

CONTRIBUTIONS TO THE KNOWLEDGE OF *VERONICA* *PERSICA* SPECIES ANATOMY

CONTRIBUȚII LA CUNOAȘTEREA ANATOMIEI SPECIEI *VERONICA* *PERSICA*

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Abstract: *Veronica persica* is one of the few *Veronica* species with solitary flowers and an abundant rooting at the level of the main stem nodes. The plant physiognomy is variable depending on the substrate on which develops, on exhibition and competition with other species. The lack of anatomy studies for this plant prompted us to study this aspect in order to contribute to a better knowledge of this plant.

Keywords: anatomy, *Veronica persica*, Romania.

Rezumat: *Veronica persica* este printre puținele specii de *Veronica* cu flori solitare la care se observă o înrădăcinare abundentă la nivelul nodurilor tulpinii principale. Fizionomia plantei este variabilă în funcție de substratul pe care se dezvoltă, de expoziție și concurența cu alte specii. Lipsa studiilor de anatomie la această plantă ne-a determinat să abordăm și acest aspect pentru a contribui la o cunoaștere cât mai bună a acestei plante.

Cuvinte cheie: anatomie, *Veronica persica*, Romania.

INTRODUCTION

Veronica genus is considered to be among the richest genera of the Romanian spontaneous flora (and elsewhere). In the Flora Europaea (Tutin et al. 1972) 62 species with many infraspecific taxa are presented and in the Romanian Flora - Vol VII - 41 species and 3 hybrids are presented (Ghișa, 1970). Recent works on the Romanian flora present 41 species, 13 subspecies and 2 varieties (Ciocârlan, 2009).

If data on the *Veronica* species morphology and chorology of the Romanian flora are found in many papers on flora and vegetation of a certain territory (Roman, 1976, Dihoru, 1979, Sirbu, 2003), data on their anatomy are totally sporadic (Răduțoiu, 2007, 2009).

In the Romanian literature the studied species is assigned to the *Scrophulariaceae* family; although the recent studies (Albach, 2004) based on phylogenetic analysis using DNA sequences assign it to the *Plantaginaceae*.

The objectives of this paper are: the evidence of some anatomical characters that help to an easier recognition of the species, illustration of essential characters through original photographs.

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MATERIAL AND METHOD

The first stage of the study was to perform numerous field trips in different locations of the country (Craiova, Păușești, Pietrari, Copăceni (VL), Alba Iulia, Bucharest, Cluj Napoca, Iași, Baia de Aramă (MH) in order to collect the study material.

The collected material was brought to the laboratory where it was preserved by pressing it in blotting paper or in liquid environment in a mixture formed of equal parts of absolute ethyl alcohol, glycerine and distilled water. It was harvested at flowering.

To complete the description of species and to highlight its structure, we performed cross-sections with anatomical razor through the roots, stems and leaves of the studied plants. The segments were cut at about the same level on the analyzed plants.

To study the leaf epidermis and epidermal productions we used the excoriation technique (tangential sections).

The microscopic sections were analyzed using a binocular microscope type Krüss (objectives 10, 20, 40), then photographed with a Nikon system.

The measurements were made at MC-3 microscope. 100 measurements and counts were made (epidermal cells, stomata). The maximum singular value (V_M), the minimum singular value (V_m) and the average value (\bar{X}) were considered that represent the arithmetic mean of the 100 singular values.

The identification of the plant material was made using the literature (Ghișa, 1960, Tutin et al., 1972, Ciocârlan, 2009).

The authors' abbreviations were made after Brummitt & Powell (1992).

RESULTS AND DISCUSSIONS

After analyzing the preserved material the following anatomical characters were observed:

The root has an obvious secondary structure in the central cylinder and has a thickness of 1170 μm (fig. 1).



Fig. 1 - Cross- section through the root of *Veronica persica* (Ob 10 x Oc. 10 - orig): 1. bark, 2. endoderm, 3. pericycle, 4. secondary bast 5. secondary xylem (wood).

The rizoderm is not obvious, and the bark is not differentiated in exoderm, cortical parenchyma and endoderm but is composed of three layers of large cells with strong colenchimatized walls. It has a thickness of 90 μm .

Between the bark and central cylinder there is a layer of small cells arranged orderly and with highly thickened walls. This layer is the endoderm because under it there is still a layer of larger cells which are arranged orderly representing the pericycle.

The secondary bast consists of numerous layers of cells arranged more or less ordered in radial rows. It has the thickness of 135 μm .

The cells of the bast have strongly thickened walls; those near the cambium have thinner walls.

The wood has a diameter of 585 μm and consists of wood vessels including the medullary rays in radial direction.

The wood vessels diameter is variable ($V_m = 15.75 \mu\text{m}$, $V_M = 40.50 \mu\text{m}$), and the mean is of $\bar{X} = 27.22 \mu\text{m}$.

The cambium is formed of several layers of rectangular cells, slightly elongated in the tangential direction.

There cannot be measured the Liberian vessels sizes because of the thickening of walls and the strict un-delimitation of cells.

The centre of the root is occupied by wood vessels and by wood parenchyma belonging to the primary xylem.

The central cylinder is very developed in relation to the bark, having a diameter of 882 μm .

The endoderm thickness is of 9 μm , and the pericycle is of 13.5 μm .

The stem has an obvious secondary structure in the central cylinder and an average thickness of 1998 μm . (fig. 2).

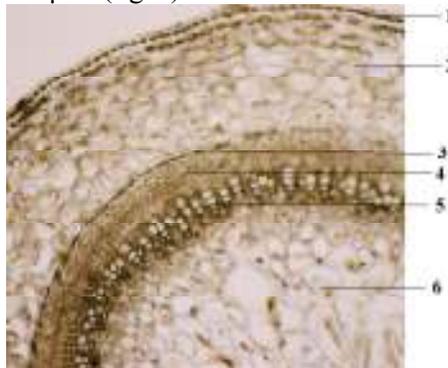


Fig. 2 - Cross- section through the stem of *Veronica persica* (Ob. 40 x Oc. 10 – orig.):
1.epidermis, 2. bark, 3. amiliphera sheath, 4. secondary bast, 5. secondary xylem, 6.
primary fundamental parenchyma.

The epidermis has only one layer and it has cells with strong cutinized walls and presents a thick outer cuticle of 4.5 μm .

The bark has several layers; it has a thickness of 283.5 μm , and is differentiated in an outer and inner bark and an amiliphera sheath (fig. 3).

The first cells layer of the outer bark has colenchimatized walls. The cells of this layer are arranged orderly, just below the epidermis. Under it there are cells that grow in size until the inner bark. The cells are ovoid, with spaces between them and with chloroplasts inside that give the green colour of the stem.

The inner bark is formed of large, ovoid cells, with spaces between them without inner chloroplasts and which decrease in size to the amiliphera sheath.

The amiliphera sheath has one layer, it has elongated cells in tangential direction which do not have spaces between them, and they have thin walls and contain reserve substances.

The central cylinder has an outer one- layered pericycle, composed of cells arranged orderly, smaller than the ones of the amiliphera sheath.



Fig. 3 - Epidermis, bark and a part of the central cylinder of the stem of *Veronica persica* (Ob. 40 x Oc. 10 – orig.)

The bast and wood are arranged as two concentric circles uninterrupted. It is difficult to distinguish between the secondary elements of the phloem and xylem.

The cambium is composed of two layers of rectangular cells, located between the bast and the wood fibres. The wood fibres and vessels are arranged orderly in radial rows.

The wood vessels decrease in diameter in centripetal direction (Fig. 4), and between them and the cambium there are wood fibres. Under the wood vessels there are smaller cells arranged in several layers, unordered, that belonged to the primary fundamental parenchyma.



Fig. 4 - Segment of central cylinder with bast and secondary xylem of the stem of *Veronica persica* (Ob 40 x Oc. 10 – orig.)

The centre of the stem is occupied by the medullar parenchyma, composed of heterodiametrics, large cells with spaces between them and without inner reserve substances.

The leaf has a bifacial structure and a thickness of 270 μm .

The superior epidermis (adaxial) has one layer, with a thick cuticle of 3.38 μm . The epidermal cells length is of: $V_m = 85.50 \mu\text{m}$, $V_M = 157.50 \mu\text{m}$, $\bar{X} = 118.35 \mu\text{m}$ and the width of $V_m = 40.50 \mu\text{m}$, $V_M = 99 \mu\text{m}$, $\bar{X} = 63.90 \mu\text{m}$. The stomata have lengths ranging from: $V_m = 29.25 \mu\text{m}$, $V_M = 31.50 \mu\text{m}$, $\bar{X} = 30.60 \mu\text{m}$. Their average density is 0.0942 stomata / mm^2 .

The epidermis between veins has cells with strong sinuous walls and with visible simple punctuations (fig. 5). The epidermal cells have walls almost straight near the median vein (fig. 6). The simple punctuations on walls can be also seen in this area.

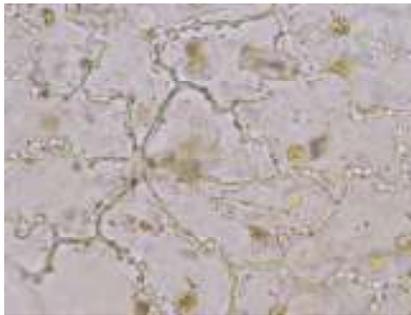


Fig. 5 - The superior epidermis between veins at the leaf of *Veronica persica* (Ob. 40 x Oc. 10 – orig.)

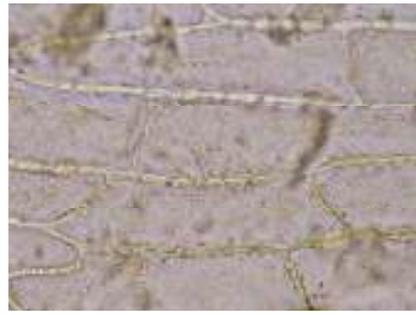


Fig. 6 - The superior epidermis near the median vein of *Veronica persica* (Ob. 40 x Oc. 10 – orig.)

The palisade parenchyma consists of 2-3 layers of radially elongated cells and has a thickness of 112.5 μm .

The lacunar parenchyma is composed of ovoid or elongated cells in the tangential direction, with large intercellular spaces; it has a thickness of 78.75 μm .

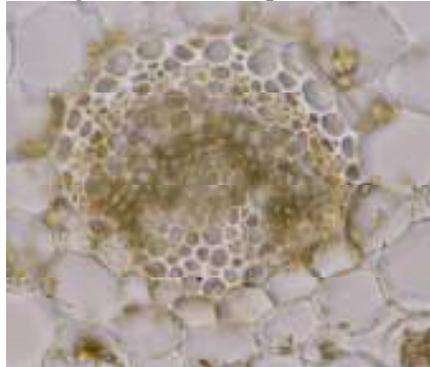


Fig. 7 - Detail on the conductor beam of the leaf of *Veronica persica* (Ob. 40 x Oc. 10 – orig.)

The abaxial epidermis cells have different dimensions (length: $V_m = 65.25 \mu\text{m}$, $V_M = 112.50 \mu\text{m}$, $\bar{X} = 89.32 \mu\text{m}$ and width: $V_m = 27 \mu\text{m}$, $V_M = 54 \mu\text{m}$, $\bar{X} = 41.62 \mu\text{m}$) and has a thick outer cuticle of $2.25 \mu\text{m}$. The wood bast conductor beam from the median vein is of open collateral type, it has the wood and the bast arranged in a crescent form that extend until the endoderm. Above the wood and bast there are several layers of cells with sclerenchimatized walls (fig. 7).

CONCLUSIONS

From the analysis of the studied material we draw some conclusions:

- it is an annual species of the *Veronica* genus with the highest values of the average thickness of the root and stem;
- unlike *Veronica filiformis* with which can be mistaken at first sight, it distinguishes by high values in all structures of the vegetative and sometimes reproductive organs (i.e. *Veronica persica* capsule may be of 7-10 mm while that of *Veronica filiformis* is of 4-5 mm);
- although this is an annual species there can be noticed an obvious secondary structure in the central cylinder of the root and stem.
- the knowledge of the vegetative organs structure of this species allows to take effective measures to control it, knowing that this plant is a weed common in hoed crops (especially during spring), which together with other species form some specific associations in these places.

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