

Full Length Research Paper

Morphological and Anatomical Studies on the Turkish Endemic *Gypsophila lepidioides* Boiss

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Gypsophila lepidioides Boiss. has a very nice appearance with white flowers, which is a local endemic species for Turkey and categorized as data deficient. The present study is based on the morphological and anatomical investigation of *Gypsophila lepidioides*. The inflorescence is panicle with many branches, bearing congested, many flowered cymules. The plant taxon was restricted to the gypsum steppe. The anatomical properties of the root, stem and leaves are described. It is determined that the root, stem and leaves are filled with a lot of druse crystals.

Key words: *Gypsophila lepidioides*, morphology, anatomy, data deficient.

INTRODUCTION

The family Caryophyllaceae, distributed mainly in temperate regions of the Northern hemisphere, includes 86 genera and about 2200 species in the subfamilies Paronychioideae, Alsinoideae and Caryophylloideae (Bittrich, 1993). The genus *Gypsophila* is predominantly Eurasian. It occurs in the north-temperate part of the old world, mainly between the latitudes of 30° and 60°. Most of the *Gypsophila* species are concentrated in a quite small part of the geographic distribution area. This part of the area, which may rightly be called the main variation centre of the genus, includes Turkey, Caucasia, northern Iraq and northern Iran. Of the 126 *Gypsophila* species, the 75 are represented in this region and 49 of them are endemic to there (Barkoudah 1962). Since the most recent works of the genus in Turkey, new species have been described; the total has now reached 55 (Huber- Morath 1967; Davis et al. 1988; Ataşlar 2000; Ataşlar & Ocak 2005). *Gypsophila lepidioides* Boiss. was gathered from Iliç-Erzincan by Aucher in 1836 and by Sintenis in 1890 (Huber- Morath., 1967). The specimens belonging to *G. lepidioides* had not been collected more than a

hundred year since Sintenis when Ekim et al. (2000) evaluated the IUCN category of that species as Data Deficient. Recently, the specimens of that taxon have been collected by Nydegger-Hügl (2000) and by Kandemir and Makbul (2004) from Iliç. *G. lepidioides* is a local endemic for Turkey and has a very nice appearance with the congested white flowers.

Many species are found on calcium-rich soils, including gypsum, whence the name of the genus originate. Some species are also sometimes called "baby's breath" or simply "Gyp" among the floral industry. Its botanical name means "lover of chalk", which is accurate in describing the type of soil in which this plant grows. *Gypsophilas* are often grown as ornamental plants in gardens; they are grown both as garden plants and also valuable as a cut flower in floristry to add as a filler to flower bouquets. Some of *Gypsophila* species are used as an expectorant and diuretic in Turkey (Barkoudah 1962; Baytop 1999).

Studies on the anatomy of this genus are limited. Anatomical differences in xylem among the most of the genera and species of Caryophyllaceae are not very well known, besides the bark characteristics are virtually unknown. The xylem and phloem in the stems of 88 Caryophyllaceae species, consisting of different life

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forms, herbaceous plants, dwarf shrubs and shrubs, of which the two are *Gypsophila* species were analysed by Schweingruber (2007). Most of the species of the genus *Gypsophila* are herbaceous. Until now, only the sporadic presence of growth rings formed by xylem and phloem has been used for defining the family Caryophyllaceae (Judd et al. 2002). The study of 34 herbaceous Caryophyllaceae species by Schweingruber and Poschlod (2005) concentrates on growth rings but discusses no further anatomical characteristics.

In recent years, this genus has been the subject of chemical studies, (Pauthe-Dayde et al. 1990; Han et al. 1996; Yang et al. 1999; Chalupowicz et al. 2006; Ünver et al. 2008). There are some studies on *Gypsophila* genus in literature (El Naggar 2004; Bezdelev AB. 2003; Alegro et al. 2000; Tsarenko OM. 2000) No information on *Gypsophila lepidioides* was found in the literature except some general taxonomic properties (Huber- Morath. 1967). This study allowed us to define the morphological and anatomical features of *Gypsophila lepidioides*.

MATERIALS AND METHODS

The examined specimens were collected from the following locations :

B7 Erzincan: Iliç, around Hasanova Village, gypsum, 39 32 85 N, 38 35 89 E, 1124m, 20.07.2004, Kandemir 6429.

Taxonomical description of the plant samples followed to Huber- Morath. (1967). The fresh samples and the herbarium materials were used for morphological analysis. Anatomical studies were carried out on the samples kept in alcohol of 70 %. The cross- sections from the different parts of the plant were taken by handle- blade. Micrometric ocular was used for the anatomical measurements. Results were presented by original drawings, photographs and tables. The photographs were taken with Leica DM LB microscopy.

RESULTS AND DISCUSSION

Morphological Properties

The morphological findings and the growing environment for the species are the following;

The plant species was perennial with woody caudex, many sterile shoots and several erect shortly velutinous, 150-350 mm stems. The leaves were lanceolate to linear-lanceolate, 18-32 x 2.5-5mm, shortly velutinous. The inflorescence was panicle with many branches, bearing congested, many flowered cymules. The bracts were scarious, lanceolate. Pedicel was nearly absent. The calyx was 2-25mm and had ovate, obtuse, apiculate teeth and densely covered with eglandular hairs. The petals were white, 2.5-4.5mm, linear oblong, obtuse, truncate, or shallowly emarginate. The habitate was gypsum banks. The plant taxon was restricted to the gypsum steppe around Iliç, Hasanova and Kuruçay. The species accompanying the investigated taxon were *Onosma*

sintensisii Hausskn. & Bornm., *Verbascum alyssifolium* Boiss., *Achilla sintensisii* Hub.-Mor., *Tanacetum alyssifolium* (Bornm.) Grierson, *Teucrium multicaule* Montbret & Aucher ex Bentham, *Scorzonera aucherana* DC, *Thesium stellerioides* Jaub. & Spach, *Salvia euphratica* Montbret & Aucher ex Bentham subsp. *liocalycina* (Rech. Fil.) Hedge. *Salvia divaricata* Montbret & Aucher ex Bentham (Figure.1, Table 1).

Anatomical Properties

Root

The root was biennial or perennial and showed secondary growth. The outer surface of root was covered by peridermal cells. These cells were dark coloured, crushed and sometimes felled out. Sclerenchymatous sheaths were present under the peridermis. Parenchymal cortex was 3-10 layered and consisted of irregular and polygonal cells. A lot of druse crystals occupied the cortex. The phloem was 4-6 layered and consisted of irregular or rectangular cells. The phloem followed by xylem which covers a big area. The cambium was not distinguishable. The xylem was composed of sclerenchymatous cells and tracheary elements. The rays were not distinguishable. The pith occupied a large region of the root and had a lot of druse crystals (Figure.2, Table 1).

Stem

Epidermis was 1-2 layered on the outer surface of the stem and consisted of flat ovoidal cells. The upper surface was covered with a relatively thin cuticle and bore glandular and eglandular hairs. Most of them were glandular hairs. The cortex was 4-12 layered and consisted of parenchymal, flat, ovoidal cells. 2-4 layered sclerenchymatous ring and a lot of druse crystals were present at the cortex. The cambium was not distinguishable. The xylem and phloem elements were clear. The large pith had a lot of druse crystals and consisted of large orbicular or polyhedral parenchymal cells (Figure.3, Table 1).

Leaf

The single layered epidermis had flat-ovoidal cells on the adaxial and abaxial surface and is covered with a thin cuticle. The whole mesophyll was composed of 4-6 layered palisade tissue with druse crystals. The parenchymal bundle sheath surrounded the median vein. The stomata and glandular and eglandular hairs were present on both the adaxial and the abaxial epidermis. Glandular hairs are unicellular or multicellular (Figure 3, Table. 1).

DISCUSSION

In this study, we aimed to examine the morphological and anatomical features of *G. lepidioides*. No information on

Table 1. Measurements of Various Tissue of *Gypsophila lepidioides* Boiss.

	Width (μm)		Mean \pm SD.	Length (μm)		Mean \pm SD.
	Min. - Max.			Min. - Max.		
Root						
Peridermis cell	10.48	41.92	24.06	\pm 11.25	7.86	36.68
Parenchyma cell	15.72	41.92	29.50	\pm 9.16	10.48	36.68
Trachea cell	13.10	68.12	32.40	\pm 18.76		
Stem						
Epidermis cell	13.10	39.30	25.40	\pm 9.25	15.72	36.68
Parenchyma	15.72	94.32	55.30	\pm 33.47	10.48	83.84
Trachea cell	15.72	52.40	33.80	\pm 13.89		
Pith cell	31.44	157.20	89.10	\pm 51.22		
Leaf						
Adaxial epidermis cell	20.96	73.36	39.80	\pm 19.82	13.10	52.40
Abaxial epidermis cell	18.34	52.40	30.00	\pm 11.94	15.72	41.92
Trachea diameter	3.75	12.50	8.80	\pm 2.65		
Flower						
Palisade cell	28.82	83.84	54.00	\pm 21.19	18.34	36.68
Spongy cell	15.72	36.68	26.20	\pm 8.29		

SD: Standard Deviation



A



B

Figure.1. General appearance of *Gypsophila lepidioides* Boiss. (A. in field B. Drawing)

G. lepidioides was found in literature except a few general taxonomic properties. The size of calyx and petals and the many morphological properties of

G. lepidioides are the new observations which have been firstly determined in this research. In the first description of *G. lepidioides*; the leaves were 20-30 x 2.5-5mm in

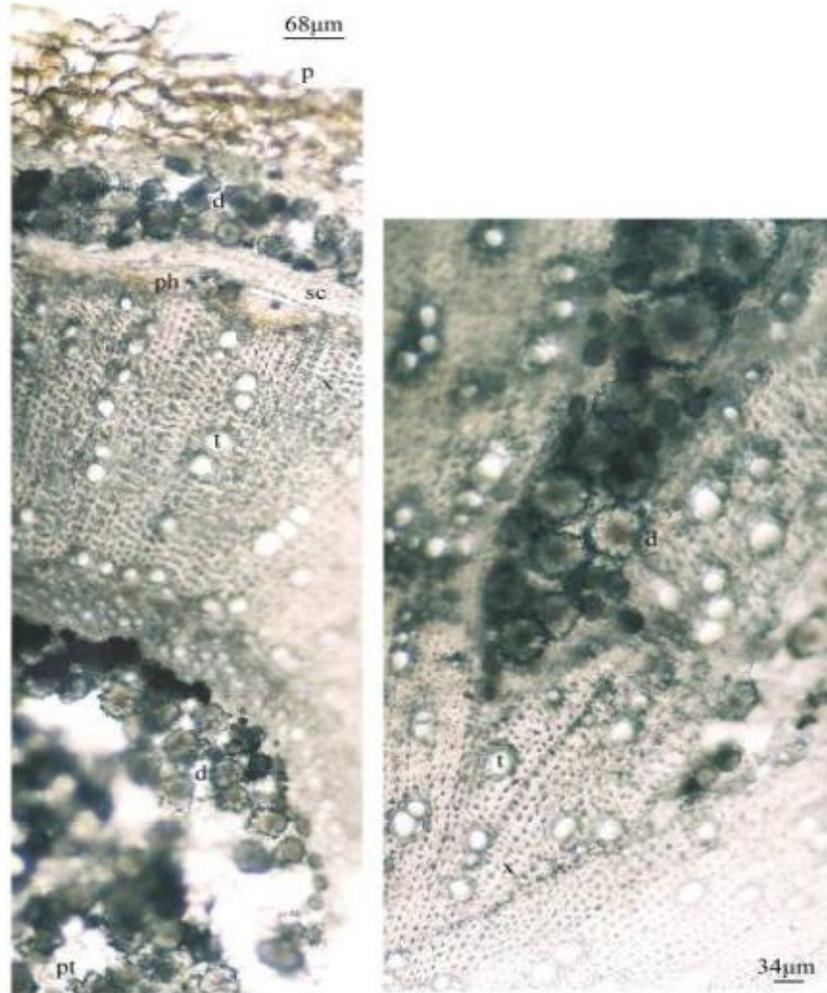


Figure 2. The cross-sections of the root of *Gypsophila lepidioides* Boiss.

p. periderm **sc.** sclerenchyma **co.** cortex parenchyma **d.** druse crystal **ph.** phloem **x.** xylem **t.** trachea **cu.** cuticle **s.** stoma cell **e.** epidermis **pp.** palisade parenchyma **sp.** spongy parenchyma **vb.** vascular bundle **pt.** pith

size. The present study showed that limits of the leaf size expanded to 18-32 x 2.5-5mm.

Metcalf & Chalk (1950) and Watson & Dallwitz (1992-1997) gave information about general anatomical characteristics of the family Caryophyllaceae. Studies on the anatomy of this genus are limited (Schweingruber, 2007). The anatomical properties given in this work provides the first detailed description of *G. lepidioides*. Analysis of the root cross-sections showed that the root was covered externally by a layer of brown, dark coloured, crushed cork cells; the secondary phloem consisted of sieve tubes and parenchyma cells; rays were absent. These results are consistent with the description given by Metcalfe and Chalk (1950). The same features have also been found on the root of *Saponaria kotschyi* Boiss. which belongs to the family Caryophyllaceae (Ataşlar 2004). A sclerenchymatous ring 2-4 layered has been seen in the stem cross-section of

the investigated taxon. Ataşlar (2004) reported a sclerenchymatous ring in the stem of *Saponaria kotschyi*. According to the same investigator; the pericycle is characterised by a sclerenchymatous ring whose width varies between different genera and species of the Caryophyllaceae family. These results are consistent with the description given by Metcalfe and Chalk (1950).

Schweingruber (2007) reported that druse crystals were very frequent in the stem parenchyma cells of the genera *Dianthus*, *Gypsophila*, *Saponaria* and *Silene* and that druse crystals sometimes expand parenchyma cells, as in *Silene latifolia* Poir. and *Gypsophila repens* L. We found the same characteristics for *G. lepidioides* in our research.

Anatomical studies on the leaf showed that the stomata were caryophyllaceous type and were present on both the adaxial and the abaxial surfaces and the mesophyll consisted of only palisade parenchyma with druse

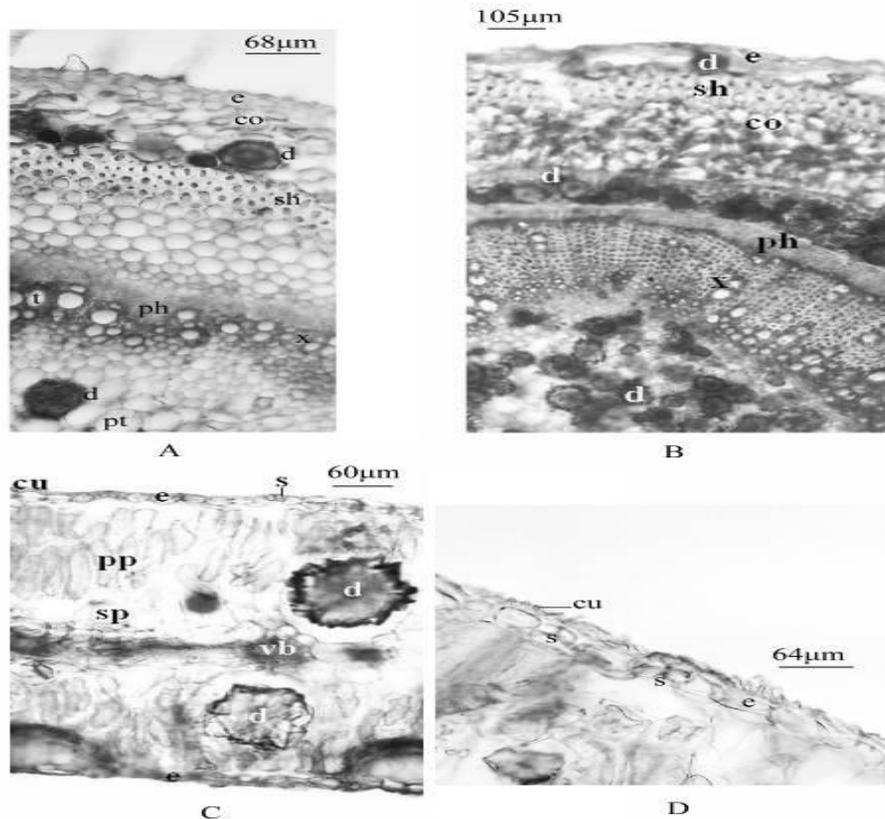


Figure 2. The cross-sections of the stem (A,B) and leaf (C,D) of *Gypsophila lepidioides* Boiss. cu. Cuticle, e. epidermis, s. stoma cell, pp. palisade parenchyma, d. druse crystal vb. vascular bundle

crystals. These anatomical features of the leaves are consistent with those of Metcalfe and Chalk (1950). Finally, the anatomical description of the investigated taxon in this work presents the first data available in the literature.

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