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ANATOMICAL AND ECOLOGICAL INVESTIGATIONS ON ENDEMIC HYACINTHELLA HELDREICHII (BOISS.) CHOUAR (ASPARAGACEAE) IN TURKEY

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ABSTRACT

The ecological and anatomical characteristics of the endemic *Hyacinthella heldreichii* (Boiss.) Chouard, which a member of the Asparagaceae family has been investigated. The plant was collected from three different localities in Konya, where it's distributed natural habitat. Soil samples were taken from the distribution areas of the plant. It has been determined that the species generally prefer tinned textured, pH alkaline, too much calcined, high inorganic matter, low phosphorus, adequate potassium, sufficient copper and iron, less zinc, very calcareous and less salty or unsalted soils. Transverse and superficial cross-section of the scape and leaf which belong to plant has taken for anatomical research. The scape and leaf anatomies of the species show common features of monocotyledons. The leaves are amphistomatic and mesophilic.

Keywords: *Hyacinthella heldreichii,* endemic, anatomy, Turkey

1. INTRODUCTION

In the Flora of Turkey, monocotyledons have 24 families, 251 genera, 1731 species and subspecies taxa. Of these 289 endemic taxa, 244 are bulbs (Özhatay, 2002). Most of our country geophytes are composed of Liliaceae, Amaryllidaceae, Asparagaceae and Iridaceae families. They are mostly distributed in Taurus, West Anatolia and Northeast Anatolia regions (Koyuncu, 1994). The family of Asparagaceae has 3632 species 143 genera and distributed natural in tropical, sub-tropical and temperate and contains medicinal, aromatic, vegetable and ornamental plants (The Plant List, 2010). In the Flora of Turkey, the family is represented in 182 species and 19 genera (Güner *et al*., 2012). *Hyacinthella Schur* which is a member of this family, is an bulb genus and 17 species represented in the world (Arslan, 2004). In our country, genus is represented 12 species and 10 of them are endemic (Güner *et al.*, 2012). Another endemic

species is *H. heldreichii* (Boiss.) Chouar which distributed in Konya province within C4 square in Turkey. Threat category of species is lower risk/conservation dependent (LR/cd), according to Red Data Book of Turkish Plants (Ekim *et al.*, 2012). *Hyacinthella* genus is constantly changing place between families (Liliaceae, Hyacinthaceae, recently Asparagaceae). For this reason, determination of anatomical and morphological characteristics of all species will conduce to state of systematically place of the genus (Tekin & Meriç, 2013). There are some studies on the morphology, anatomy and ecology of this genus. *Hyacinthella micrantha* (Boiss.) Chouard (Kandemir *et al.*, 2000), *H. lineata* (Steudel) Chouard (Selvi *et al.*, 2008), *Hyacinthella acutiloba* K.Perss. & Wendelbo (Tekin & Meriç, 2013) and *H. glabrescens* (Yetişen *et al.*, 2012) endemic species for Turkey, have been investigated morphologically and anatomically. There is no report on anatomical and ecological characteristics of a Turkish endemic *H. heldreichii*. In this study, the ecological and anatomical characteristics of the species have been reported in detail.

2. MATERIAL AND METHODS

H. heldreichii samples were collected from three different localities in Konya/Bozkır-Seydişehir between the years of 2014 and 2015, specially between March - April in the flowering period. The plants were identified and materials placed into Herbarium of Necmettin Erbakan University Ahmet Kelesoğlu Education Faculty Biology Department. Some of the samples were put in glass bottles (containing 70% alcohol) with plastic caps. Anatomical studies were carried out with materials fixed in 70% alcohol. The samples of the leaves and scape cross-sections were studied with upper and lower surface sections.

Basic fuchsine dyes were used to distinguish the tissues in the receiving sections (Baytop, 1972). Photographs of the anatomical sections were taken using Olympus BX50 microscope. In ecological studies, analysis of soil samples were taken from three locations of soil surface, depth between 0-20 cm in diameter and approximately 1 kg mix soil has been used. Samples was dried at room conditions and prepare for analysis by passing through a 2 mm sieve. Chemical and physical analyzes of soil samples were carried out according to standard methods (Bayraklı, 1987). Analysis of soil samples were commentates according to Kaçar (1972).

3. RESULTS

***3.1 Scape*:** In the transverse section of the scape, there is an epidermis layer which is composed of oval and quadrangular cells with a single line on the outermost and a cuticle layer. There are 4-6 layers of cortex between the epidermis layer and the sclerenchymatic layer. Cortex is composed of cells with spaces oval or spheroidal shapes. Under this cell layer, regularly arranged and oval shaped 4-9 layered sclerenchyma cells are present. There are vascular bundles under the

sclerenchymatic tissue as different sizes and arranged with two regular rings . Vascular bundles are closed collateral type. The vascular bundles in the external ring are small, and those in the inner ring are large. The pith region is composed of isodiametric shaped parenchymatic cells of different sizes (Figure 1).

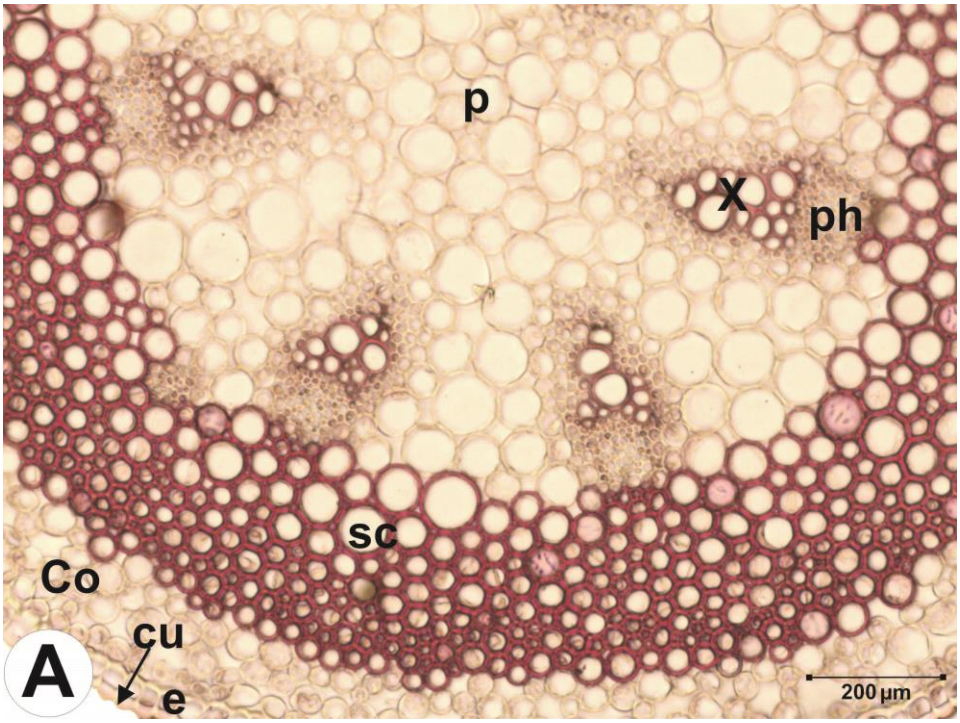

Figure 1. The transverse section of the scape: **cu** – cuticle; **e** – epidermis; **co** – cortex; **sc** – scleranchyma; **ph** – phloem; **x** – xylem

***3.2 Leaf*:** In the cross-section of the leaf, a single layered epidermis layer are present on the upper and lower surface. The epidermis cells on the upper and lower surface are surrounded by a thin cuticle. The epidermis cells on the leaf surface are generally rectangular while the epidermis cells surrounding the lower surface are smaller and oval. Leaf amphistomatic and mesophyll structure is unifacial. Mesophyll is composed of 10-16 layered of unequal orbicular cells. Some mesophyll cells contain raphide crystals. The mesophyll cells below the upper epidermis and lower epidermis are smaller than the central mesophyll cells. The vascular bundles are closed collateral type and the xylem and the phloem is up and under the leaf, respectively (Figure 2).

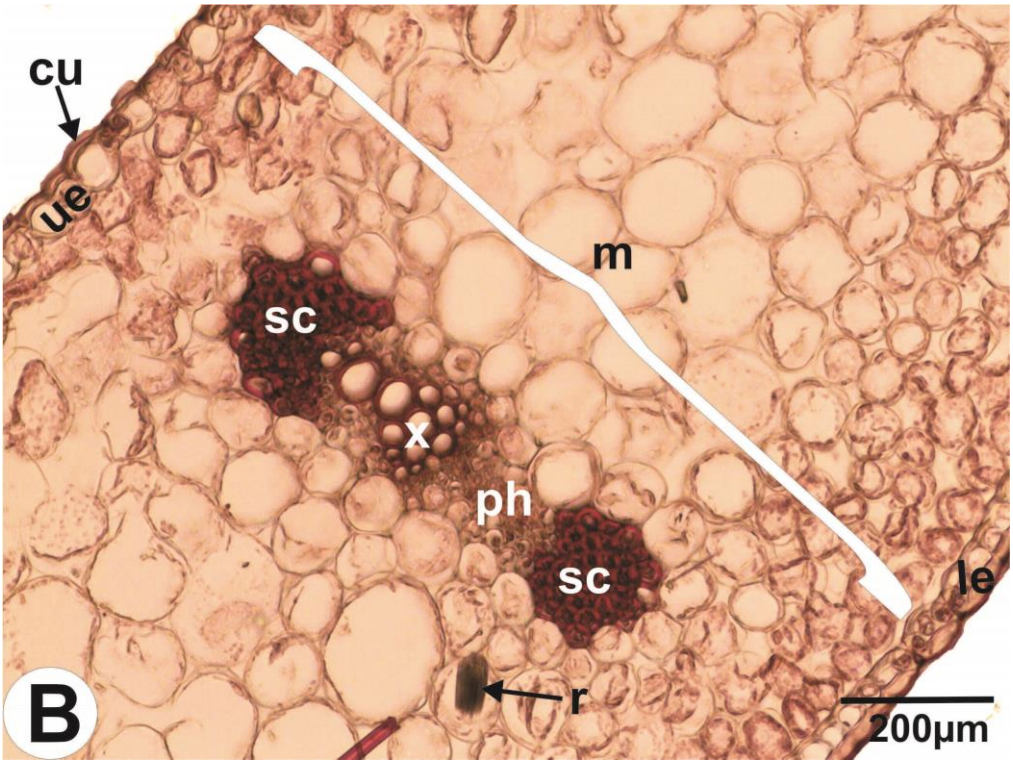

Figure 2. The transverse section of the leaf: **cu** – cuticle; **ue** – upper epidermis; **ph** – phloem; **x** – xylem; **le** – lower epidermis; **r** – raphide crystals; **m** – mesophyll

***3.3 Leaf surface anatomy*:** Stoma cells are present on the lower and upper surface of *H. heldreichii*. The leaves are amphistomatic and type of the stoma is anomocytic. The size of the stomata is almost equal to the size epidermal cells, so its mesomorphic type. In the leaf area under the x20 objective on the upper surface, there are on avarage 11 stomata. Under the x20 objective on the lower surface in the leaf are, there are on avarage 12 stomata in *H. heldreichii* (Figure 3).

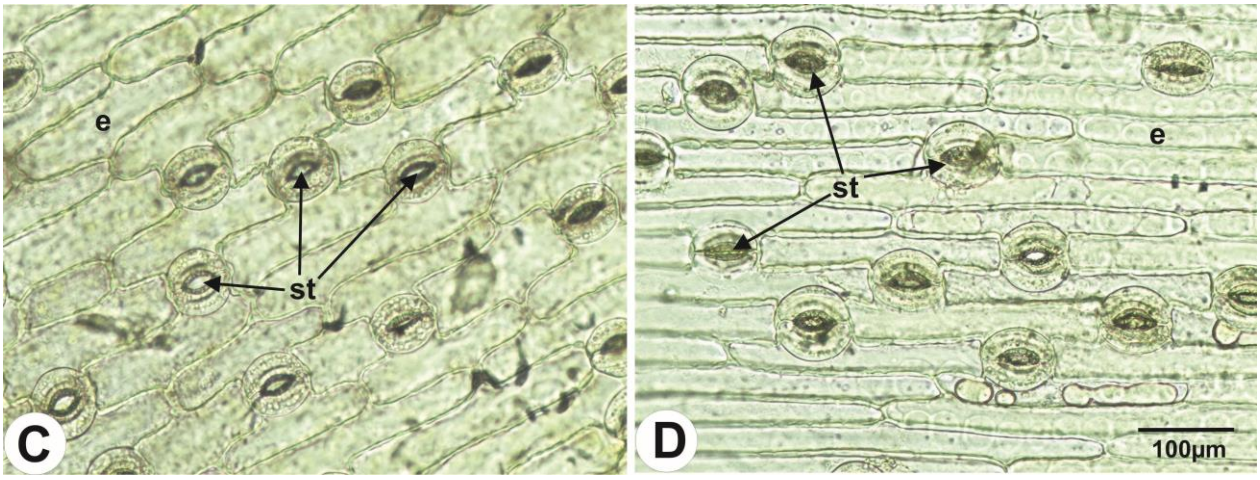

Figure 3. Upper surface section of the leaf. *c* – Upper surface ; **d**– Lower surface; **st** – stoma; **e** – epidermal cell.

3.4 Soil Properties: Investigated soil samples were taken from the naturally distribution areas of the plant. Samples receipt from different three locality. It has been determined that the species generally prefer tinned textured, pH alkaline, too much calcined, high inorganic matter, low phosphorus, adequate potassium, sufficient copper and iron, less zinc, very calcareous and less salty or unsalted soils.

4.DISCUSSION

In the study, anatomical and ecological features of the endemic species *H. heldreichii* has been investigated. According to the results, anatomical features of scape of the species are similar with the common characteristics of the monocotyledons (Cutter, 1971). Anatomical characteristics of scape and leaf belong to *H. heldreichii* shows similarities with other studied *Hyacinthella* species but *H. heldreichii* shows some differences (Selvi *et al.,* 2008,Yetişen *et al*., 2012, Tekin & Meriç, 2013). The scape of *H. heldreichii* include monolayer epidermis, multilayer sclerenchymatic tissues, parenchymatic pith, various sized vascular bundles and 4-6 layered parenchymatic cortex. In the *H. acutiloba*, cortex consist of 5-6 cell layer, *H. lineata* 3-6, *H. glabrescens* 4-5 and *H. micrantha* 5-6 (Kandemir *et al*., 2000, Selvi *et al,*. 2008, Yetişen *et al*., 2012, Tekin & Meriç, 2013). However *H. micrantha* entirely lacks sclerenchymatic tissue in its scape (Kandemir *et al.*, 2000).

Taxonomically, the shape and distribution of calcium oxalate crystals in plant tissues may be useful in monocotyledons (Prychid & Rudal, 1999). *H. acutiloba* have calcium oxalate raphide crystals in their scape cortex. Moreover, *H. glabrescens* have sand crystals it's in the

cortex cell (Yetişen *et al.*, 2012, Tekin & Meriç, 2013). The other studied Hyacinthella species have not crystals in their scape, similar as our finding results (Kandemir *et al.*, 2000, Selvi *et al.*, 2008).

Anatomical properties of the leaf in *H. heldreichii* are observed similarly with the studied *Hyacinthella* species (Kandemir *et al.*, 2000, Selvi *et al.*, 2008, Yetişen *et al*., 2012, Tekin & Meriç, 2013). Mesophyll of *H. acutiloba* have got calcium oxalate raphide crystals and is isolateral. The raphide crystals are also present in *H. micrantha* and *H. lineata* have not raphide crystals in their leaf mesophyll (Kandemir *et al.*, 2000, Selvi *et al.*, 2008).

According to the present and previous studies, mesophyll anatomy in the genus *Hyacinthella* show differences among the species with regard to arrangement of the mesophyll. Leaf mesophyll is isolateral in the previously studied species (Kandemir *et al*., 2000, Selvi *et al*., 2008, Tekin & Meriç, 2013) but it's unifacial in *H. heldreichii*.

The raphide crystals are present in mesophyll of *H. acutiloba* and *H. micrantha* (Selvi *et al*., 2008, Tekin & Meriç, 2013). Also, raphide crystals are present in our studied species. However, *H. lineata* has not raphide crystals in their leaf mesophyll (Kandemir *et al*., 2000).

As for ecological studies, it was observed that *H. lineata* preferred similar soils as *H. Heldreichii;* organic matter, salt content and amount of potassium. *H. heldreichii* preferred pH alkaline, very low phosphorus and very calcareous soils. However, *H. lineata* distributed in neutral, nitrogen-rich, phosphorous-rich, and calcareous soils (Selvi *et al.*, 2008).

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