

Morphological, anatomical and ecological studies of *Gynandris sisyrinchium* (L.) Parl. in Turkey

CANAN ÖZDEMİR, EMINE ALÇİTEPE & HAKAN SEPET

Celal Bayar University, Faculty of Art and Science, Department of Biology, Manisa, Turkey; cozdemir13@gmail.com

Özdemir C., Alçitepe E. & Sepet H. (2011): Morphological, anatomical and ecological studies of *Gynandris sisyrinchium* (L.) Parl. in Turkey. – Thaiszia – J. Bot. 21: 1-9. – ISSN 1210-0420.

Abstract: This work is based on morphological, anatomical and ecological studies of *Gynandris sisyrinchium* (L.) Parl. each flower of which is lasting only a few hours. The genus *Gynandris* is represented by only one taxon, *Gynandris sisyrinchium* (syn. *Iris sisyrinchium*) in Turkey. Anatomical cross-section of the root, stem and leaf of plant is studied and demonstrated.

In this study it has been determined that the plant prefers clayey-loamy textured soil, poor in calcium carbonate, being acitic and containing varying amounts of organic matter being very rich in nitrogen. The plant grows on nonsaline soils. The analysis of some elements (N,P,K) was carried out in both above the ground and underground parts of this plant. In addition, analysis of chemical soil composition sample where the plant grows was carried out.

Keywords: *Gynandris sisyrinchium*, morphology, anatomy, ecology, Turkey.

Introduction

The Iridaceae family comprises about 70 genus and 1800 species in the world. This family is represented by 6 genera (*Iris* L., *Hemadactylus* Miller, *Gynandris* Parl., *Crocus* L., *Romulea* Marotti, *Gladiolus* L.) in Turkey (SEÇMEN et al.1989; HEYWOOD, 1998). *Gynandris* is represented in Turkey by only one taxon which is *G. sisyrinchium* investigated in this study (DAVIS, 1984; 1988; GÜNER et al. 2000).

There are some studies in the *Gynandris* genus (PEREZ & PASTOR, 1994; LOEUILLE et al. 2003). Few studies which are on systematic implications of *G.*

sisyrinchium are also available (PARADIS & POZZO DI BORGO 1999, OGANEZOWA 1997). There is not any morphological and anatomical study resembling this work belonging to *G. sisyrinchium* in the literature, except the "Flora of Turkey" (DAVIS, 1984).

In this study morphological, anatomical and ecological properties of *G. sisyrinchium* were examined and the results compared with some Iridaceae members and some others geophytes.

Materials and Methods

Plant samples were collected from natural population.

B1 Manisa:CBU Campus, under Quercus about 100 m 20.04.2004-2005 Özdemir 2135. Taxonomical description of the plants was made according to DAVIS (1984). For anatomical examination, the specimens were fixed in 70 % alcohol. Fresh samples were used in each case for experimental analysis. The plant was preserved in the herbarium CBU.

In the ecological study, the soil and the plant samples were collected from different area of natural population. Ten plant individuals were used for element analysis. Underground and above the ground parts of the plant samples were divided into small pieces and dried at 70 °C in oven for 48 hours and then grinded by plant mill. Soil samples were collected from 0-20 cm depth, brought to laboratory, dried by air and sieved using 2 mm mesh. Texture, pH, total soluble salts, calcium carbonate and organic matter content determinations were made according to standart methods (ÖZTÜRK et al. 1997). Element analysis was also made according to standart methods (KAÇAR, 1972, BAYRAKLI 1987, ALLEN et al. 1976).

Results

Morphological characters

Corm 12-35x10-32 mm in size. Corm tunic is in dark brown colour, and reticulate fibrous. Scapa 4-35 cm in lenght. Leaves two, with long sheating basal portion and free lamina linear, 8-40 cm in lenght, 2-8 mm in width. Spathes scarious of flowering time; innermost 34-70 mm, outermost slightly shorter than the inner. Each flower in 1-2 cymes with 1-3 (4) flowers, lasting only a few hours. Falls lavender-blue colored with white signal patch, and 15-30x4-11 mm in size. The limp of them obovate-elliptic, spreading. Standards erect, shorter and narrower than falls; limbs lanceolate, narrowing into slender, channeled claw. Filaments 4-15 mm long, anthers 5-10 mm long. Style branches suberect, 7-20 mm long. Capsule about 20 mm in size, except beak. Seeds small, angled, ovoid oblong, brow, blackish-brown (angulae-pyriform), and 1.05-0.08x1.02-2.02 in size (Figs. 1, 2).



Fig.1. *Gynandriris sisyrynchium*: natural habitat (left) and herbarium sample (right)

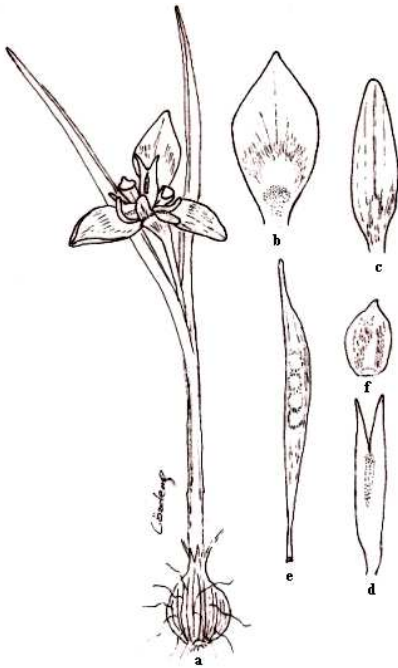


Fig.2. *Gynandriris: sisyrynchium*: a – flowering plant, b – fall, c – standard, d – style, e – capsule, f – seed

Anatomical characteristic

Root : Cortex parenchymatic, 8-10 layered and without intercellular spaces. Endodermal cells without wall thickenings in cross-section. Primary vascular tissue surrounded by pericycle; pericycle single layered, with thin-walled parenchymatical cells. There are 3-7 metaxylem on the median part of vascular cylinder. Xylem strands at the periphery of the vascular cylinder are 6-8 reaching the pericycle. Phloem occupies narrow part (Fig. 3).

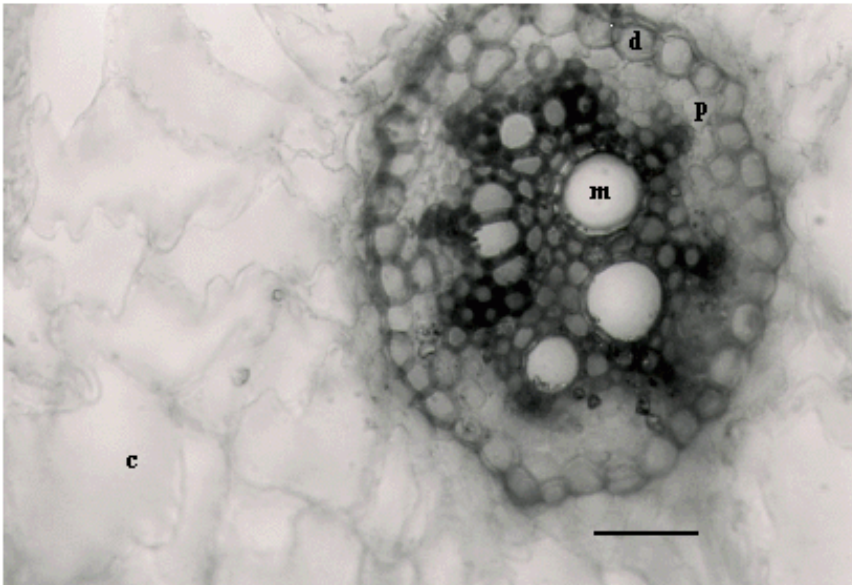


Fig. 3. Cross-section of root of *Gynandriris sisyrrinchium* (bar – 37 μ m): c – cortex, d – endodermis, p – pericycle, m – metaxylem.

Scape: Epidermis is single layered on the surface of scape. Cuticle is present on epidermis. Cortex located under epidermis has 5-8 layers. There is sclerenchymatous ring under cortex 5-10 layered with thick walled. Vascular bundles of scape are bigger in pith part than in other parts. Sclerenchyma cells surrounded the vascular bundles. These cells of sclerenchyma are more on the small vascular bundles than the others. The pith is occupied by vascular bundles. There are a lot of starch grains in parenchymatic cells which surrounded vascular bundles (Fig. 4).

Leaf : The upper epidermis cells were smaller than the lower one. Cuticle was present on lower and upper epidermis. Cuticle was thin on the upper epidermis. The vascular bundles were arranged in a single order being present at the median region of leaf. Sclerenchymatic ring surrounded the big vascular bundles. Sclerenchymatic ring was not distinguishable on the small vascular bundles (Fig.5).

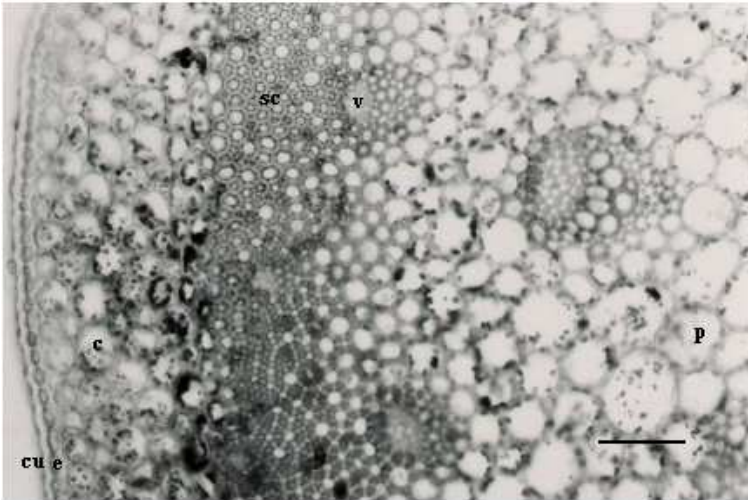


Fig. 4. Cross-section of scape of *Gynandriris sisyrinchium* (bar – 180 μ m): cu – cuticle; e – epidermis, c – cortex, sc – sclerenchymatous ring, v – vascular bundle, p – pith cell.

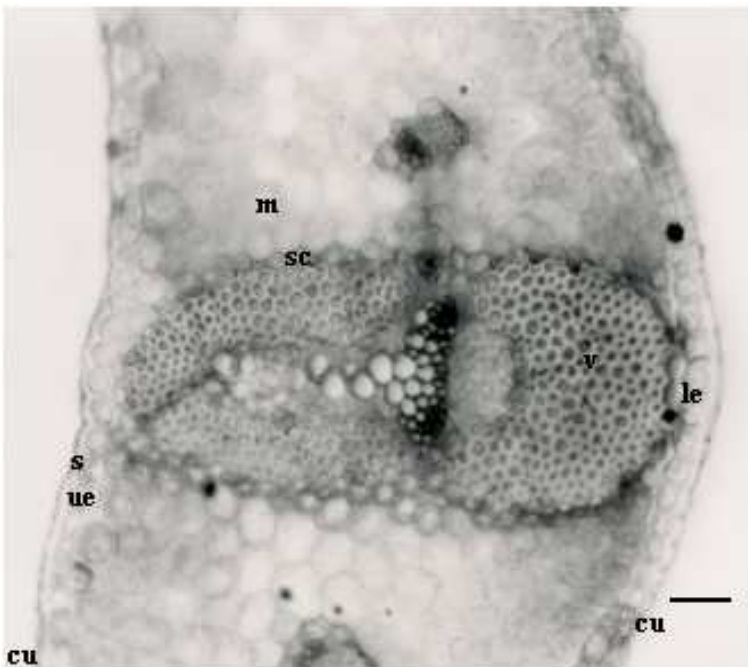


Fig. 5. Cross-section of leaf of *Gynandriris sisyrinchium* (bar – 74 μ m): cu – cuticle, ue – upper epidermis; s – stoma cell, m – mesophyll, sc – sclerenchymatous ring, v – vascular bundle, le – lower epidermis.

Tab. 1. Measurements of various tissue of of *Gynandriris sisyrinchium* (L.) Parl.

	Width (µm) min.max.	Length (µm) min. max.		Width (µm) min. max.	Length (µm) min. max.
Root			Leaf		
Epidermis cell	11.2-27.5	8.2-22.3	Upper cuticle	7.95-10.6	
Endodermis cell	10.6-26.5	9.0-26.0	Upper epidermis cell	10.6-21.2	10.6-21.2
Perisikl diameter	7.95-21.2		Lower epidermis cell	15.9-37.1	15.9-31.8
Metaxylem diameter	21.2-37.1		Mesophyll diameter	26.5-63.6	
Scape			Lower cuticle	10.6-15.9	
Cuticle	5.3-10.6				
Epidermis cell	15.9-26.5	2.65-14.25			
Cortexcell diameter	42.4-142.5				

Ecological characteristic

Soil analysis : Soil supporting *Gynandriris sisyrinchium* in general has clayey-loamy texture. Results of soil analysis are presented in Tab. 2, 3.

Tab. 2. Analysis of physical soil composition.

pH	Texture class	CaCO ₃ (%)	Total salinity (µS/cm)	Organic matter (%)
6.23	clayey-loamy	0.76	6.95	18.2

Tab. 3. Analysis of chemical soil composition.

Element	Mean values (ppm)
N	9.1000
P	1.0892
K	210.23
Cu	10.032
Fe	5.9890
Mn	11.373
Zn	0.7832
Ca	3743.0
Mg	656.31
Na	40.972

Plant analysis : The results of the analysis of plants collected during flowering season are presented in Tab. 4.

Tab. 4. Analysis of chemical plant composition.

Element	Aerial parts	Underground parts
	Mean values (ppm)	Mean values (ppm)
N	1500.0	1000.0
P	1742.9	813.80
K	17590	5030.5
Cu	9.7161	7.6085
Fe	125.28	93.338
Mn	25.125	28.255
Zn	22.131	8.532
Ca	28115	8730.7
Mg	2966.5	931.70
Na	1165.8	212.23

Discussion

In this article we have tried to demonstrate morphological, anatomical and ecological characteristics of *G. sisyrinchium*. *G. sisyrinchium* and *G. monophylla* Boiss. & Heldr. ex Klatt are the allied species. *G. monophylla* has only a single leaf and small flowers. The morphological properties of *G. sisyrinchium* showed some differences from *G. monophylla* when our findings compared to findings in previous studies (DAVIS, 1984). In this study of *G. sisyrinchium*, size of the plant, falls and anthers were determined respectively as 4-35 cm, 15-30 x 4-11 mm and 5-10 mm, while those measurements were given for *G. monophylla* as 4-6 cm, 11-18 mm and 3-4 mm in Flora of Turkey (DAVIS, 1984). Thus *G. sisyrinchium* and *G. monophylla* can be distinguished with these differences.

According to the results in the present study there were 5-8 xylem strands. So these protoxylem groups is said to be pentaarch and poliarch. A correlation exists among the diameter of the vascular cylinder and the number of protoxylem groups and the presence or absence of a pith. When the diameter of vascular cylinder is large, a pith is usually present and the number of protoxylem groups is high (FAHN, 1982). In the present study *G. sisyrinchium* had a large vascular cylinder. The same feature was observed in the root of *Crocus danfordiae* Maw, *Gladiolus atrovilloceus* Boiss., *Lilium ciliatum* P.H. DAVIS, (ÖZYURT 1978; ÖZDEMİR 2003; ÖZDEMİR et al. 2004). In the investigated plant the vascular bundles were located in the central part of scape and also in the periphery. The same feature is seen *Crocus chrysanthus* (Herbert) Herbert, *Merendera attica* (Spruner) Boiss & Spruner and *Romulea columnae* Seb. & Mouri subsp. *columnae* (ÖZDEMİR & AKYOL 2004, ÖZDEMİR et al. 2004; KUTBAY et al. 2001), but is not seen in *Crocus pulchellus* Herbert (ÖZDEMİR & AKYOL 2005). One of the most prominent features of the leaves of Iridaceae members is the vascular bundles usually extending to the epidermis as girders (RUDALL & GOLDBLATT 1991). The same feature was observed in the leaves of *G. sisyrinchium*. FAHN (1982) has pointed out that crystals are present in the members of Iridaceae.

Furthermore KOCA (1996) has emphasized that there were crystals in the rhizomes of some species of Iris. In the present study concerning this feature it has been observed that there were crystals in the cross section of corm, corm tunic and scape of *G. sisyrinchium*.

According to the results concerned to the soil texture, this plant grows mainly on clayey-loam soils. It has been reported by various researchers that plants such as *Asphodelus aestivus* L. (Liliaceae) which is like *G. sisyrinchium* generally prefer loamy soil (ÖZTÜRK, 1982; PIRDAL, 1989) and are located at Mediterranean region.

The CaCO₃ content of the soil was low, depicting the fact that *G. sisyrinchium* prefers soils poor in CaCO₃. The species such as *Asphodelus aestivus* Brot., *Capparis spinosa* Brot. and *Capparis ovata* Desf. distributed in western Anatolia, have been reported to prefer soils poor in CaCO₃ (PIRDAL, 1989; ÖZDEMİR & ÖZTÜRK, 1996).

Salt concentration was found to be very low in the soil. Nitrogen concentration was low in the aerial and underground parts. Phosphate concentration was within optimum limits in the above the ground parts. But phosphate concentration was low in the underground parts. Potassium concentration was medium-rich level in the above the ground and underground parts.

References

- ALLEN S.E. GRIUSHAW H.M. & PARKINSON J.A. (1976): Chemical Analysis in Methods in Plant Ecology- Edited by CHAPMAN S.B. Blackwell Scientific Publications Oxford.
- BAYRAKLI F. (1987): Toprak ve Bitki Analizleri - Ondokuz. Mayıs Üniv. Yayınları, Yayın No:17.
- DAVIS P.H. (1984): Flora of Turkey and the East Aegean Islands- Edinburgh Univ Press Vol 8 Edinburgh.
- DAVIS P.H., MILLI R.R. & KIT T. (1988): Flora of Turkey and the East Aegean Islands- (Suppl 1) Edinburgh Univ Press Vol 10 Edinburgh.
- FAHN A. (1982): Plant Anatomy- Third Edition Pergomon Press Oxford.
- GÜNER A., ÖZHATAY N., EKİM T. & BAŞER K.H.C. (2000): Flora of Turkey and the East Aegean Islands- (Suppl 2) Edinburgh Univ Press Vol 11 Edinburgh.
- HEYWOOD V.H. (1998): Flowering Plants of the World. BT Batsford Ltd London.
- KAÇAR B. (1972) : Bitki Analizleri- Ankara Üniv Basımevi Ankara.
- KOCA F. (1996): Morphological and Anatomical Studies on some endemic *Iris* L. species (Sec.Iris) in Turkey -Tr J Bot 20: 43-57.
- KUTBAY H.G., ÖZDEMİR C. & KESKİN M. (2001): An Anatomical Study on *Romulea columnae* Seb.& Mauri subsp. *columnae* (Iridaceae)- J Econ & taxon Bot Vol 19 : p.79-86.
- LOEUILLE B., GOLDBLATT P., MANNIG J.C. & SAVOLAINEN V. (2003): Molecular Phylogeny of genus *Moraea* (Iridaceae : Irideae) DNA sequences analysis- Acta Bot Gallica 150 (3) : p.345-353.
- OGANEZOWA G.G. (1997): The seeds structure of some Iridaceae in connection with their systematics, geography and phylogeny. I. subfamilies Nivenioideae and Iridoideae- Bot. Zh., ross. Akad. Nauk 82, 2. p.14-29.
- ÖZDEMİR C., AKYOL Y. & ALÇİTEPE E. (2004): Morphological and Anatomical Studies on Two Endemic *Crocus* Species of Turkey Area -Pak J Bot 36 (1) : p.103-113.

- ÖZDEMİR C. & AKYOL Y. (2004): Morphological and Anatomical Study on *Crocus chrysanthus* Herbert (Herbert) -Indian J Bot Vol:28 (3).
- ÖZDEMİR C. & AKYOL Y. (2005): The Morphological and Anatomical Studies on *Crocus pulchellus* Horber (Iridaceae) In Turkey-Journal of Economic & Taxonomic Botany. 29, No: 1, p.237-245.
- ÖZDEMİR C., AKYOL Y. & ALÇİTEPE E. (2004): An Investigation on the Morphological of *Merendera attica* (Spruner) Boiss. & Supruner -Journal of Economic & Taxonomic Botany. 28, No: 4, p.911-918. India,.
- ÖZDEMİR C. (2003):The Morphological Anatomical and Cytological Properties of Endemic *Lilium ciliatum* PH Davis (Liliaceae) In Turkey -Pak J Bot 35 (1) : p.99-110.
- ÖZDEMİR F. & ÖZTÜRK M. (1996):Batı Anadolu'da Yayılış Gösteren Capparis L. Türlerinin Bireysel Ekolojisi Üzerinde Araştırma -Tr J Bot 20: p.117-123.
- ÖZTÜRK M. (1982): *Inula graveolens* (L.) Desf.'in Ekofizyolojisi II Edafik İlişkileri -Atatürk Univ Fen Der 2 Özel Sayı 1 p.480-492.
- ÖZTÜRK M., PIRDAL M. & ÖZDEMİR F. (1997): Bitki Ekolojisi Uygulama Kitabı -Ege Üniv Fen Fak Kitaplar Serisi No:156.p.25-36.
- ÖZYURT S. (1978): Palandöken Dağları Çevresinin Liliaceae ve Iridaceae Familyalarına ait Bazı Geofitler Üzerinde Morfolojik ve Ekolojik İncelemeler - Atatürk Üniv Basımevi.
- PEREZ E. & PASTOR J. (1994): Contribution to the karyological study of the family Iridaceae in Western Andalucia Lagasalia 17 (2) p.257-272.
- PIRDAL M. (1989): *Asphodelus aestivus* Brot.'un Autekolojisi Üzerinde Bir Araştırma - Doğa TU Botanik Der 13 S.1 p.89-101.
- PARADIS G. & POZZO DI BORGO M.L. (1999): The protected species *Gynandriris sisyrinchium* (Iridaceae) in Corsica: chorology and description of its sites. - Bull. Soc. Bot. Centre-Ouest. n.s. 30. p.3-20.
- RUDALL P.R. & GOLDBLATT P. (1991): Leaf Anatomy and Phylogeny of Ixioideae (Iridaceae) -Bot J Linn Soc 106 p.329-345.
- SEÇMEN Ö., GEMİCİ Y., LEBLEBİCİ E., GÖRK G. & BEKAT L. (1989): Tohumlu Bitkiler Sistematiji -Ege Üniv Basımevi İzmir.

Received: August 09th 2010
Revised: January 25th 2011
Accepted: January 25th 2011