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MORPHOLOGICAL AND ANATOMICAL STUDY ON ENDEMIC *CROCUS OLIVIERI* GAY SUBSP. *ISTANBULENSIS* MATHEW SUBSPECIES (IRIDACEAE)

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ABSTRACT

In this study, morphological and anatomical properties of *Crocus olivieri* Gay subsp. *istanbulensis* Mathew were investigated. Cross-sections of root, scape and leaf parts of the plant were examined and demonstrated by photographs. Most of the anatomical properties are similar to the other member of Iridaceae family. Sclerenchyma groups were observed around to leaf vascular bundle. Morphological and anatomical findings compared with other two subspecies of *Crocus olivieri.*

Key Words: Anatomy, *Crocus olivieri* subsp. *istanbulensis ,* Iridaceae, Morphology.

ENDEMIK *CROCUS OLİVİERİ* GAY SUBSP. *İSTANBULENSİS* MATHEW ALTTÜRÜ (IRIDACEAE) ÜZERİNDE MORFOLOJİK VE ANOTOMİK BİR ÇALIŞMA

ÖZ

Bu çalışmada *Crocus olivieri* Gay subsp. *istanbulensis* Mathew' in morfolojik ve anatomik özellikleri araştırılmıştır. Bitkinin kök, gövde ve yaprak kısımlarından enine kesit alınarak incelenmiş ve fotoğraflanmıştır. Anatomik özelliklerin çoğu Iridaceae familyası üyeleriyle benzer özellikler göstermiştir. Yaprak iletim demetlerinin etrafında sklerenkima grupları gözlenmiştir. Morfolojik ve anatomik bulgular diğer iki *Crocus olivieri* alttürü ile karşılaştırılmıştır.

Anahtar Kelimeler: Anatomi, *Crocus olivieri subsp*. *istanbulensis* , Iridaceae, Morfoloji

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1. INTRODUCTION

Iridaceae is a large and diverse family of about 80 genera, mainly central on the southern hemisphere continents. There are 80 species of *Crocus* L. worldwide (Satıl et al 2007). Many species of the family Iridaceae are grown in parks and garden as ornamental plants due to their beautiful flowers (Baytop 1984). Some *Crocus* species were used for making dye, perfume and medicaments as long ago as 1600 B.C. (Brighton et al 1980). The saffron *Crocus* (*Crocus sativus* L.) was the first to be cultivated and has been grown for economic purposes since ancient times. 63 Crocus taxa are distributed naturally in Turkey. 40 of these taxa are endemic for Turkey and endemism rate is 63% (Davis 1984; 2000). C. olivieri Gay species have three subspecies as *C. olivieri* ssp. *olivieri* Herbert, *C. olivieri* ssp. balansae (Gay ex Baker) Mathew and *C. olivieri* Gay ssp. istanbulensis Mathew (Davis 1984).

In this study, morphological and anatomical properties of *Crocus olivieri* Gay subsp. istanbulensis Mathew were investigated and compared with other two subspecies of *Crocus olivieri.* There has not been detailed study on the *Crocus olivieri* subsp. istanbulensis**.**

2. METHODS

Materials were collected from A2 Istanbul, Aydos, 200 m, in year of 2012. Specimens were kept in the herbarium at Celal Bayar University. Morphological illustration of the plant taxon was made from fresh and dry specimens followed “Flora of Turkey” volume 8 (Davis 1984). Morphological measurements was made from root, scape and leaf of fresh plant material. For anatomical studies plant specimens were fixed in 70% ethanol. Hand cuts was stained with sartur reactive and safranin. Preparates photographed with motorized Leica DM 300 microscope. Measurements were taken using ocular-micrometer of root, stem and leaf cell sizes of the species. Minimum, maximum, mean and standart deviation was determined.

3. RESULTS

Morphological findings

Plant lenght is 13-23 cm. Ovoid shaped corm is 1.8-3.2 x 2.2-3.4 cm. Corm tunic is wholly and coarsely fibrous, fibres are often weakly reticulate at apex. Leaves are 1-5, synanthous and 1.5-7 mm in broad. Membranous and whitish bracteole is present, equal to or slightly smaller than bract. Throat of perianth is yellow and glabrous. Yellow to orange-yellow flowers are 2-4 in number. Tepals are 1.5-3.5 x 0.4-1.2 cm and shaped as obtuse to subacute. Filaments are 3-10 mm in lenght, yellow and glabrous. Anthers are 6-15 mm in lenght, yellow. Style is 20-23 mm in lenght and dividing into 6 slender yellow to orange branches (Figures, 1,2,3).

Figure 1. General appearance of *C. olivieri* ssp. *istanbulensis* in natural area

Figure 2. General appearance of *C. olivieri* ssp. *istanbulensis* in natural area

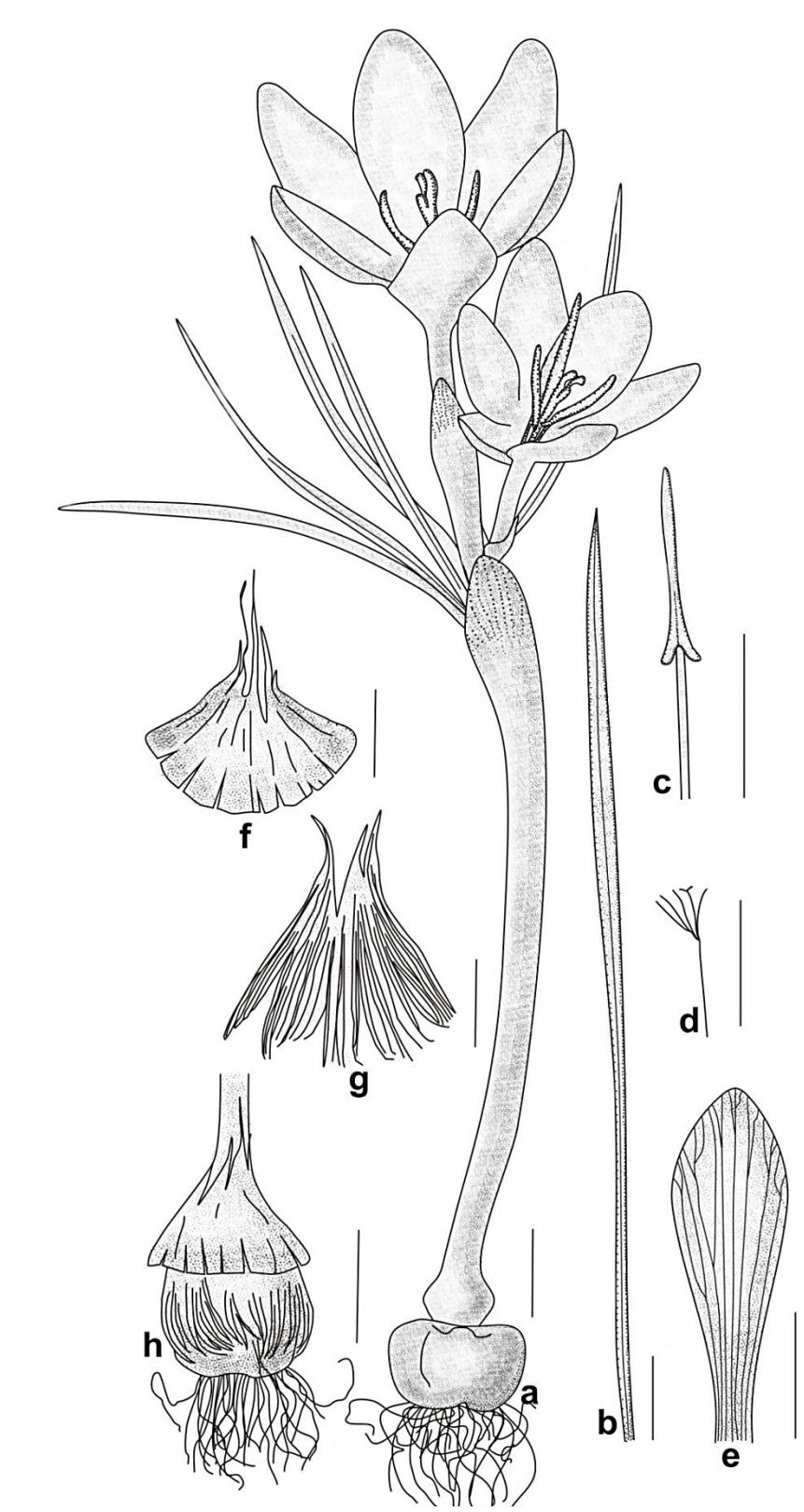

Figure 3 . General appearance and some parts of *C. olivieri* ssp. *istanbulensis*; a: general appearance, b:leaf, c:stamen, d:style, e:tepal, f:inner tunic, g:outer tunic, h: corm; scale bars: 1 cm

Anatomical findings

Root: There is a single-layered epidermis covered by thick cuticle on the outer surface of root. Cortex is 4-7 cell layered. Endodermis is single-layered. The wall thickenings of the endodermal cells are four sided. Pericycle is single layered and located under the endodermis. A big metaxylem and 3-4 xylem strands are present in vascular tissue.

Scape: Shape of scape is quadrangular. Outer part of scape is covered by thick cuticle. Epidermis is single-layered. Upper and lower walls of the epidermis are thickened. There is 6-10 layered cortex parenchyma under epidermis. Cortex cells are thin walled, parenchymatous and have intercellular spaces. A small pith region is present under the cortex at the center of scape. Vascular bundles at the center are large and 4-5 in number. Vascular bundles at the edges are smaller than others and 6-8 in number.

Leaf: Leaves have a central nearly rectangular keel and 2 long lateral arms with their margins recurved towards the keel. The characteristic pale stripe running axially along the centre of the leaf is caused by the parenchymatous cells in the keel, which lack chloroplasts and break down to form an air space. Both adaxial and abaxial surfaces have a thick serrate cuticle. The epidermis is single layered on abaxial and adaxial surfaces of the leaf. Vascular bundles are located in one row and close the abaxial epidermis. The bundle sheath consists of sclerenchymatic cells at the phloem pole of vascular bundles (Table.1; Figure. 4).

Table 1. Measurements of anatomical features of *C. olivieri* ssp. *İstanbulensis*

	Width (µm)		**Lenght (µm)**	
	Min – Max	**Mean ±SD**	**Min – Max**	**Mean ±SD**
Root				
Epidermis cell	15 -23	18 ±4.3	10-22	16±4.63
Cortexcell (diameter)	25 -38	32±4.5		
Endodermis cell	17 -33	22±5.2	12-15	13±0.96
Perisikl cell	9 -13	11±1.0	3-8	5±1.65
Metaxylem(diameter)	14-24	20±3.6		
Scape				
Epidermis cell	10-15	11±1.13	10-19	16±3.53
Cortexcell (diameter)	25-43	29±2.23		
Trachea (diameter)	15-20	18±1.22		
Pith cell (diameter)	25-40	28±3.54		
Leaf				
Adaxial Epidermis	12-25	18±5.8	8-14	11±2.42
Abaxial Epidermis	13-23	19±4.0	9-18	15±3.48
Pallisade p. Cell	14-18	17±2.4	35-46	39±4.08
Spongy p. Cell	17-45	30±9.48	17-35	23±6.78

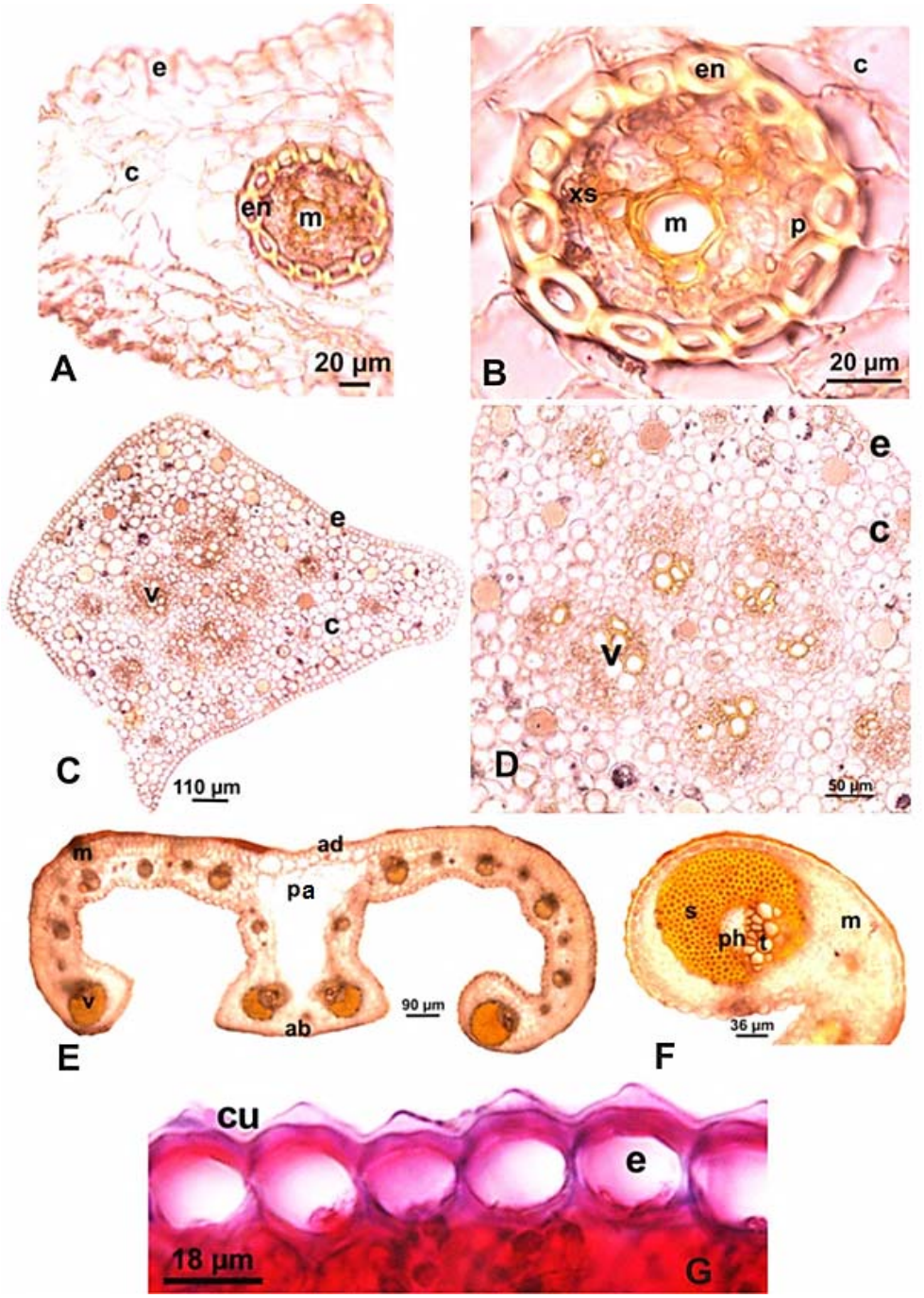

Figure. 4. Cross sections of *C. olivieri* ssp. *istanbulensis* ; A,B: Root; C,D: Scape; E,F,G: Leaf; ab: abaxial epidermis, ad: adaxial epidermis, c:cortex, cu: cuticle, e:epidermis, en: endodermis, m: mesophile, mx: metaxylem, p: perisikl, ph:phloem, s:sclerenchyma, t:trachea, xs:xylem strand, v:vascular bundle

3-DISCUSSION

In this study, we aimed to demonstrate the characteristics of *C. olivieri* subsp. *istanbulensis* by evaluating the results obtained from morphological and anatomical investigations. Morphological differences were determined by comparing the results obtained from this subspecies with those published on the other subspecies *C. olivieri* ssp. *olivieri* (Özdemir et all. 2011; Davis 1984) and *C. olivieri* ssp. *balansae* (Kaya 2010; Davis 1984). The differences obtained in this way were examined in both morphological and anatomical aspects. In the study dealing with *C. olivieri* ssp. *olivieri*, it was determined that this taxon is distinguished from *C. olivieri* ssp. *balansae* by the style being distinctly divided into 6 branches, which is 12-15 divided style of *C. olivieri* ssp. *balansae* (Davis 1984; Kaya 2010). *Crocus olivieri* ssp. *istanbulensis* is distinguished from other subspecies with leatherlike, wholly and coarsely fibrous corm tunic. This distinctive character was observed in the present study. In anatomical studies it has been determined that the root of the taxon has 3-4 xylem strands. The root does not have pith, instead it has a metaxylem. The same feature has been reported on the root of *Crocus aerius* Herbert, *Romulea columnae* Sebast. & Mauri subsp. *columnae* and *Crocus pulchellus* Herbert (Özyurt 1978; Kutbay et al 2001). The thickening is very clear on the walls of the all endodermal cells. Same feature is observed in *C. fleischeri* Gay, and *C. danfordiae* Maw this (Özdemir et al 2004). According to the results of this study, vascular bundles are located in the peripheral and central parts of the scape. This feature has been observed in *C. olivieri* ssp. *balansae* (Kaya 2010) , *C. olivieri* ssp. *olivieri* (Özdemir et all. 2011), *C. fleischeri* and *C. danfordia*, while it has not been observed in the scape of *C. pulchellus* (Özdemir et al 2004). The leaves of the investigated taxon have a central nearly rectangular keel. The leaves of other *Crocus* species have a rectangular keel too (Özyurt 1978; Brighton et al 1980). The leaves have a pale stripe running axially along the centre of the leaf. This is a common feature in the genus (Rudall and Mathew 1990). Two large keel bundles are always present at the 2 keel corners; also large bundles are present at the arm; sclerenchymatous inner bundle sheaths are present as caps at phloem poles of bundles in *Crocus olivieri* ssp. *istanbulensis* . The same features were observed in some Crocus species (Rudall and Mathew 1990; Rudall and Goldblatt 1991). While *Crocus olivieri* ssp. i*stanbulensis* leaves have 4 big and 8-10 little bundles like *C. olivieri* ssp. *olivieri* that *C. olivieri* ssp. *balansae* have 4 big and 10-12 little bundles. Keel shape and arm angle is very similar in all *Crocus olivieri* subspecies.

4-CONCLUSION

The morphological and anatomical features of *Crocus olivieri* ssp. *istanbulensis* were examined in this study. *Crocus olivieri* ssp. *istanbulensis* has some characteristic morphological and anatomical features from other subspecies of *Crocus olivieri* such as leatherlike and fibrous corm tunic, leaf vascular bundle number and thickening in endodermal walls.

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