

# A morphological and anatomical study of *Hyacinthella glabrescens* (Liliaceae)

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**Abstract.** In this study, the morphological and anatomical properties of *Hyacinthella glabrescens* were investigated. Cross-sections of root, scape and leaf parts of the plant were examined and demonstrated by photographs. Sand and raphide crystals were observed in the root and scape cross-sections. Most anatomical properties were similar to the other members of *Liliaceae* family. Sclerenchyma groups were observed around the leaf vascular bundle.

**Key words:** Anatomy, *Hyacinthella glabrescens*, *Liliaceae*, morphology.

## Introduction

The *Liliaceae* family contains important medicinal and ornamental plants. It is cosmopolitan and usually spreads in the tropical and mild climate areas and is represented approximately by 250 genera and 3500 species across the world (Satil & Akan 2006). Thirty-six genera and over 461 species of the family are distributed naturally in Turkey (Erik & Tarıkahya 2004). The genus *Hyacinthella* Schur is a member of the *Liliaceae* family and is represented by 17 species across the world (Arslan 2004). Ten species and one hybrid, *H. micrantha* (Baker) Chouard × *H. heldreichii* (Boiss.) Chouard, are distributed naturally in Turkey. Of these, eight species are endemic and the endemism rate is 80 % (Davis 1984; Güner & al. 2000).

In this study, the morphological and anatomical features of the endemic species *Hyacinthella glabrescens* (Boiss.) K. Perss. & Wendelbo are investigated.

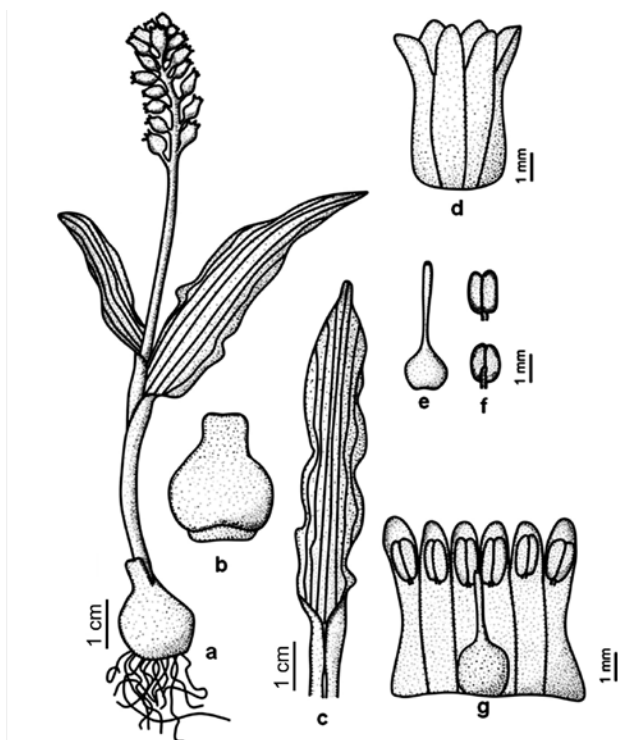
## Material and methods

Material was collected from natural populations (Turkey, square C5) in March, during the period of flowering, in 2010–2011. Specimens were kept in the Herbarium of the Celal Bayar University. Morphological illustrations of the plant taxon were made from fresh and dry specimens, according to *Flora of Turkey* (Davis 1984). Morphological measurements were taken from the root, scape and leaf of the fresh plant material. For anatomical studies plant specimens were fixed in 70% ethanol. The paraffin method (Algan 1981) was applied for preparing a cross-section of the root, scape and leaves of *H. glabrescens*. Transverse sections of 15–20 µm were made with a sliding microtome and stained with safranin-fast green. The preparations were photographed with motorized Leica DM 300 microscope. Measurements by ocular micrometer were taken of the root, stem and leaf cell sizes of the species. The minimum, maximum, mean, and standart deviation were determined.

## Results

### Morphological findings

Bulb shape of the perennial species is ovoid and oval. Bulbs are covered by off-white membranous tunic. Roots are light-brown and 1–5 cm long. Leaves are two in number. The first leaf is 6–20 mm wide, the second is nearly always half as broad. Leaf margin is completely glabrous, wavy and curved inward. Scape length is 4.5–15 cm at anthesis, and up to 25 cm in fruit. Pedicels are 2–7 mm long. Lobes of perianth are half as long as the tube and broadly elliptic, subobtusate or submucronate in shape. Perianth is 4–6.5 mm and deep blue-violet in colour. Flower is tubular-campaixulate. Six purple and epipetalous stamens are present in each flower. Ovary is superior (Fig. 1).

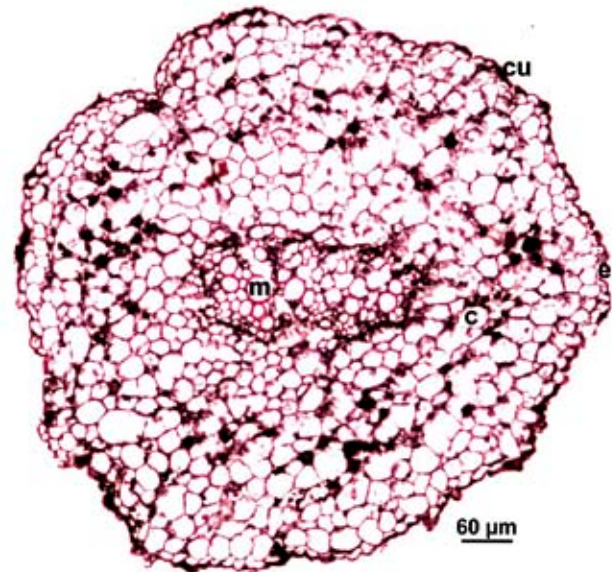


**Figure 1.** General view and some parts of *H. glabrescens*; a – general view, b – bulb, c – leaf, d – flower, e – pistil, f – anther, g – flower and generative organs.

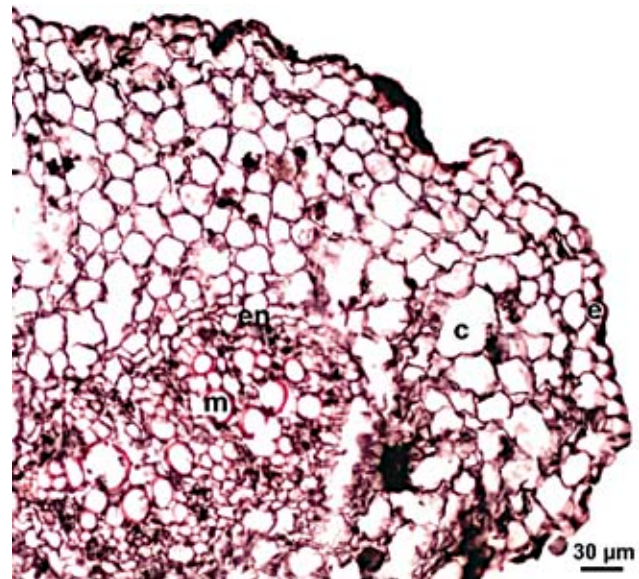
### Anatomical findings

**Root:** There is a single-layered epidermis covered by a thick cuticle on the outer surface of root. The layered exodermis consists of larger-size cells than the epidermis. Cortex is 5–11 layered, and parenchymatous cells are circular or elliptical in shape. Intercellular spaces are present in the cortex. Also raphide and sand crystals

have been observed in the cortex cell. Endodermis is single-layered. The wall thickenings of the endodermal cells are three-sided towards the cortex. Pericycle is single-layered and located under the endodermis. Metaxylem fills the vascular cylinder (Figs 2, 3).



**Fig. 2.** Root cross section of *H. glabrescens*; e – epidermis, c – cortex, cu – cuticle, m – metaxylem.



**Fig. 3.** Root cross section of *H. glabrescens*; e – epidermis, en – endodermis, c – cortex, m – metaxylem.

**Scape:** The shape of scape is circular. Its outer part is covered by a thick cuticle. Epidermis is single-layered. Upper and lower walls are thickened. There is a 4–5 layered cortex parenchyma under the epidermis. Cortex cells are thin-walled, parenchymatous and have intercellular spaces. Sand crystals were present in the cortex cell. Under the cortex there is a 7–9 cell layered

sclerenchyma. There is a large pith under the cortex at the center of scape. The pith cells are thin-walled, parenchymatic and have intercellular spaces. The vascular bundles at the center are large and 4–5 in number. The vascular bundles at the edges are smaller in size and 11–13 in number. (Figs 4-6).



Fig. 4. Scape cross section of *H. glabrescens*; c – cortex, e – epidermis, p – pith, v – vascular bundle.

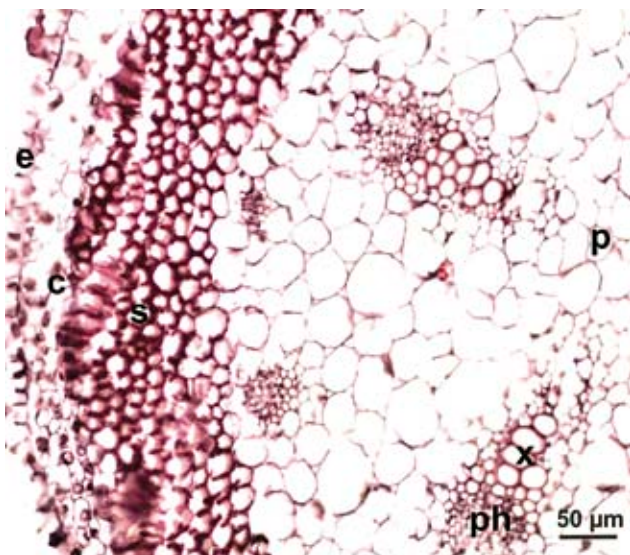


Fig. 5. Scape cross section of *H. glabrescens*; c – cortex, e – epidermis, p – pith, ph – phloem, s – sclerenchyma, x – xylem.

**Leaf:** Cuticle is present both on the adaxial and abaxial surfaces of the leaf. Epidermis is single-layered on each of the two surfaces of the leaf, and oval or rectangular in shape. There is a 2–3 layered palisade parenchyma under the adaxial and abaxial epidermis. A 4–6 layered spongy parenchyma intercellularly spaced is present between the palisades. Large and small-sized vascular bundles are located in the spongy parenchyma.

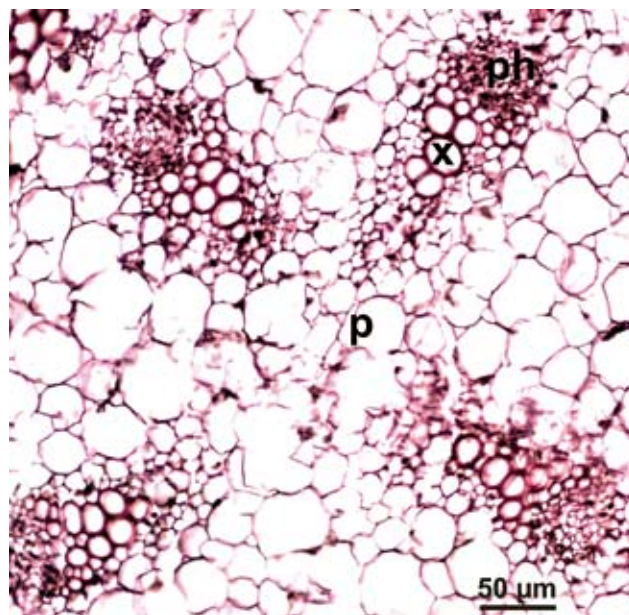


Fig. 6. Scape cross section of *H. glabrescens*; p – pith, ph – phloem, x – xylem.

There are sclerenchyma groups on the adaxial and abaxial parts of the vascular bundles (Figs 7, 8 and Table 1).

Table 1. Measurements of anatomical features of *H. glabrescens*.

Measured features	Width (μm)		Length (μm)	
	Min–Max	Mean±SD	Min–Max	Mean±SD
<b>Root</b>				
Epidermis cell	17–25	22±2.78	12–18	16±1.93
Cortexcell (diameter)	20–43	31±7.87		
Endodermis cell	19–28	22±3.83	10–18	14±2.62
Perisikl cell	13–18	16±2.11	12–18	17±3.32
Metaxylem(diameter)	5–30	23±8.84		
Pith cell (diameter)	12–28	16.4±4.15		
<b>Scape</b>				
Epidermis cell	10–13	11.6±1.10	13–19	15.4±2.44
Cortexcell (diameter)	15–28	21.6±5.12		
Trachea (diameter)	10–25	15±5.56		
Pith cell (diameter)	10–40	26.4±8.21		
<b>Leaf</b>				
Adaxial Epidermis	12–35	21±9.06	17–40	25±8.05
Abaxial Epidermis	18–25	21±3	15–23	19±2.54
Pallisade p. Cell	20–31	27±4.31	30–50	37±7.33
Spongy p. Cell	30–50	39±7.73	20–51	36±9.97

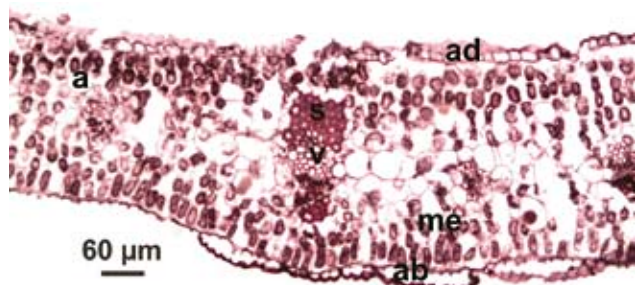


Fig. 6. Scape cross section of *H. glabrescens*; p – pith, ph – phloem, x – xylem.

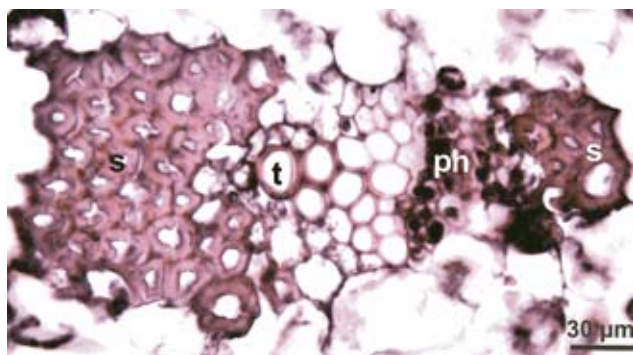


Fig. 6. Scape cross section of *H. glabrescens*; p – pith, ph – phloem, x – xylem.

## Discussion

The morphological and anatomical features of the Turkish endemic *H. glabrescens* are examined in this study. The numerical findings relating to the morphological characters of the species seemed to agree with the first measurements of Davis in the *Flora of Turkey* (Davis 1984).

The sclerenchyma groups and sand crystals are distinctive of interspecies disorder (Selvi 2008). Raphide and sand crystals have been observed in the cortex cells of the root and scape cross-sections. Yazgan & al. (1986) have observed sand crystals in the root cross-section of *Asparagus officinalis* L., which belongs to the same family. Fahn (1990) maintained that sand crystals are present in the dicotyledone stems of some *Liliaceae* members. Crystals are a steady characteristic of the plant. The shape and location of the crystals in plants are very important for taxonomic studies (Metcalf & Chalk 1983; Yentür 1995; Fahn 1990). Kandemir & al.

(2000) have observed sand crystals in the *H. micrantha*. Therefore, sand crystals can throw light on the phylogenetic relationship between *Hyacinthella* species.

Sclerenchyma groups surrounding the leaf vascular bundle have been observed in most *Liliaceae* members (Esau 1977; Fahn 1990). In our study, sclerenchyma groups were observed on the adaxial and abaxial parts of the vascular bundles of *H. glabrescens* leaf cross-section (Figs 7, 8). We expect these findings to contribute to the further phylogenetic and taxonomic studies into the *H. glabrescens* species.

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