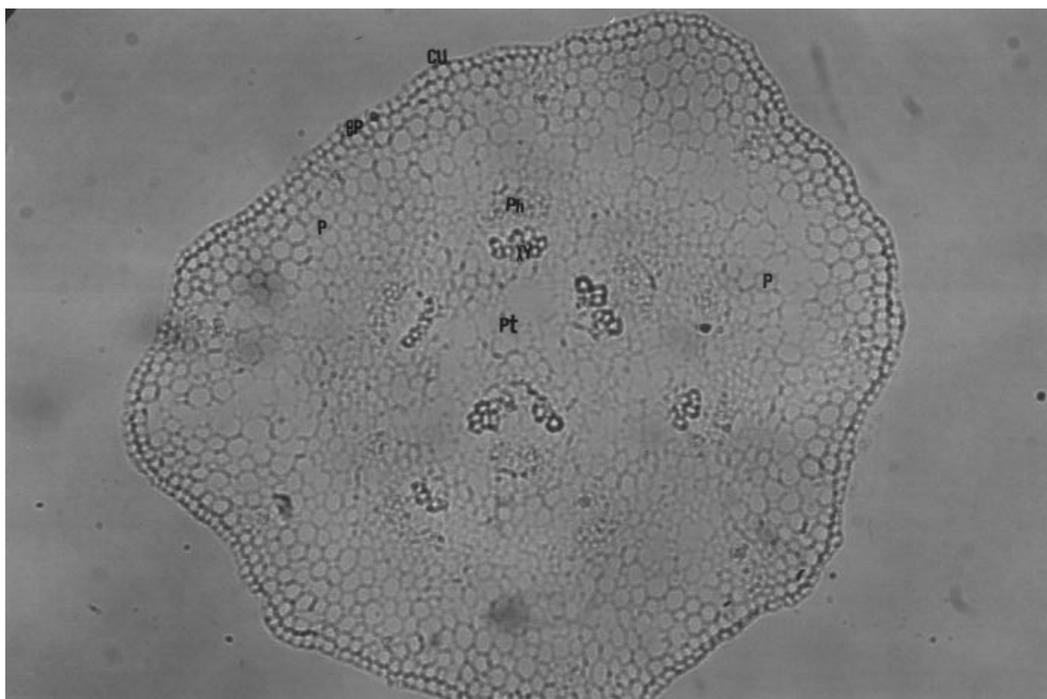


Figure 3. Cross-section of stem of *Crocus pallasii* Goldb. subsp. *turcicus* B. Mathew (10 x 10)  
 cu: cuticle, ep: epidermis, ph: phloem, p: parenchyma, pt: pith, xy: xylem.

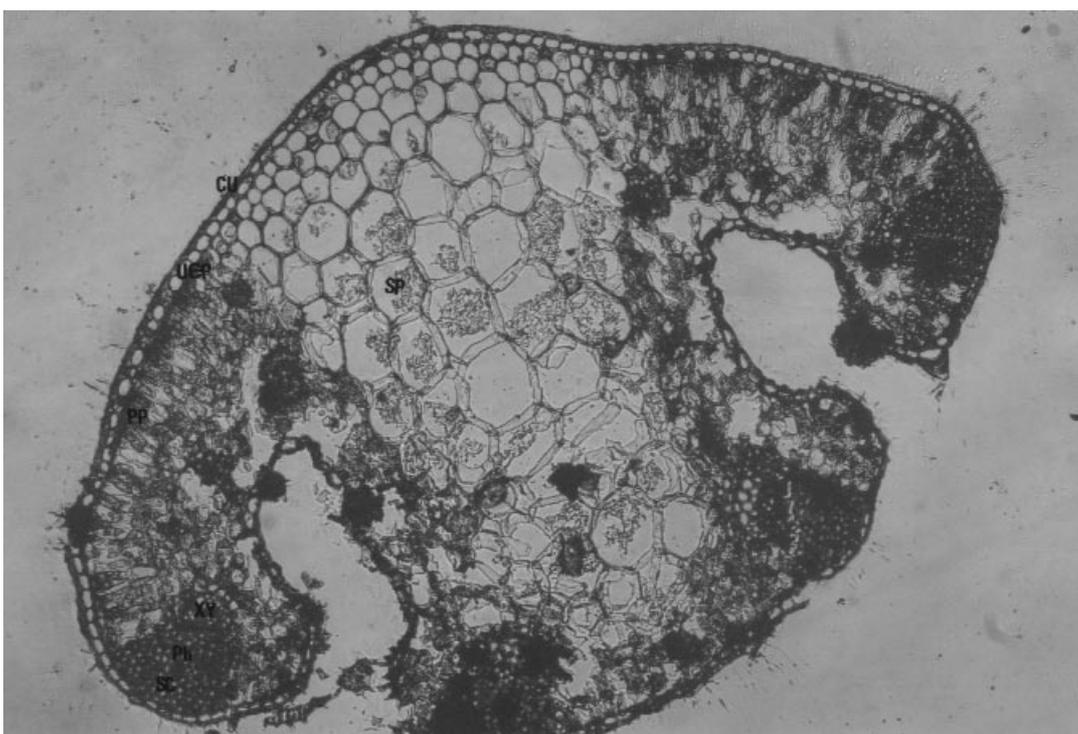


Figure 4. Cross-section of leaf of *Crocus pallasii* Goldb. subsp. *turcicus* B. Mathew (10 x 10)  
 cu: cuticle, uep: upper epiderma, pp: palisade parenchymatic cells, sc: schlerencymatic cells, ph: phloem, xy: xylem  
 sp: spongy parenchymatic cells.

### Observations on population

*Crocus cancellatus* subsp. *damascenus* and *C. pallasii* subsp. *turcicus* are distributed in Şanlıurfa around 500-850 m on rocky slopes and steppes with *Sternbergia clusiana* (Ker-Gawl.)Ker-Gawl. ex Sprengel, *Asphodelus aestivus* Brot., *Salvia* L. sp., *Asperula* L. sp., *Sedum* L. sp. and *Ranunculus* L. sp.

It was observed that *C. cancellatus* subsp. *damascenus* is more widely distributed than *C. pallasii* subsp. *turcicus* in the field, but there are some negative factors affect both of these taxa. Grazing, the construction of channels and dams around Şanlıurfa and gathering by the local people for food are reducing the populations.

### Results and Discussion

In this study, two taxa of *Crocus* namely *Crocus pallasii* subsp. *turcicus* and *Crocus cancellatus* subsp. *damascenus*, which flower in autumn, were observed.

The findings were compared with those in the Flora of Turkey and it was determined that there are some differences between this study and the characteristics given in the Flora of Turkey. These are given in Table 1.

Some morphological characters of these two taxa were not given in the Flora of Turkey, such as the height of the plant and corms, and details of the fruit and seeds. These characters are provided in this study. There are some differences between the Flora of Turkey and our findings but with these differences the descriptions of the taxa are widened; in general, the findings of this study are in agreement with those in the Flora of Turkey.

In the anatomical study, the stem and leaves of the taxa are observed and it is concluded that there is a similarity in their anatomical structure; however, in *Crocus cancellatus* subsp. *damascenus* the vascular bundles are more abundant and regular than those in *C. pallasii* subsp. *turcicus*.

Table 1. Comparison of morphological characteristics between our study and the Flora of Turkey with respect to *Crocus pallasii* subsp. *turcicus* and *Crocus cancellatus* subsp. *damascenus*.

Morphological characters	<i>C. pallasii</i> subsp. <i>turcicus</i>		<i>C. cancellatus</i> subsp. <i>damascenus</i>	
	Flora of Turkey	The findings of this study (Akan & Eker)	Flora of Turkey	The findings of this study (Akan & Eker)
Plant height (cm)	unknown	10-22	Unknown	10-25
Corm (cm)	(2-)3.5-6 (diam.)	0.7-2 x 1-2.4	(1-)1.5-3 (diam.) (height x width)	0.9-3 x 0.8-2.5 (height x width)
Tunic rings	unknown	rings present at base	unknown	rings present at base
Leaf number	absent at anthesis	present at late anthesis	rarely visible	usually absent (rarely present)
Leaves	(5-)7-17	4-22	3-7	2-10
Leaf width (mm)	0.5-1.5	0.5-1.5	2-3 (-4.5)	2-3
Scape height (cm)	unknown	1.5-7	unknown	1.5-5
Perianth tube height (cm)	unknown	5-12	unknown	5-9
Perianth segments (cm)	1.9-5 x 0.4-1.6	2.4-4.8 x 0.6-1	2.3-5.5 x 0.5-1.8	2.4-4.8 x 0.7-1
Filament	glabrous	glabrous	glabrous or papillose	glabrous
Fruit (capsule)	unknown	cylindrical, above ground level	unknown	cylindrical, 1.5-2.6 cm, at ground level
Seeds	unknown	3-4 mm, rounded	unknown	3 mm, brownish

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