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Anatomical study on *Vaccinium arctostaphylos* L.

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Vaccinium arctostaphylos L. (Ericaceae), locally named Qaraqat, is widely used in Iranian folk medicine as antidiabetic and antihypertensive agents. The anatomical study on the different organs of the plant was performed to give a clear standard for identification of the drug. Various diagnostic elements such as particular cells, rubiaceous stomata, covering and glandular trichomes, Ca-oxalate crystals were found in different parts.

1. Introduction

The genus *Vaccinium* (Ericaceae) is represented in Iran only by the species *Vaccinium arctostaphylos* L. [1, 2]. This species grows wildly in the Northern forests [1, 2] and is locally known as "Qaraqat and/or Cyah-gileh" [3, 4]. The plant is therapeutically relevant in Iranian folk medicine. For example, the berries are widely used as antidiabetic and antihypertensive agents [3].

In regard to phytochemical profiles of *V. arctostaphylos*, the occurrence of flavonol glycosides [5] and coumarins [6] in leaves, phenolic acids and their derivatives in leaves [6] and unripe fruits [7] have been reported. In addition, the essential oil composition of the flowering aerial parts has been determined [8].

The anatomical studies on different *Vaccinium* species proved to be incomplete upon bibliographical revision. Metcalf and Chalk only partially described certain species [9]. The objective of the present work is to study the internal anatomy of the different organs of *V. arctostaphylos* and to provide a useful micrographic reference standard for identification and quality control of the drug.

2. Investigations, results and discussion

2.1. Leaf

The transverse section of the leaf shows the following characters.

2.1.1. Lamina (Fig. 1–5)

Upper epidermis: It is composed of a single row of thin walled polygonal cells with a fairly thick cuticle (Figs. 1, 3).

Mesophyll: Two types of parenchyma can clearly be differentiated, upper (paliside) and lower (spongy) parenchyma, which contains abundant chloroplast. The upper one is formed of two layers of compactly arranged cylindrical cells. The lower one is made of several layers of irregularly shaped cells with large intercellular spaces. Also, both rosette (abundant) and prismatic (occasional) Ca-oxalate crystals are present in the mesophyll (Fig. 1).

Vascular tissue: It is found at the level of spongy parenchyma (Fig. 1).

Lower epidermis: It consists of a single layer of cuticulized polygonal cells. The lower epidermis cells are smaller

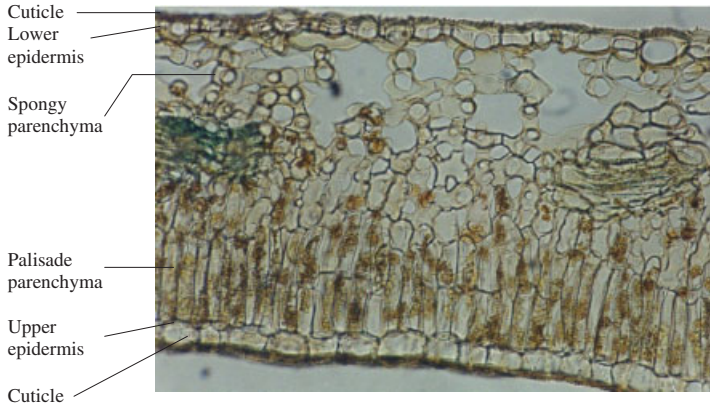

Fig. 1:
T. S. of the lamina (× 70)

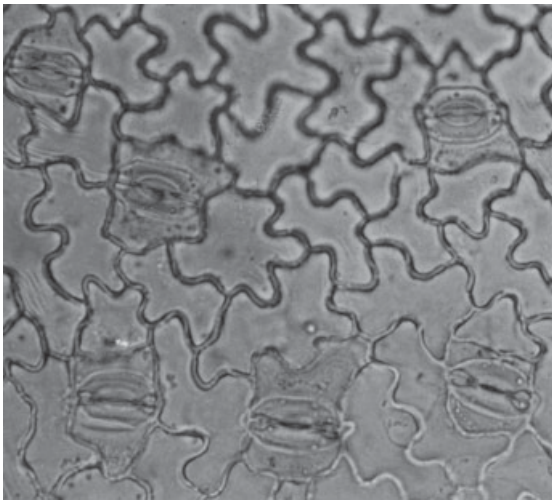

Fig. 2: Lower epidermis with rubiaceous stomata (× 280)

than those of the upper epidermis. Stomata are present on this surface and rubiaceous type (Figs. 1, 2). There are two types of trichomes on the lower epidermis, covering and glandular trichomes. Long and thin unicellular covering trichomes occur frequently around the large vein (Fig. 4). Stalked multicellular glandular trichomes occur occasionally around the midrib and are also present at the edge of each serration of the leaf (Fig. 5).

2.1.2. Midrib (Fig. 6)

Epidermis: The upper and lower epidermises are made of a single row of cuticulized cells. Trichomes and stomata are similar to those of the lamina.
Cortex: It is formed of several layers of thick walled rounded cells. The outer layers are collenchymatous and gradually become parenchymatous towards the vascular tissue. Crystals are similar to those of the lamina.
Meristele: It is well marked, crescent shaped, with central xylem, an arch of phloem below and pericycle fibers below and above.

2.2. Stem

The transverse section of the stem exhibits the following characters (Fig. 7).

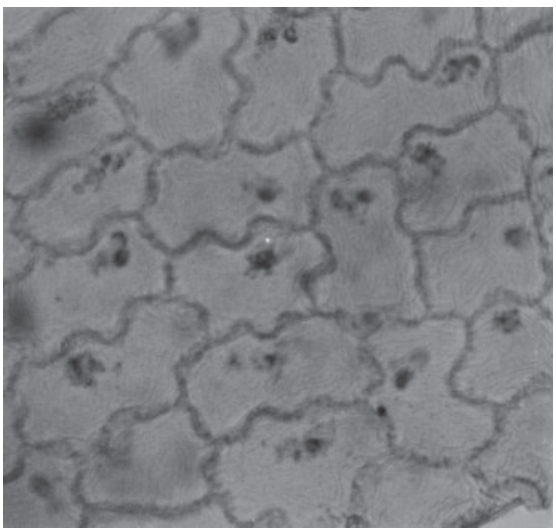

Fig. 3: Upper epidermis (× 280)

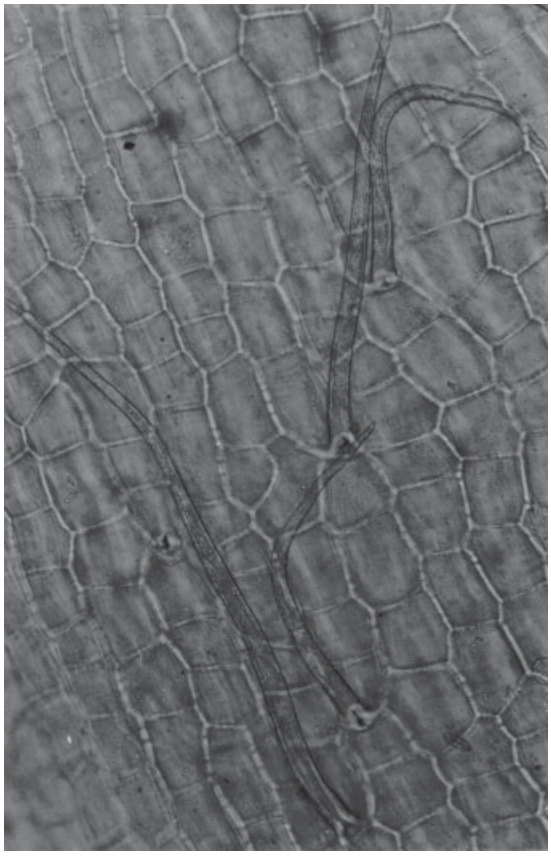

Fig. 4: Lower epidermis with covering trichomes (× 175)

Epidermis: It is made of a single layer of polygonal cells with a thick cuticle. The covering trichomes and rubiaceous stomata occur occasionally on it.
Cortex: Two regions can clearly be differentiated, outer zone and inner zone. The first one is composed of 5–7 layers of compacted thick walled rounded cells and the

Fig. 5: A glandular trichome at the edge of the leaf serration (× 280)

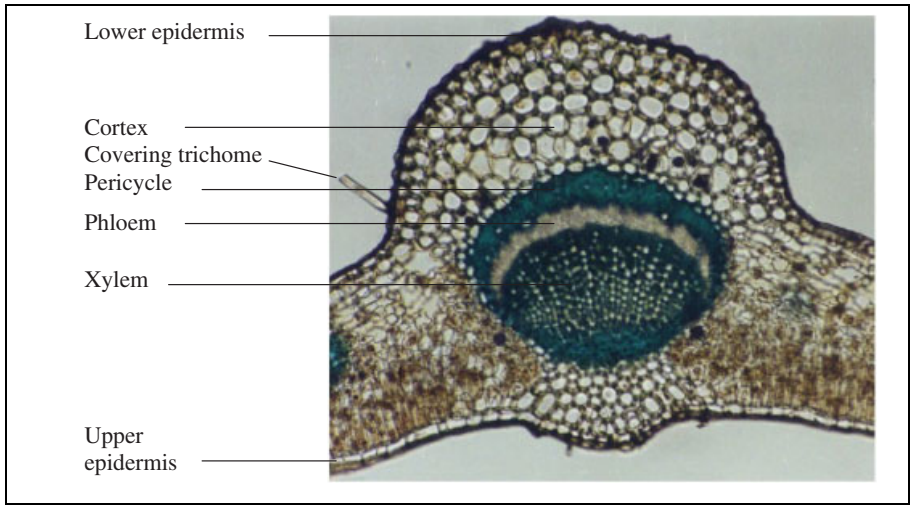

Fig. 6:
T. S. of the midrib (× 70)

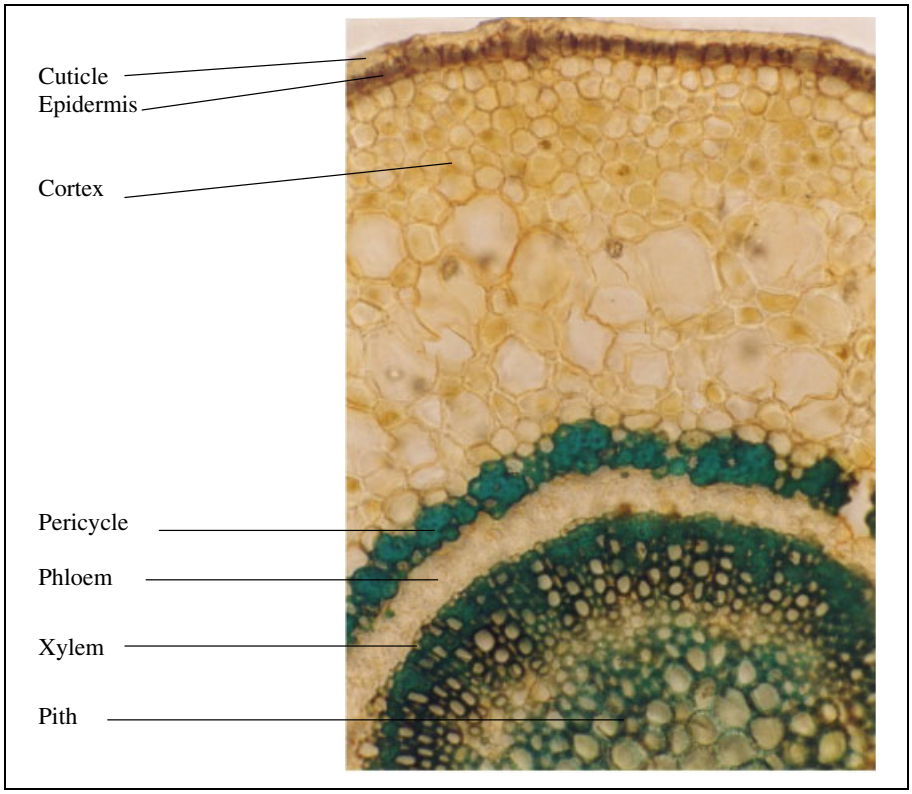

Fig. 7:
T. S. of the stem (× 175)

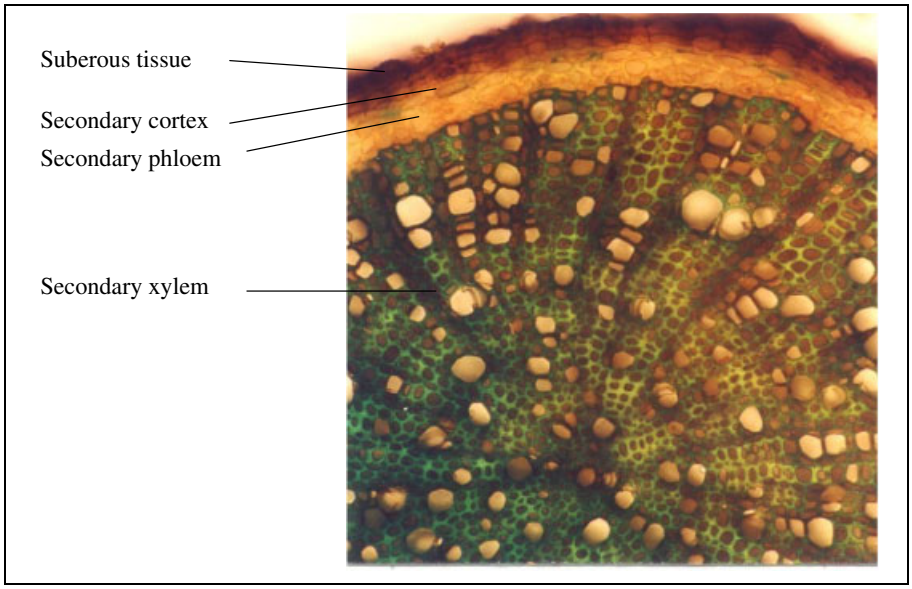

Fig. 8:
T. S. of the root (× 175)

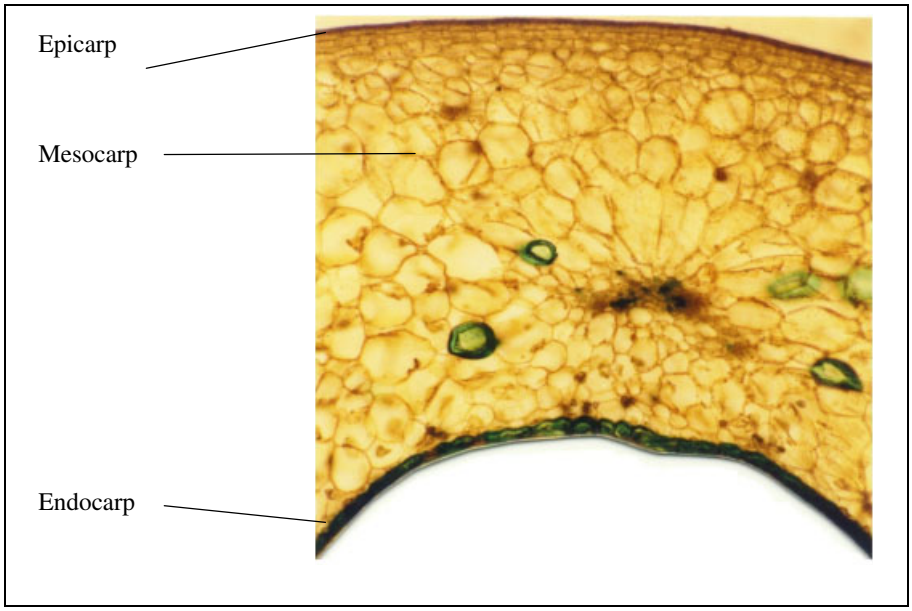

Fig. 9:
T. S. of the fruit (× 70)

second one is formed of several rows of parenchyma cells, which contains numerous cavities. The rosette Ca-oxalate crystals are found in a few cells.
Pericycle: It is well marked and consists of a more or less complete ring of a few layers of lignified fibers.
Vascular tissue: It is composed of a continuous cylinder, which is composed of phloem (externally), cambium and xylem (internally).
Pith: It is made of fairly large thick walled rounded cells. Some of cells are slightly lignified.

2.3. Root

The transverse section of the root shows secondary growth with the following characters (Fig. 8).
Cork: It is the outer layer of the root and formed of a few rows of suberized cells. Under the layer lies cork cambium.
Secondary cortex: It is narrow and composed of cortical parenchyma cells.
Vascular tissue: It forms a continuous cylinder and is made of secondary phloem, cambium and secondary xylem.

2.4. Fruit

The transverse section of the fruit reveals the following characters (Figs. 9–12).
Epicarp: It is formed of a single layer of polygonal cells. Rubiaceous stomata occur occasionally (Figs. 9, 10).
Mesocarp: It contains two different regions, outer part and inner part. The first one is composed of 2–3 layers of compacted thick walled rounded cells and the second one is made of several rows of large thin walled parenchyma cells. The sclerenchyma cells occur regularly in the inner parenchyma tissue. Also, the rosette Ca-oxalate crystals are found in a few parenchyma cells (Figs. 9, 11).
Endocarp: it consists of a single layer of sclerenchyma cells (Figs. 9, 12).

3. Experimental

3.1. Plant material

The different parts of *V. arctostaphylos* (leaf, stem, root and fruit) were collected from the forest region of Asalem in the North of Iran on August 2000. Voucher specimens have been deposited in the Herbarium of Pharmacognosy Department, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran (No. 6520 THE).

Fig. 10: Epicarp (× 175)

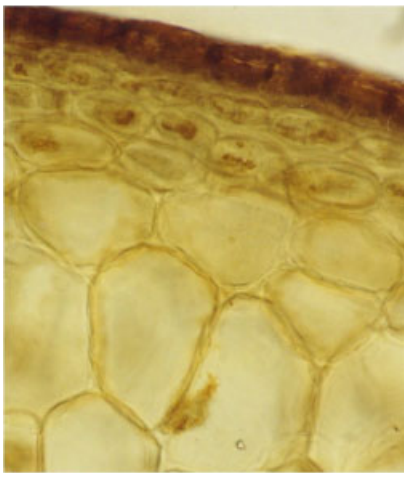

Fig. 11: Mesocarp (× 175)

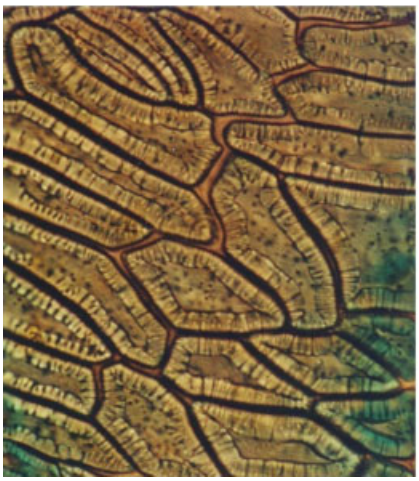

Fig. 12: Endocarp (× 175)

3.2. Histological methods

Anatomical studies were performed on the prepared transverse sections of the different organs of the plant according to usual methods [10]. The sections were studied and photographed by a Leitz optical microscope and a Leitz stereoscopic microscope.

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