

Leaf and Petiole Anatomy of *Viburnum opulus* L. (Adoxaceae)

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Geliş / Received: 17/11/2017, Kabul / Accepted: 12/02/2018

Abstract

The genus *Viburnum* L. comprises with four species in Turkey. The *Viburnum* species are known as “gilaburu, giraoğlu, giligili, dağdağan, dağdığan, geleboru, gilabada, gildar” in Turkey. In this study, the leaf and petiole anatomy of *V. opulus* L., are described in detail. Vascular bundle is collateral type. Leaves are bifacial and hypostomatic. There are rare glandular trichomes on lower epidermis. Both upper and lower epidermises are covered with thick cuticle and cells are single layered. Midrib has 1-2 layered collenchyma and 4-5 layered parenchyma. Druse crystals occur in parenchyma cells. The mesophyll is consisted of 1-2 layer palisade parenchyma and 2-3 layer spongy parenchyma. Anomocytic stomata are surrounded by 4-5 ordinary epidermal cells. There are not any trichomes on the cross section of the petiole. Petiole has a total of three vascular bundles, with a big arc-shape bundle in the middle. In each corner, there are two small arc-shape bundles. Arc-shaped vascular bundles are surrounded by parenchymatous cells consisted of druses.

Keywords: *Viburnum opulus*, Adoxaceae, Anatomy, Leaf, Petiole

Viburnum opulus L. (Adoxaceae) Türünün Yaprak ve Petiol Anatomisi

Öz

Viburnum L. cinsi Türkiye’de dört tür ile temsil edilmektedir. Ülkemizde “gilaburu, giraoğlu, giligili, dağdağan, dağdığan, geleboru, gilabada, gildar” isimleri ile tanınır. Bu çalışmada, *V. opulus* L. türünün yaprak ve petiol anatomisi ayrıntılı olarak tanımlanmıştır. Vasküler demet kollateral tiptedir. Yapraklar bifasiyal ve hipostomatiktir. Alt epidermiste örtü tüyleri seyrek. Üst ve alt epidermis hücrelerinin üstünde kalın bir kutikula tabakası vardır ve hücreleri tek sıralıdır. Orta damarda, epidermanın altında sırasıyla 1-2 sıralı kollenkima ve 4-5 sıralı parankima hücreleri bulunur. Parankima hücreleri druz kristalleri içerir. Mezofil tabakası 1-2 sıralı palizat parankiması ve 2-3 sıralı sünger parankimasından oluşur. Anomositik stomalar 4-5 basit epidermal hücre ile çevrelenmiştir. Yaprak sapı enine kesitinde tüye rastlanmamıştır. Yaprak sapında üç iletim demeti bulunmaktadır. Ortadaki iletim demeti büyük ve yay şeklindedir. Her köşede ise iki küçük yaysı iletim demeti bulunmaktadır. Yaysı iletim demetleri druz kristalleri içeren parankimatik hücrelerle çevrilmiştir.

Anahtar Kelimeler: *Viburnum opulus*, Adoxaceae, Anatomi, Yaprak, Petiol

1. Introduction

The genus *Viburnum* L. (Adoxaceae) is widespread in temperate regions of the northern hemisphere. It consists of about 165 species of shrubs or small trees. Four species are recorded in the Flora of Turkey. The *Viburnum* species are known as “gilaburu, gileburu, gilebolu, gilaboru, giraoğlu, giraboğulu, girabolu, geleboru, giligili, dağdağan, dağdığan, geleboru, gilabada, gildar” in Turkey (Davis, 1972; Davis et al., 1988; Winkworth and Donoghue, 2005;

Koşar et al., 2011). Its Turkish name is known as gilaburu (Güner et al., 2012) *Viburnum opulus* L. has some folkloric usages as expectorant, diuretic and against kidney disorders, diabetes, bile and liver disorders, prostate disorders, epilepsy and mumps diseases. Bioactive compounds of *Viburnum* fruits were reported to antioxidant, antimicrobial and immunostimulant activities (Altun et al., 2010; Sarıkaya et al., 2010; Altundag and Ozturk, 2011; Erdogan-Orhan et al., 2011; Koşar et al., 2011; Tuzlacı and Şenkardeş, 2011; Korkmaz and Karakuş, 2015; Akgül et al., 2016). Rich chemical

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contents of the *V. opulus* has been investigated by many researchers (Velioglu et al., 2006; Çam and Hişil, 2007; Altun et al., 2008; Karaçelik et al., 2015; Boyacı et al., 2016). Some *Viburnum* species have been examined in terms of wood anatomical properties (Ogata 1988), Eom and Chung (1996) and palynology (Kollmann and Grubb, 2002), pylogeny (Winkworth and Donoghue, 2005) and cytology (Egolf, 1962), but investigations of the Turkish wild *Viburnum* species, especially in anatomical sense, have been very limited. There is a comparative anatomical study between shoot and leaves of four Turkish *Viburnum* species by Beyazoğlu et al. (2008). The objective of the current study is to investigate the leaf and petiole anatomical characters of *V. opulus*.

2. Materials and Methods

Plant samples of *V. opulus* were collected from Kayseri. The samples were dried using standard herbarium techniques and stored herbarium of the Faculty of Pharmacy, İstanbul University (Ecevit-Genç 857). Live samples were fixed in 70% ethanol. Anatomical investigations were carried out on the cross-sections of the leaves and petiole and surface sections of the leaves. Cross-sections were stained with sartur reagent. The photographs of the sections were taken using with the Olympus BH-2 microscope.

3. Results and Discussion

Leaf and petiole anatomical characters of *V. opulus* were examined in detail in this study. Leaf surfaces have a thick cuticle. Epidermises consist of single layer cells of oval or rectangular. The outer walls of the upper and lower epidermal cells are undulate. Midrib is semicircular and has 1-2 layers

collenchyma located below both epidermises. Arc-shaped vascular bundles were surrounded by 4-5 layers oval and orbicular. Parenchymatous cells including druses. Vascular bundle is collateral type (Figure 1a). The leaves are bifacial and hypostomatic. Eglanular trichomes are rarely located on the lower epidermise. The mesophyll is differentiated into 1-2 layer palisade parenchyma and 2-3 layer spongy parenchyma (Figure 1b). Anomocytic stomata are surrounded by 4-5 ordinary epidermal cells. The upper epidermis cells are bigger than the lower ones (Figure 1b, c, d). Cross section of the petiole revealed the following elements. The upper and lower epidermises comprise uniseriate, oval and rectangular cells. At the petiole surface of the *V.opulus*, do not have any trichomes. There are 5-6 layered chlorenchyma cells at the corners and 1-2 layered chlorenchyma cells at the margins. Petiole has a total of 3 arc-shaped vascular bundles, the big one is in the middle. In each corner, there are 2 small arc-shaped vascular bundles. All vascular bundles are surrounded by a parenchyma cells consisted of druses (Figure 2a, b).

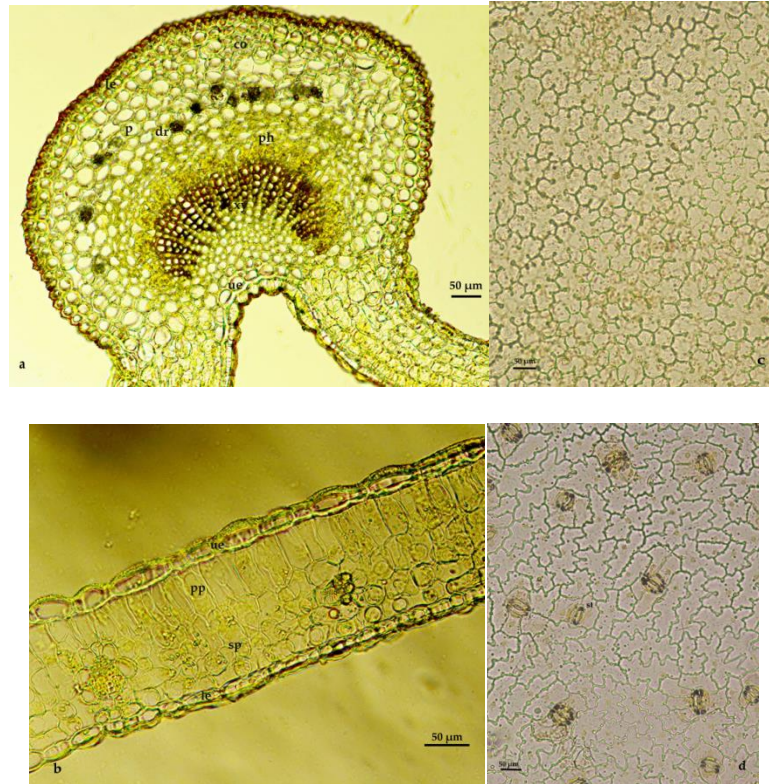


Figure 1: Cross section of the midrib (a), cross section of mesophyll (b), upper surface of leaves (c), lower surface of leaves (d), **dr:** druse; **le:** lower epidermis; **p:** parenchyma; **ph:** phloem; **pp:** palisade parenchyma; **sp:** spongy parenchyma; **st:** stoma; **ue:** upper epidermis; **xy:** xylem

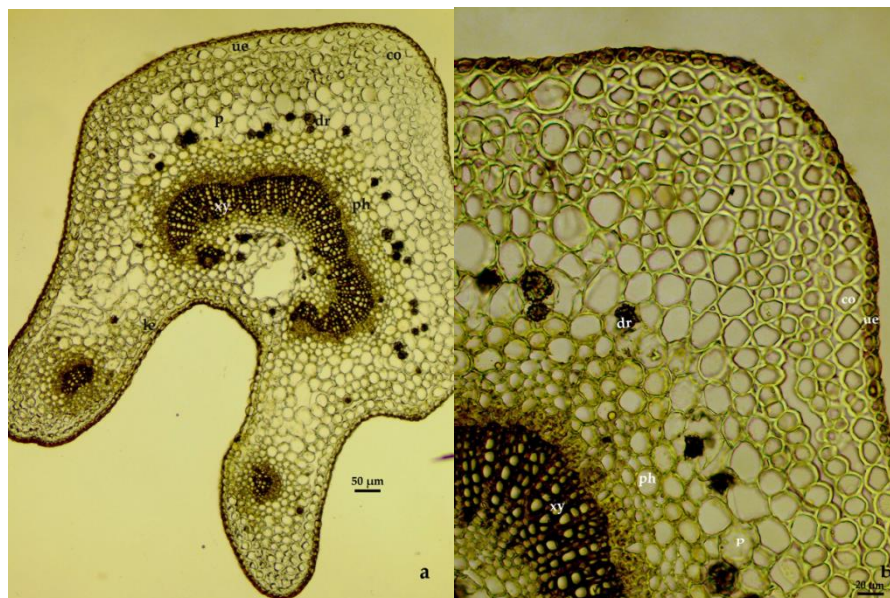


Figure 2: Cross section of the petiole (a, b), **co:** collenchyma; **dr:** druse; **le:** lower epidermis; **p:** parenchyma; **ph:** phloem; **xy:** xylem

4. Conclusions

Leaf and petiole anatomical characters were examined in detail in this study which

provide useful information on the anatomy of *V. opulus*.

In the current study, only eglandular trichomes were found on the leaves. However, Metcalfe and Chalk (1972) found glandular and non-glandular hairs on the *Viburnum* species. Beyazoğlu et al. (2008) found eglandular hairs on the both surface of leaves. Metcalfe and Chalk (1972) reported mesophyll include single layer of palisade cells but we found into 1-2 layer palisade parenchyma. Vascular cylinder was found, slightly flattened on the adaxial side of petiole in *V. opulus* and *V. tinus* by Metcalfe and Chalk (1972) but this situation was not confirmed by the present study for *V. opulus*. The naturally grow *Viburnum* species in Turkey are generally branched near the base, (1972). Morphologically, they are quite similar, but some differences could be observed in anatomical features of shoot, cork and leaves (Beyazoğlu et al. 2008). Therefore, our results will be more valuable for comparison in case the rest of the species of *Viburnum* examine.

5. References

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