



A morphological, palynological and ecological study of the *Glaucium cappadocicum* in Turkey

Fatma Mungan KILIÇ^{*1}, Kemal YILDIZ², Murat KILIÇ²

¹ Department of Crops and Animal Production, Kızıltepe Vocational Training High School, Artuklu University, Kızıltepe, Mardin, Turkey

² Department of Biology, Faculty of Science and Letters, Celal Bayar University, Manisa, Turkey

Abstract

Glaucium cappadocicum, belonging to the Papaveraceae family, is an herbaceous plant. The species were investigated in terms of morphological, palynological and ecological characteristics. The species was collected natural habitat as possible in the vegetation period during May to August of 2013 to 2014. Throughout the study, the microphotographs of seeds and pollen taken using the electron microscope, the tables showing the characters and species habitats soil were analysed. Pollen grains usually were spheroidal in shape and tricolpate aperture, ornamentation microecinate and microperforate. Seed features; oblong-reniform, that surfaces alveolate and faveolate was observed. Soil analysis results; *G. cappadocicum*; pH slightly alkaline, salinity much-extrem, within loamy soil, poor organic matter.

Key words: *Glaucium*, morphology, palynology, ecology, Papaveraceae, Turkey

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Türkiye'nin *Glaucium cappadocicum* Boiss. türü üzerine morfolojik, palinolojik ve ekolojik bir çalışma

Özet

Glaucium cappadocicum, Papaveraceae familyasına ait otsu bir bitkidir. Tür morfolojik, palinolojik ve ekolojik özellikleri bakımından incelenmiştir. Tür doğal yetişme ortamlarından 2013-2014 yılları, Mayıs-Ağustos aylarında vejetasyon dönemlerinde toplanmıştır. Tohum ve polenlerin elektron mikroskopuyla mikrofotografı çekilmiş, elde edilen veriler tablo haline getirilmiş ve türün yetiştiği toprağı analiz edilmiştir. Polenler genellikle sferoidal ve apertür durumu trikolpat, ornamentasyon mikroekinat-mikroperforat şeklindedir. Tohum özellikleri; oblong-reniform, yüzeyleri alveolat-faveolat olarak gözlemlenmiştir. Toprak analiz sonuçları; hafif alkali, ekstrem tuzlu, tınlı, organik madde açısından fakir topraklarda yetişir.

Anahtar kelimeler: ekoloji, *Glaucium*, morfoloji, palinoloji, Papaveraceae, Türkiye

1. Introduction

The genus *Glaucium* Mill. (Papaveraceae), most of whose species spreads throughout the Mediterranean, south-western Asia and Australia, is represented by a total of 25 species on worldwide and consists of annual, biennial and perennial herbaceous plants (Kadereit, 1993; Kiger, 2007; Mingli et al. 2008). When the distribution schedule of the species belonging to the *Glaucium* genus was constituted, it was seen that its species had spread throughout Europe, Africa, Asia (Temperate), Tropical Asia and Australia. When the number of the species of *Glaucium* in these regions was investigated, it was noticed that they have been widely covered in the West Asia region.

Glaucium growing mostly in saline soils and seaside is represented by a total of 11 taxa in Turkey, 5 of which are endemic. (Seçmen et al. 1998; Yıldırım, 2012; Aykurt et al. 2017). Turkey ranks second with respect of having the maximum number of species following Iran. *G. cappadocicum* an endemic species for Turkey and its type specimen was collected from Euphratem in 1889 by Aucher (Cullen 1965).

* Corresponding author / Haberleşmeden sorumlu yazar: Tel.: +905062848847; Fax.: +905062848847; E-mail: fatmamungankilic@artuklu.edu.tr

Mory (1979) divided the Iran-Turan *Glaucium* taxa into 2 sections depending on the fruit's split situation, namely *Acropetale* and *Glaucium*. It was asserted in this evaluation that the section of *Acropetale* was more primitive than the *Glaucium* section. Aykurt et al. (2017) revealed in their study *Glaucium alakirensis* has small pollen grains whereas those of *G. leiocarpum* and *G. secmenii* are medium sized in the micro-macromorphological study carried out by Gran and Sharifnia (2008) on the species of *Glaucium* that have spread in Iran, through examination of 28 qualitative and 37 quantitative characters of a total of 18 *Glaucium* taxa, they performed *G. haussknechtii* and *G. grandiflorum* taxa's synonym according to the morphologies of pollen and seed.

G. cappadocicum. is very different from other *Glaucium* species in terms of taxonomy. Our aim, we are studied taxonomical, ecological aspects it and to enlarged description of *G. cappadocicum*.

2. Materials and methods

The research material were collected from its growing habitats, their photos were taken and records of the species were kept, the tables showing the features of species (Table 1, Figure 1). Soil (for ecological studies) specimens of *G. cappadocicum* were obtained from Erzincan district.

The pollen and seeds of taxa were analysed using a scanning electron microscope (SEM) and coated with gold using the POLARON SC 7620 brandlining machine. Stearn (1996) performed seed analysis, Punt et al. (2007) performed palynological analysis evaluations. The pollen grains of species examined consisted of fresh specimens collected in their natural habitats. The voucher specimens of the samples were deposited at the Celal Bayar University herbarium. All the pollen grains for LM examination were prepared following the standard procedure of Wodehouse (1935). They were observed in glycerin-water using a standard Olympus CX21FS1 microscope with D plan 1.00-1.25 160/0.17 oil immersion objective and NFKx3.3 LD 125 lens. Fifty pollen grains per specimen were regarded as sufficient for the palynological analysis. For SEM, pollens were directly mounted on stubs using double-sided adhesive tape. Samples were coated with gold POLARON SC7620 ion-sputter and then observed by standard techniques using a LEO 440 SEM. The measurements are based on 15 to 20 readings from each specimen. Pollen shape, polar length, equatorial width, exine thickness, colpus length and colpus width were measured. Punt et al. (2007) were consulted for the palynological terminology.

During the fieldwork, soil samples were taken 10-30 cm depths where the plants were collected. Analyses of these soil samples in bags Manisa agriculture province was carried out within the directorate and other methods were applied (Scheffer and Schachtschabel 1989; Schlichting and Blume 1966)

1. Soil Reaction (Ph) :The reaction of soil samples is measured with "glass electrode pH meter". Actual acidity for soils with 1/2,5 distilled water; for acidity cation exchange, a rate of 1/2,5 soaked with nKCl, kept in a night and measurement is following (Irmak 1954; Jackson 1962; Gülçur, 1974)

2. Electrical conductivity (ECX103): The electrical conductivity of the prepared soil saturate extract at 25 ° C was determined by measuring the miliSiemens / cm in the "Conductance Bridge" device.

3. Total lime: Total lime is determined by Scheibler calcimeter (Gülçur, 1974)

4. Grain size (Structure): According to the "Hydrometer method of Bouyoucos" of soils grain diameters; the determination of soil types, performed according to international grain diameter classification (Irmak 1954; Gülçur 1974)

5. Available forms of phosphorus (P) in soils: Acid reaction soil was modified according to method "Bray and Kurtz No. 1", alkaline reaction of soil according to method "Olsen" (Ülgen and Ateşalp, 1972) is determined by "Spectronic 20D calcimeter device".

6. Available forms of potassium (K), calcium (Ca), Magnesium (Mg), Determination of "ammonium acetate method" was carried out using (Jackson 1962; Kaçar, B. 1994).

3. Results

3.1. Morphology

In our morphological investigation was observed species is; Biennial. Stems 30-75 cm, erect, branched, glabrous. Radical leaves 15-25x6-10.5 cm, thickly, obovate-runcinate, somewhat lobed or irregularly serrate-dentate. The lower segments triangular-ovate, grand large lobed. Upper leaves 1-2x0.6-1.2 cm, subcordate-amplexicual, large crenalis. Buds ovate-oblong. Sepals 1.7-2.5 cm, glabrous. Petals 1.6-2.2x2-2.5 cm, yellow, with dark yellow spot at the base. Stamen 1.1-1.5 cm, numerous. Siliquae 10-16 cm, pedicel 4-6 cm, thin, etuberculate, somewhat torulose.

As a result of our morphological analysis, there were differences from the data of Flora of Turkey and Mory's (1979) study regarding the following properties: *G. cappadocicum*, plant height, leaf length on stem, length of sepal and fruit (Table 2).

Table 1. General features of *G. cappadocicum*

Habitat	:	Slopes
Flowering times	:	May-June
Distribution in the World	:	Endemic
Altitude	:	950-1400 m
Phyto-geographic region	:	İran-Turan elements
Threat category	:	EN B2c(i,ii,iv); D1



Figure 1. General appearance of *G. cappadocicum*

Table 2. Morphological comparison of *G. cappadocicum* (cm).

Characters	Flora of Turkey measurements	Mory's Measurement	Our measurements
Plant height	30-50	30-50	43-75
Radical leaves	-	15-25	18-24x6-10.5
Stem leaves	-	0.5-1	1-2x0.6-1.2
Petal	-	2.5	1.6-2.2x2-2.5
Sepal length	-	1-1.5	1.7-2.5
Fruit length	10	10	10-16

Distribution in Turkey: East Anatolia Region, Upper Euphrates.

B7 Erzincan: Kurutschai (Kuruçay), Hassanova, Sint. 1889:999, Erzincan: Kuruçay-İliç, after Çiftlik village, roadside Northern slopes, 1040 m, 27.05.2013, F. Mungan, K. Yıldız, M. Kılıç, KY 449, Erzincan: From Kuruçay-İliç highway to Kemah Sularbaşı village, rocky slopes, 1100-1400 m, 19.07.2013, F. Mungan, K. Yıldız, M. Kılıç, KY 480. Erzincan: From Kuruçay-İliç highway to Kemah, 20 km to Kemah, northern slopes, 1350 m, 19.07.2013, F. Mungan, K. Yıldız, M. Kılıç, KY 481 (Figure 2).

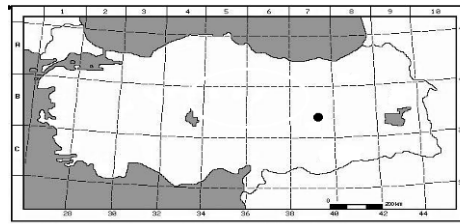


Figure 2. Distribution map of *G. cappadocicum* (●)

3.2. Mikromorphology

The pollen and seeds of taxon were analyzed in SEM, Stearn (1996) performed seed analysis, Punt et al. (2007) performed palynological analysis evaluations (Figure 3, 4; Table 3).

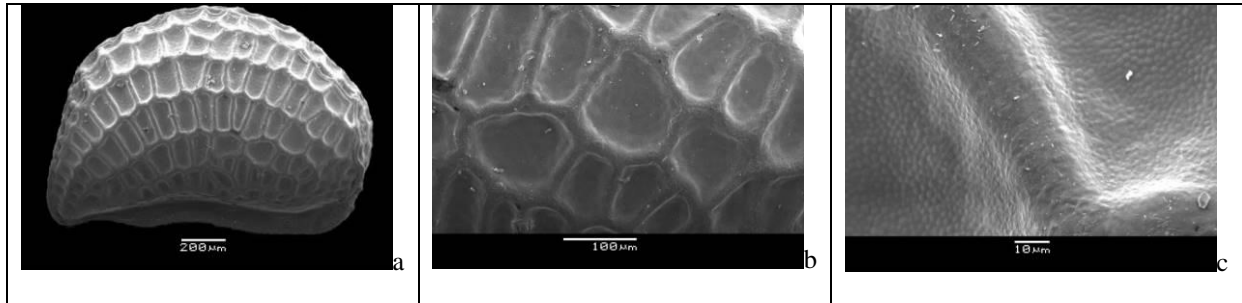


Figure 3. Seed (SEM) of *G. cappadocicum*, a. general view b, c. surface

Table 3. Seed morphological characters of *G. cappadocicum*

Seed features		mm
Seed Height	Min-max	0.90-1.23
	Mean (SD)	1.09(0.07)
Seed Width	Min-max	1.15-1.84
	Mean (SD)	1.54(0.16)
Hilum Height	Min-max	0.98-1.61
	Mean (SD)	1.27(0.20)

3.3. Palinology

Pollen grains examined with light microscope and SEM, pollen terminology (Punt et al. 2007) used for palynological investigation. Except for *G. cappadocicum*, the pollen properties of the taxa studied are here described for the first time. The pollen grain characters of the taxa studied are presented in Table 4. All the pollen grains for LM examination were prepared following the standard procedure of Wodehouse (1935) (Figure 5). All studied taxa are spheroidal in shape; the polar perimeter is tricolporate. The average size of pollen grains was 30.3 μm polar length and 33,06 μm in equatorial width (Table 4). Colpus length and colpus width mean values were measured 24,96 μm and 11,83 μm, respectively.

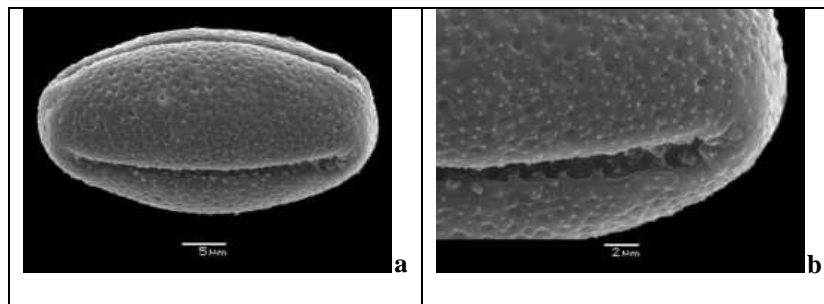
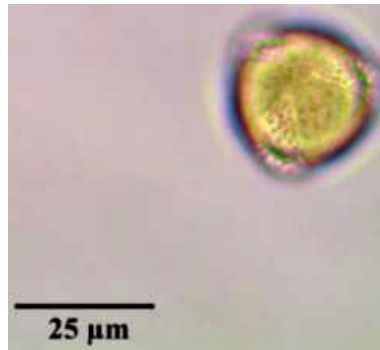


Figure 4. *G. cappadocicum*. Pollen (SEM). a. general view, b, ornamentation

Figure 5. *G. cappadocicum*. Pollen (LM).Table 4. Pollen morphological characters of *G. cappadocicum*

Pollen features	μm	
Pollen Height	Min-mak	25-36
	Mean (SD)	30,3 (1.88)
Pollen Diameter	Min-mak	26-37
	Mean (SD)	33,06 (2.06)
P. Height / P. Diameter	0.91	
Colpus height	Min-mak	20-30
	Mean (SD)	24,96 (1.65)
Colpus width	Min-mak	10-13
	Mean (SD)	11,83 (0.87)
Exine	Min-mak	1-2
	Mean (SD)	1.81 (0.27)
Intine	Min-mak	1
	Mean (SD)	1(-)
Pollen shape	Spheroidal	
Aperture	Tricolpate	
Ornamentation	Microecinate-Microperforate	

3.4. Ecology

To determination ecological properties of *G. cappadocicum* environment which it grows, have done soil analysis (Oğuz 2008). Examination results; *G. cappadocicum*; pH slightly alkaline, salinity much-extrem, calcium carbonate (CaCO₃) moderate-rich calcareous, within loamy soil, poor organic matter, phosphorus (P) minimal, potassium (K) and calcium (Ca) sufficient, magnesium (Mg) insufficient (Table 5).

Table 5. Soil analysis of *G. cappadocicum*

Station number	480	481
parameters		
Depth (cm)	0-30	0-30
pH	7,40	7,42
Salt (mS/cm)	1510	1060
Lime (%)	10,14	4,29
Texture	Loamy	Loamy
Organic substances (%)	0,560	1,000
Beneficial P (ppm)	0,41	0,62
Beneficial K (ppm)	131	137
Ca (ppm)	1569	1545
Mg (ppm)	28	23

4. Conclusions and discussion

The description of species was enlarged and a new treath category was proposed. Besides, a pollen description was composed for *G. cappadocicum* according to scanning electron microscopy (SEM) and light microscopy (LM) studies. Pollen grains are spheroidal and microechinate. Seeds reniform and seed surface alveolate-faveolate. Investiageted soil; slightly alkaline, salinity strongly saline-extremely saline, calcium carbonate, phosphorus, potassium, calcium, magnesium of our soil samples range between 7.40-7.42, 0.41-0.62 ppm, 131-137 ppm, 1545-1569 ppm, 23-28

ppm. In this study, *G. cappadocicum* compared with data of Flora of Turkey, deficiencies of description has been addressed and enlarged. The threat categories of the species were re-evaluated using IUCN Red List categories and criteria (IUCN 2008). Result of soil analysis has become knowledge about species ecological requirements.

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