

Studies on the Anatomical Structure of the Leaf and Stem of *Daphne pontica* L. (Thymelaeaceae)

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Summary : This study was carried out on the anatomical structure of the leaf and stem of *Daphne pontica* L. *Daphne pontica* L., a plant of the Thymelaeaceae family, was collected from the Bolu-Gölcük region of Turkey. Anatomical characters of the leaf and stem of this plant were examined for the first time in this study.

Key Words: Thymelaeaceae, *Daphne pontica* L., Anatomical structure

Received : 4.11.2002

Revised : 17.2.2003

Accepted : 21.3.2003

Daphne pontica L. (Thymelaeaceae) Yaprak ve Dallarının Anatomik Yapısı Üzerinde Çalışmalar

Özet : Bu çalışma *D. pontica* L.'nin yaprak ve dallarının anatomik yapıları üzerinde gerçekleştirildi. Bir Thymelaeaceae familyası bitkisi olan *Daphne pontica* L. Türkiye'nin Bolu-Gölcük yöresinden toplandı. Bitkinin yaprak ve dallarının anatomik karakterleri ilk defa bu çalışmada incelendi.

Anahtar kelimeler : Thymelaeaceae, *Daphne pontica* L., anatomik yapı

INTRODUCTION

Daphne (Thymelaeaceae) is represented by 70 world-wide species¹⁻⁵ including 7 species in Turkey, namely *D. glomerata*, *D. gnidioides*, *D. mezereum*, *D. mucronata*, *D. oleoides*, *D. pontica* and *D. sericea*⁶⁻⁹.

Among these species, *Daphne pontica* L. is called sırımbağı, sırımbağı, kurtbağı, locally. These evergreen erect shrubs, sparingly branched, 40-100 cm, with slightly fragrant flowers in pairs on a common peduncule and black ovoid or subglobose fruits, grow naturally as an underforest plant, especially in the northern Anatolian Region and partially in the Marmara and Inner Anatolian Region of Turkey⁶⁻¹⁰.

Daphne species contain an irritable resin, so these species are known as very toxic-plants for both humans and animals^{8, 11, 12}. Toxicity had been observed

especially in children who had eaten them. It is known that 10-12 fruits of these plants are deadly poisonous, so these species must not be used internally⁸. Besides, there are several rumors concerning *D. pontica* L., which is a poisonous plant of our country, for use in the treatment of psoriasis in some regions of Turkey. Also, the ethanolic extract of seeds of *D. pontica* L. had been found to be effective for KB and IM9 cells¹³.

There have been some phytochemical studies on *D. pontica* L. in Turkey¹⁴⁻¹⁶, but, there is no research either for *D. pontica* L. or for other species regarding the anatomical structure.

In this respect, first of all, we started to study *D. pontica* L. anatomically. The stem and leaf anatomies of *D. pontica* L. were studied and described with original drawings and photographs for the first time, in

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order to support the identification of these species and to have an approach regarding the phytochemical studies.

MATERIAL AND METHOD

MATERIAL

Daphne pontica L. was collected (in flowering times) from the Bolu-Gölcük region of Turkey at an altitude of 950-1200 m, in May 1994. The voucher specimen was deposited in AEF (Ankara Üniversitesi Eczacılık Fakültesi Herbariumu, AEF 17721).

METHOD

The materials used for the anatomical studies were preserved in 70 % ethanol. Cross sections of the leaf and stem were prepared by hand from preserved material and boiled in a solution of Chloral Hydrate and Sartur Reagent. Sartur Reagent contains KI-I, aniline, sudan-III, lactic acid, alcohol and water¹⁷. Indian ink and distilled water were used for marking mucilage. However all studies were performed in Sartur Reagent. Illustrations were made using a Leitz-Wetzlar (45°) drawing prism. The cross sections were photographed with an automatic camera attached to a Carl Zeiss Jena microscope.

RESULTS

Leaf Anatomy

There is an evident projecting part on the lower surface of the leaf indicating the midrib vein in cross section (Fig. 1). There is collenchyma as a supporting tissue both under the upper epidermis and over the lower epidermis in cross section of the midrib vein of leaf. The vascular bundles, phloem, which is made of thin-walled, small cells, are surrounded by xylem in a semicircle. There are schlerenchyma fibers with thick, lignified walls that partly encircle the phloem between phloem and collenchyma in the lower part. There are few sclereids with a wide lumen among those. There are thin-walled xylem parenchyma cells in the xylem tissue at the center of the midrib vein

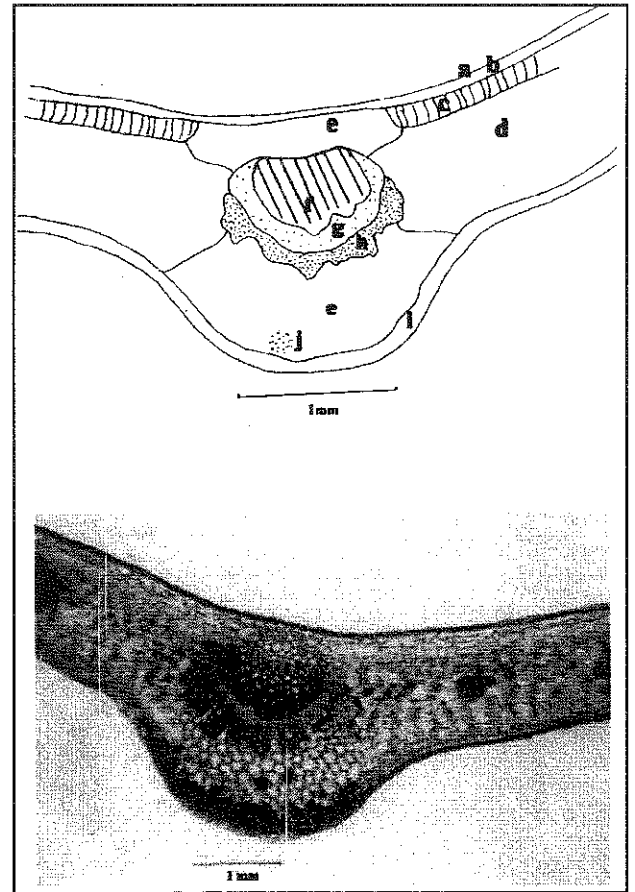


Fig. 1. *Daphne pontica* L.: Cross section of midrib
a: cuticle, b: upper epidermis, c: palisade parenchyma, d: spongy parenchyma, e: collenchyma, f: xylem, g: phloem, h: schlerenchyma, i: lower epidermis, j: starch grains

(Fig. 1, 2). The cells of the lower epidermis are similar to those of the upper epidermis except that the lower epidermis cells are smaller than the upper ones. Both lower and upper epidermis are composed of rectangular cells which are pitted and rather thickened. Especially there is a thick cuticle below the midrib vein (Fig. 2). Generally the upper epidermal cells contain mucilage. So, these epidermal cells are usually enlarged due to the swelling of the mucilage present. There is no hair on the lower or upper epidermis. Stomata with 3-5 neighbour cells are present only at the lower epidermis with kidney shaped stomata cells. The upper epidermis is devoid of stomata (Fig. 3, 5). Crystalloid structures are found in both lower and upper epidermis (Fig. 4, 5). Additionally, there are starch grains in collenchyma, spongy parenchyma and stomata. The single layer of thin-

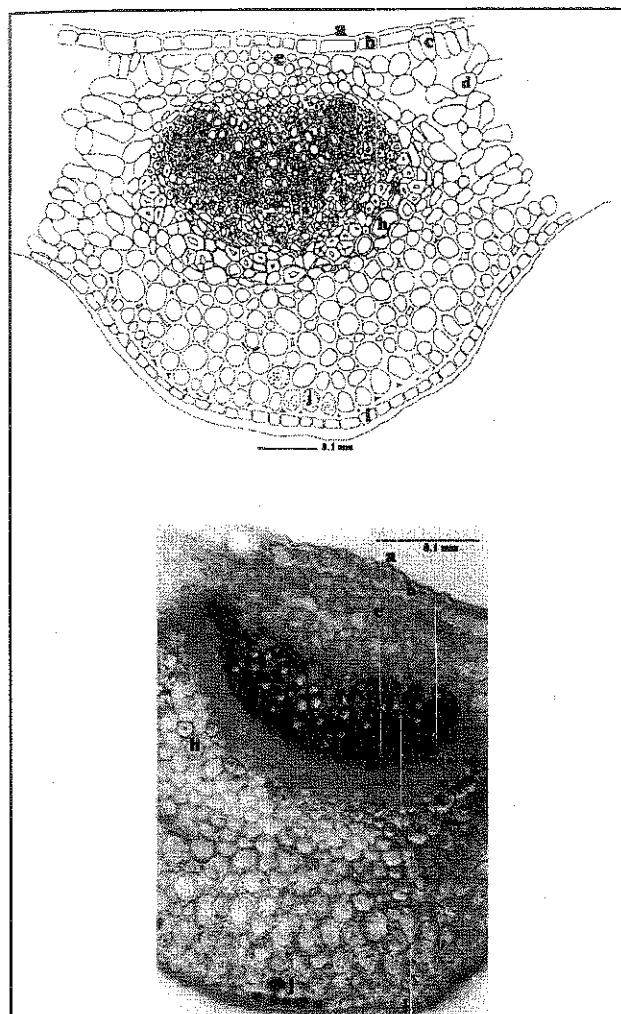


Fig. 2. *Daphne pontica* L.: Cross section of midrib
 a: cuticle, b: upper epidermis, c: palisade parenchyma, d: spongy parenchyma, e: collenchyma, f: xylem, g: phloem, h: sclerenchyma, i: lower epidermis, j: starch grains

walled, short, cylindrical palisade cells are located rather closely packed under the upper epidermis. The irregular cells of spongy parenchyma with large intercellular spaces compose a loose tissue in this bifacial leaf (Fig. 3-5).

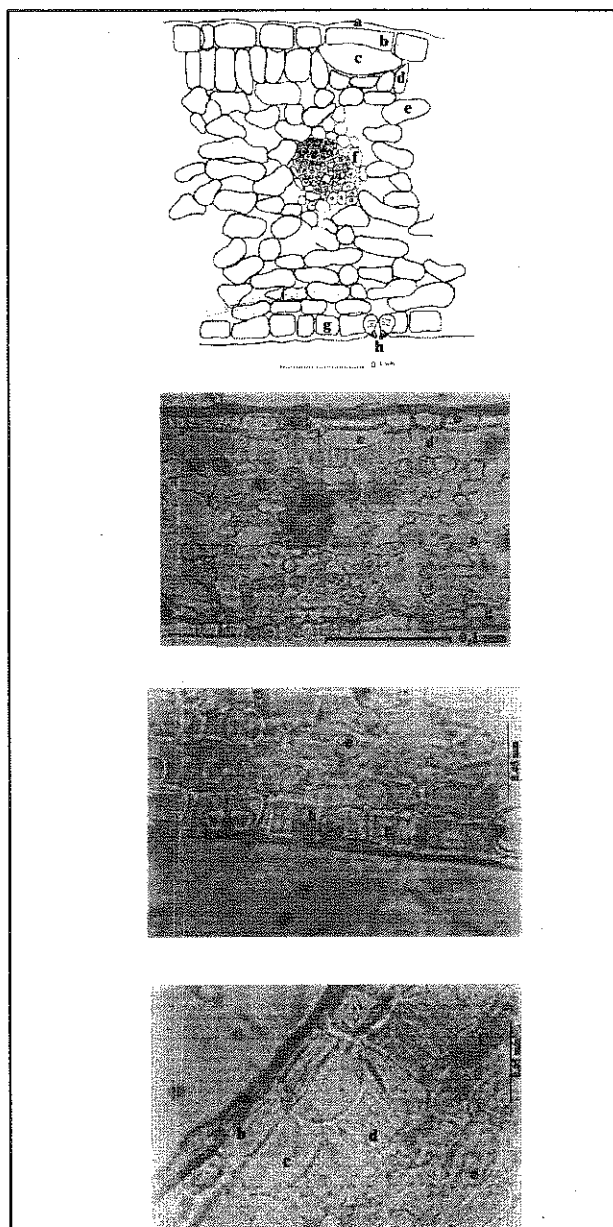


Fig. 3. *Daphne pontica* L.: Cross section of leaf lamina
 a: cuticle, b: upper epidermis, c: mucilage cell, d: palisade parenchyma, e: spongy parenchyma, f: vascular bundle, g: lower epidermis, h: stoma, i: starch grains

Stem Anatomy

Stems are circular in cross section (Fig. 6). The cork exists as occasional fragments of reddish-brown from the adherent bark. Periderm is at the outermost portion with different numbers of layers. Periderm consists of multi-layered rectangular cells. Periderm, cor-

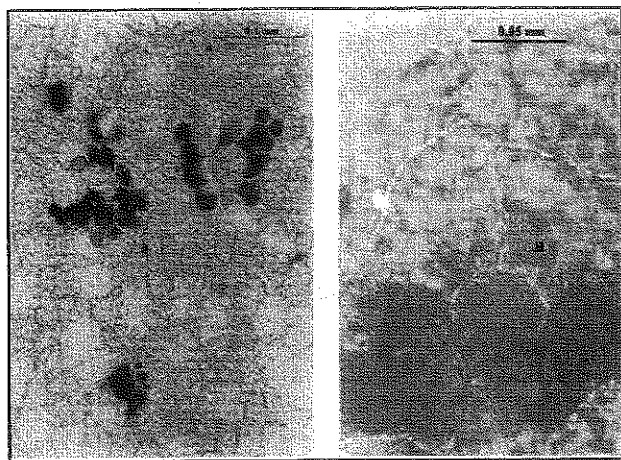


Fig. 4. Superficial section of leaf of *D. pontica* L. (upper epidermis)

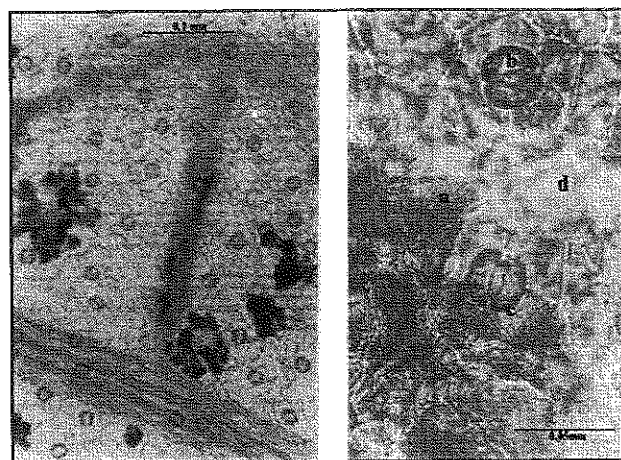


Fig. 5. Superficial section of leaf of *D. pontica* L. (lower epidermis)
a: crystalloid structure, b: stoma, c: starch grains, d: mucilage cell

tex parenchyma, schlerenchyma, phloem, xylem and pith are observed in cross sections of the stem as characteristic elements. Cortex parenchyma cells with reticulate thickened cellulosic walls are located under periderm (Fig. 7, 8). Towards the center, phloem, dilated pith rays and schlerenchyma fibers are located. Pith rays with very characteristic dilatation pattern have reached the cortex parenchyma with expansion (Fig. 6, 7). Pith rays that are radiant from pith to cambium are generally in one row, occasionally two rows (Fig. 8, 9). Pitted walls of pith ray cells are evident. Abundant numbers of fibres occur in groups usually associated with the other elements of the xylem. They are lignified with moderately thickened walls and their lumens are generally nar-

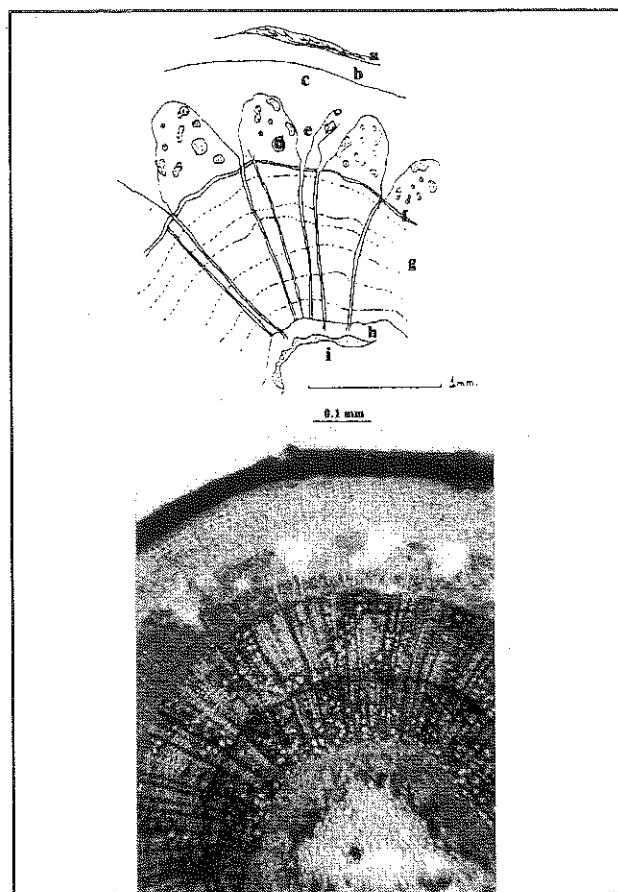


Fig. 6. *Daphne pontica* L.: Cross section of stem
a: cork, b: periderm, c: cortex parenchyma, d: schlerenchyma, e: dilated pith ray, f: phloem, g: cambium, h: xylem, i: pith

row or sometimes wide. The diameter of the schlerenchyma fibers becomes larger from cambium to cortex parenchyma. Phloem consists of thin-walled cells. Cambium consists of thin-walled, narrow rectangular shaped cells in three or four layers. In some sections, cambium has been crushed and broken (Fig. 8, 9). Wood is composed of trachea, tracheid, xylem parenchyma, and schlerenchyma fibers. Many layered trachea and tracheids are seen covering a large area. The cells are moderately thick-walled, lignified and have fairly numerous pits. These cells are almost angled. There are large tracheas among them. Xylem parenchyma cells are small, cellulosic and thin-walled. There is a large pith at the center of the stem. Cellulosic walls of these spherical shaped cells are thickened. Schlerenchyma bundles surround the pith like a ring in the center (Fig. 9).

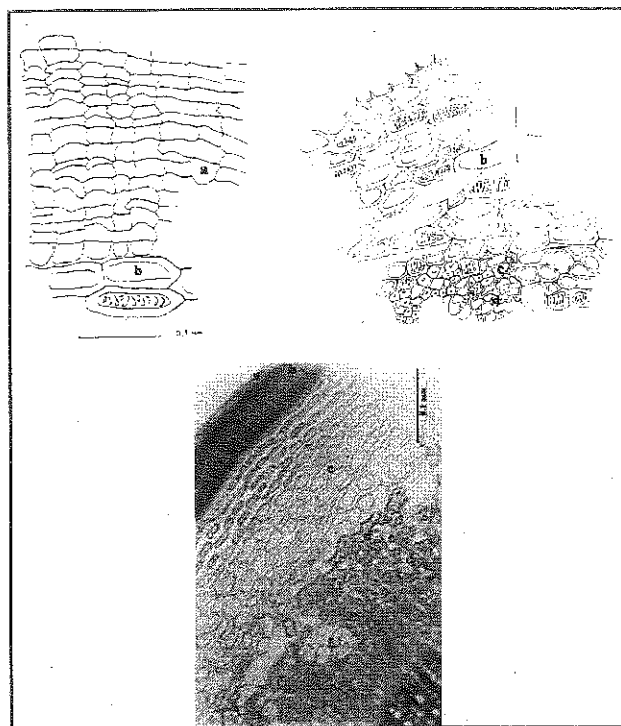


Fig. 7. *Daphne pontica* L.: Cross section of stem
a: cork, b: periderm, c: cortex parenchyma, d. schlerenchyma, e: phloem, f: dilated pith ray

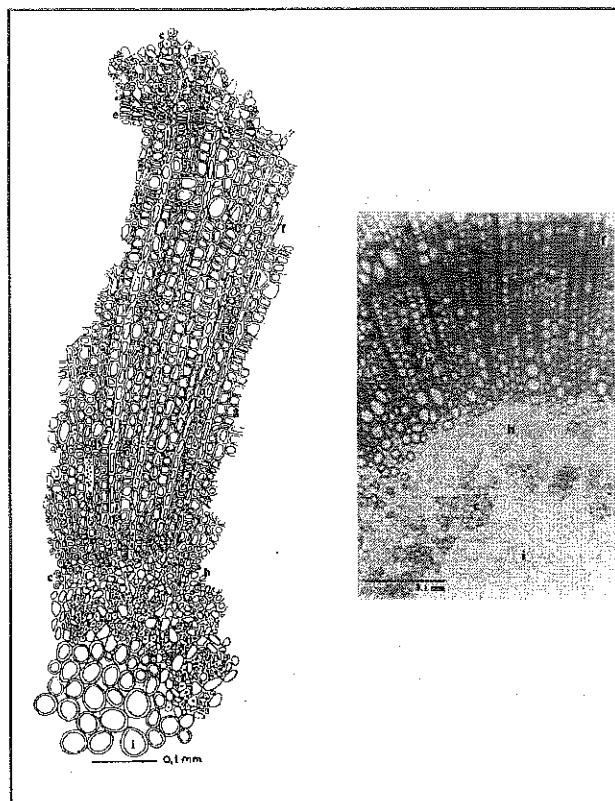


Fig. 9. *Daphne pontica* L.: Cross section of xylem region
c: schlerenchyma, d: phloem parenchyma, e: cambium, f: pith ray, g: xylem, h: xylem parenchyma, i: pith

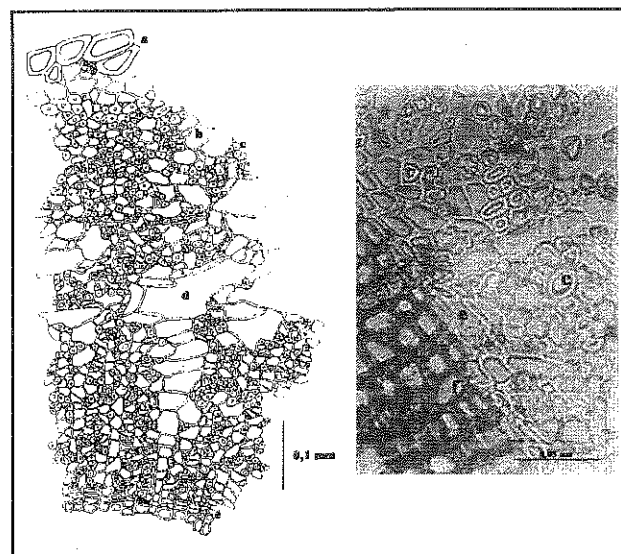


Fig. 8. *Daphne pontica* L.: Cross section of stem
a: cortex parenchyma, b: phloem parenchyma, c: schlerenchyma, d: dilated pith ray, e: cambium, f: xylem

DISCUSSION

In this study, we investigated the anatomical structure of the leaf and stem of *Daphne pontica* L. growing in Turkey. *D. pontica* L. can be separated easily from other species growing in Anatolia, especially with its flowers in pairs and black fruits, but, there is no study on *D. pontica* L. to identify it anatomically. In this respect, the leaf and stem of this plant have been investigated to identify the anatomical characters.

D. pontica L. contains mucilage in its leaves as similarly observed in many genus of Thymelaeaceae family¹⁸. Mucilage could be found mostly in the upper epidermis cells, whilst stomata were found only at the lower epidermis. As mucilage was found in the upper epidermis, it swelled toward inside and compressed the cells of the palisade parenchyma causing them to shorten and broaden at the bifacial leaf.

It is interesting that we have observed groups of unusual crystalloid structures in the leaves. These crystalloid structures are most probably the cluster crystals of calcium oxalate.

In addition, we observed that *D. pontica* L. contains a large xylem part and many schlerenchyma fibers in the stems.

Anatomical characters can be used to support morphological characters in plant identification. Therefore, anatomical characters also very important in point of view. Although detailed morphological characters are known for *D. pontica* L., there has been no anatomical characters investigated for this plant to support the morphological characters. It was aimed to determine distinguishing characters for the anatomy of this species.

Thus, it is important that *D. pontica* L. was examined anatomically for the first time among the other *Daphne* species, to support its morphological characters and phytochemical studies. This study will establish a base for further studies on the subject.

Acknowledgement

The authors wish to thank Ankara University, Institute of Health Sciences, Research Fund (ARFO) for support of this master thesis.

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