

MORPHO-ANATOMICAL CONSIDERATIONS UPON THE SHOOT OF SOME *ROSA* L. CULTIVARS FROM THE BOTANIC GARDEN OF IASI (1ST NOTE)

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Abstract. The paper presents the results of a comparative study regarding shoot morphology and anatomy of two climbing rose cultivars from the Botanic Garden of Iasi: ‘*Paul’s Scarlet Climber*’ and ‘*Veichenblau*’.

Key words: *Rosa* cultivars, morpho-anatomy, shoot

Introduction

The presence of the rose collection in the Rosarium Section of the Botanic Garden, which contains more than 600 rose cultivars and over 20 rose species [FINCIUC CARMEN & MITITIUC M., 2002] let us carry out some complex morphological and anatomical observations, in order to explain the behavior (acclimatization) of those cultivars in the Rosarium Section.

The main structure characteristics of the species which belong to *Rosaceae* family are presented in numerous synthesis regarding dicotyledons anatomy or angiosperms anatomy [METCALFE C. R. & CHALK L., 1950; MORVILLEZ M. F., 1919; SOLEREDER H., 1899]. In Romania there were made less histo-anatomic studies with taxonomic importance, useful to make differences between closed taxa, as an appendix to the morphologic studies [ADUMITRESEI LIDIA & TĂNĂSESCU VIOLETA, 2005; ADUMITRESEI LIDIA & al., 2006; ADUMITRESEI LIDIA & al., 2005, TOMA C. & al., 1997; TOMA C. & RUGINĂ RODICA, 1998; ZAMFIRACHE MARIA-MAGDALENA & al., 2006].

The paper ekes out the morphological observations in two *Rosa* infraspecific taxa with some anatomic observations upon the shoot, which can better explain some biologic qualities of the taxa, in order to find better culture measures, to evidence their ornamental value..

Material and methods

The paper is focused on two once-flowering rose cultivars, a climbing rose: ‘*Paul’s Scarlet Climber*’ (Fig. 1) and a rambling rose: ‘*Veichenblau*’ (Fig. 2).

In order to carry out the histological analysis, the vegetal material represented by the shoot, has been fixed and preserved in 70% ethylic alcohol on May, 6th, 2009 and processed upon the methods used in vegetal anatomy studies. The cross sections through the middle region of root, rachis and foliar limb were analyzed in a Novex-Holland light microscope. The light micrographs were performed using a Sony DSC-W5/W7/W15/W17 camera. More than that, the epidermis of the foliar limb has been analyzed in front side view.

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Results and discussions

Morphologic dates

'Paul's Scarlet Climber' (Fig. 1)

Author: Paul, W., 1916. Climber, once-flowering. Long branches, above 300 cm; glossy, dark green leaves. Involte big flowers, with dark red petals, weak perfumed. Resistant to diseases and frost. It lends to balconies, pyramids, pergolas.

'Veichenblau' (Fig. 2)

Author: Schmidt, Germany, 1909. Rambler, once-flowering. Long branches, above 400 cm, almost devoid of spines; glossy, dark green leaves. Small, semi-involte flowers, grouped in big clusters; mauve petals, white stripped, with strong fragrance.

Although is old and once-flowering, this cultivar is still in culture due to its ornamental qualities.

Histo-anatomic dates

The shoot (Fig. 3)

'Paul's Scarlet Climber'

The cross section has a circular shape. The epidermis bears cells with thickened and strong cutinized external wall; the cuticle goes deeply through the epidermic cells, till the subepidermic layer. Stomata, less numerous, are situated under the level of the surrounding epidermic cells.

The cortex is quite thick (12-13 layers of cells) and collenchymatized (4-5 layers of cells) in the external part. Some of the cells belonging to the central part or to the external part of the cortex contain simple calcium oxalate crystals, rarely ursines.

The conductive tissues are represented by numerous vascular bundles disposed on a ring, separated by narrow medullar rays. The phloem consists of sieved tubes, guard cells and a few parenchymatic cells. The xylem consists of vessels disposed on radial rays, separated by lignified parenchyma near the pith, and of lignified parenchyma and libriform near the phloem. At the periphery of the bundles, a thick sheath of sclerenchymatic fibers is present, with thick walls, strongly lignified and reduced lumina.

Pith is parenchymatic, formed by two categories of cells: some of them are very small and other very big, both having thickened and lignified walls, framing a characteristic network (Fig. 3); the cells with oxalate crystals are absent.

'Veichenblau' (Fig. 4)

The epidermis bears cells with thickened and cutinized external wall; the cuticle goes partially through the epidermic cells, on a smaller superficies than in the other cultivar. Here and there, stomata are present, situated under the level of the surrounding epidermic cells.

The cortex is thick (14-15 layers of cells) and collenchimatized in its external part; the collenchyma consists of 5-6 layers, grouped as poles (Fig. 4); some of the cells of the cortex contain simple oxalate crystals. The oxalate crystals are more numerous than in the other studied species (Fig. 5).

The conductive tissues form numerous vascular bundles disposed on a ring and separated by narrow medullar rays. The oxalate crystals are present in the phloemic parenchymatic rays, but are extremely rare. Phloem consists of sieved tubes, guard cells and parenchymatic cells. The xylem presents vessels disposed on radial layers, separated by cellulosed parenchyma near the medulla and lignified parenchyma and libriform near the

phloem. At the periphery of the phloem belonging to all vascular bundles there is a sheath of sclerenchymatic fibers with lignification in progress (Fig. 4).

Pith is parenchymatic-cellulosed with both big and small cells which contain few simple oxalate crystals or ursines (Fig. 6) and form a characteristic network.

The leaf

'Paul's Scarlet Climber'

The rachis (Fig. 7-9)

The cross section has a circular shape, with a deep adaxial groove and two ribs. The angular subepidermic collenchyma, almost continuous, consists of 2-3 layers. The cells with oxalate crystals are absent. The conductive tissues form 4 vascular bundles: one of them is very big, in the center, two of them are small, lateral bundles, and the fourth appear in one of the two ribs. Sometimes, the fifth bundle can be observed, very small, consisting only of xylem (Fig. 7). The periphloemic sclerenchyma is well developed, formed by cells with thickened walls (Fig. 8). Around each vascular bundle, near the periphloemic sclerenchyma, the cells belonging to the fundamental parenchyma have thickened and lignified walls (Fig. 9).

At the adaxial face, in the groove and in its lateral parts, going to the abaxial face (where the collenchyma is present) there are numerous cells with lignified walls, grouped or isolated.

The foliar limb

The epidermis, in front side view, is formed by numerous cells of irregular shape, with waved lateral walls (in the upper epidermis) or moderately to strongly waved lateral walls (in the lower epidermis). Anomocytic stomata are numerous; they are present only in the lower epidermis, so the foliar limb is hypostomatic. Along the veins, by transparency, a few cells with simple oxalate crystals or ursines are present in the upper epidermis and numerous in the lower epidermis. Protective hairs are absent.

In cross section, the middle vein is prominent at the abaxial face. The protective hairs and the crystalliferous cells are absent. The collenchyma of the middle vein consists of only 2 layers. The periphloemic sclerenchyma forms a continuous cordon, bearing cells with thickened walls and narrow lumina. Both epidermis (Fig. 10), but especially the upper one, display big cells, with the external wall strongly thickened and covered by a thin cuticle.

The mesophyll (Fig. 10) consists of bilayered palisade tissue (trilayered in some regions) and lax lacunary tissue, with wide aeriferous spaces. The structure of the foliar limb is difacial-heterofacial with normal dorsiventrality.

'Veichenblau'

The rachis (Figs. 11 and 15)

The cross section of the rachis has an elliptic shape; the abaxial face has a sinuous contour (with ribs and delves), while the adaxial face presents two high ribs and a deep groove, in form of W (in comparison with the anterior studied species).

In both abaxial and adaxial faces, the epidermis presents unicellular protective hairs (Fig. 11). The mechanic tissues: the collenchyma (3-4 layers of cells- Figs. 11 and 12) and the perifascicular sclerenchyma are well represented; in the sclerenchyma, the cells have thick walls (the lignification is in progress) and reduced lumina (Figs. 14 and 15).

The crystalliferous cells are quite rare, presented only in the adaxial face. The vascular tissue consists of 6 vascular bundles: 3 of them are disposed on a big arch; other 2-3 are present on each lateral part (Fig. 11).

The foliar limb

In front side view, the epidermis (Fig. 17) presents cells of polygonal profile, with moderately waved lateral walls (in the upper epidermis) and of irregular shape with moderately to strong waved lateral walls (in the lower epidermis). Anomocytic and tetracytic stomata are present, uniform spread in the lower epidermis, so the limb is hypostomatic. Here and there a few groups of stomata are present in the axils of the veins (Fig. 17b). In the epidermis of the veins, unicellular protective hairs are present, with thick walls and reduced lumina. They are rare in the upper epidermis and numerous in the lower epidermis.

Calcium oxalate, as macles and ursines, in quite equal proportions, is weak represented in the upper epidermis and more numerous in the lower epidermis.

In cross section through the foliole (Fig. 18), the median vein is prominent at the lower epidermis. Both epidermis consists of isodiametric cells, 3-4 layers of collenchyma in hypodermic position, a fundamental parenchyma with a few cells containing simple oxalate crystals or ursines, a vascular bundle with primary structure and a sheath of sclerenchymatic fibers with cellulosed walls. The epidermis of the middle vein as well as the epidermis of the lateral regions present small and medium protective hairs, with thick wall and reduced lumina.

Both epidermis, but especially the upper one, bear big cells, tangentially elongated, with the external wall thicker than the others; some of the cells present division walls, which is a characteristic of the *Rosaceae* family. The mesophyll is differentiated in bilayered palisade tissue (Fig. 18) towards the upper epidermis and lacunary tissue (3 layers of cells), more compact, towards the lower epidermis, so the foliar limb has a bifacial structure, with normal dorsiventrality. The crystalliferous cells are absent.

Conclusions

The epidermic cells of the stem have thickened and strong cutinized external walls; the cuticle goes deeply through the epidermic cells, to the hypodermic layer (*'Paul's Scarlet Climber'*) or partially (*'Veichenblau'*). The cortex has various thickness (12-13 layers in *'Paul's Scarlet Climber'* or 14-15 in *'Veichenblau'*), collenchymatized in the external part (continuous collenchyma in *'Paul's Scarlet Climber'* and discontinuous in *'Veichenblau'*) and presents cells with oxalate crystals. The presence of calcium oxalate indicates the adaptability of the studied taxa in the conditions of the Botanic Garden, in conformity with researches in other taxa [5].

The classification of the two taxa in climbing and rambling roses is testified by the structure of the mechanic tissues, especially by the better developed sclerenchyma in *'Paul's Scarlet Climber'* than in *'Veichenblau'*, as well as by the structure of the pith, as a network, with lignification tendencies in *'Paul's Scarlet Climber'* regards *'Veichenblau'* where is still cellulosed. Those aspects justify the necessity of using props in order to sustain the stem of *'Veichenblau'* and even of *'Paul's Scarlet Climber'* (later).

In the rachis of the leaf numerous vascular bundles are present: 4-5 in *'Paul's Scarlet Climber'* and 5-6 in *'Veichenblau'*; the periphloemic sclerenchyma is lignified in *'Paul's Scarlet Climber'* and still in progress in *'Veichenblau'*. The differences are made by the profile, too, as well as by the presence of some groups of cells with lignified walls in the fundamental parenchyma of the rachis of *'Paul's Scarlet Climber'* which play a supplementary role in the climbing process.

Regarding the folioles, the epidermic cells display irregular shape; the protective hairs are present only in 'Veichenblau', while the oxalate crystals are present in both studied cultivars; stomata are anomocytic, exception in 'Veichenblau' where tetracytic stomata are present, too; those aspects can explain the hybrid origin of the cultivar. The mesophyll is bilayered in 'Veichenblau' and trilayered in 'Paul's Scarlet Climber'.

References

- ADUMITRESEI LIDIA & TĂNĂSESCU VIOLETA. 2005. Studii histo-anatomice asupra lăstarului anual la *Rosa glauca* Pourr., *Lucr. Ști., Ser. Agron.* **48**, published on CD (5 pg.).
- ADUMITRESEI LIDIA, TOMA C. & TĂNĂSESCU VIOLETA. 2006. Observații histo-anatomice asupra lăstarului anual la *Rosa canina* L. 'Inermis', *Lucr. Ști., Ser. Agron.* **49(2)**: 519-524.
- ADUMITRESEI LIDIA, TOMA C. & TĂNĂSESCU VIOLETA. 2005. Studii morfo-anatomice asupra lăstarului unor soiuri înrudite de trandafir, *Simpoz. Ști. Anual – Horticultura - știință, calitate, diversitate și armonie*, Fac. Hort., Univ. Agron. Med. Vet. Iași, sect. I, **48**: 567-572.
- FINCIUC CARMEN & MITITIUC M. 2002. Observații fenologice privind comportamentul unor soiuri de trandafiri din colecția de Roze de la Grădina Botanică Iași, *Bul. Grăd. Bot. Iași*, **11**: 195-204.
- FLORIA VIOLETA. 1998. Cercetări de morfo-biometrie și histo-anatomie ontogenetică, comparată și experimentală la diferite specii și soiuri de pomi fructiferi din familia *Rosaceae*. *Teză de doctorat*, Univ. „Alexandru Ioan Cuza” Iași, Fac. Biol., 365 pp.
- KRUSSMANN G.. 1986. *Rosen, Rosen, Rosen: unser Wissen über die Rose*. (2. Aufl.), Berlin und Hamburg: Paul Parey Verlag.
- METCALFE C. R. & CHALK L. 1950. *Anatomy of the Dicotyledons (Rosaceae, 1: 539-553)*, Oxford: Clarendon Press.
- MORVILLEZ M. F. 1919. Recherches sur l'appareil conducteur foliaire des *Rosacées*, des *Chrysobalanées* et des *Légumineuses*. *Thèse*, Paris.
- SOLEREDER H. 1899. *Systematische Anatomie der Dicotyledonen*. Stuttgart: Fr. Enke Verlag.
- TOMA C. & GOSTIN IRINA. 2000. *Histologie vegetală*, Iași: Edit. Junimea.
- TOMA C., NIȚĂ MIHAELA, ZAMFIRACHE MARIA-MAGDALENA, AIFTIMIE ANCA, MATEI SORINA & CĂLDĂRUȘ LIDIA. 1997. Contribuții la cunoașterea lăstarului de 1 an de la unele specii de *Rosa* L., *Lucr. Ști., Ser. Hort.*, **40**: 335-341.
- TOMA C. & RUGINĂ RODICA. 1998. *Anatomia plantelor medicinale. Atlas*. București: Edit. Acad. Române, pp. 238 – 240.
- ZAMFIRACHE MARIA-MAGDALENA, TOMA C., BURZO I., ADUMITRESEI LIDIA, TOMA IRINA, OLTEANU ZENOVIA, MIHĂIESCU D., TĂNĂSESCU VIOLETA, APETREI R. I. & SURDU ȘT. 2006. Morphological, anatomical, biochemical and physiological researches upon taxa of *Rosa* genus cultivated in Iasi Botanical Garden (2nd note), 4th Conference on Medicinal and Aromatic Plants of South - East European Countries, Iași – România, 28th – 31st of May, pp. 11.

Explanation of plates

PLATE I

'Paul's Scarlet Climber' (Fig. 1)

'Veichenblau' (Fig. 2)

Cross section through the shoot of 'Paul's Scarlet Climber' (Fig. 2), 'Veichenblau' (Fig. 3);

Cross section through the shoot of 'Veichenblau' (Figs. 5 and 6);

PLATE II

'Paul's Scarlet Climber': Cross section through the rachis (Figs. 7-9), cross section through the foliar limb (Fig. 10);

Cross section through the rachis of 'Veichenblau' (Figs. 11 and 12);

PLATE III

Cross section through the rachis of 'Veichenblau' (Figs. 13-15);

'Paul's Scarlet Climber' – epidermis in front side view: upper (a) and lower (b) epidermis (Fig. 16);

'Veichenblau' – epidermis in front side view: upper (a) and lower (b) epidermis (Fig. 17);

'Veichenblau' – Cross section through the foliar limb (Fig. 18);

Bar = 100 μm

PLATE I



Fig. 1



Fig. 2

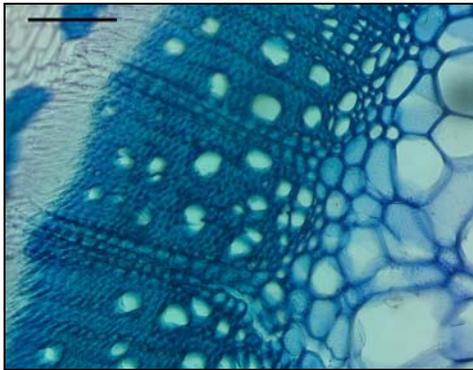


Fig. 3



Fig. 4

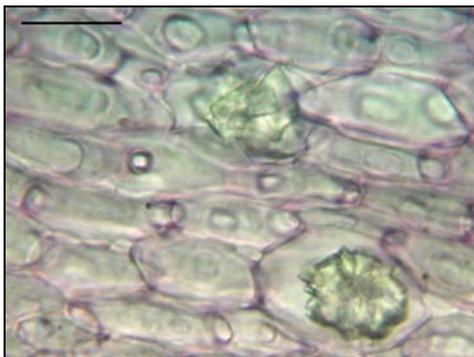


Fig. 5

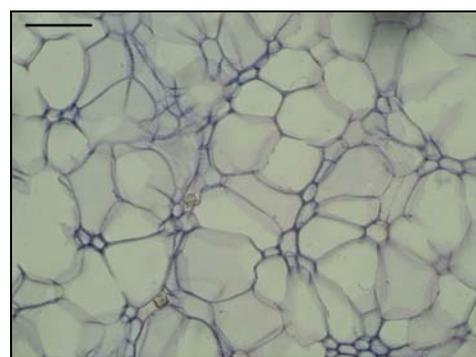


Fig. 6

PLATE II

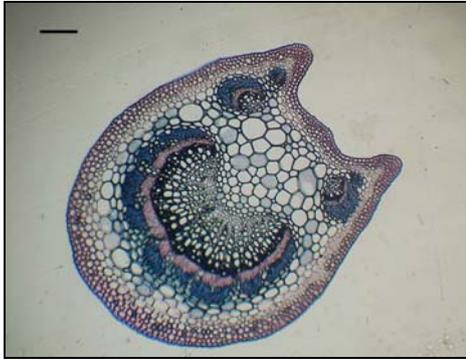


Fig. 7

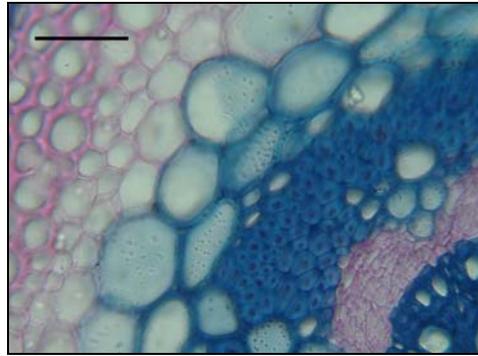


Fig. 8

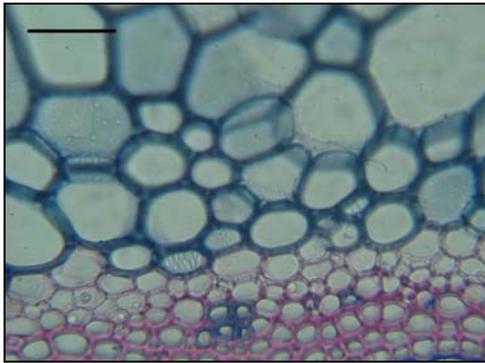


Fig. 9



Fig. 10



Fig. 11

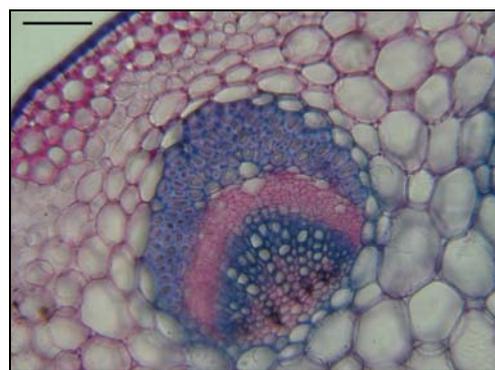


Fig. 12

PLATE III

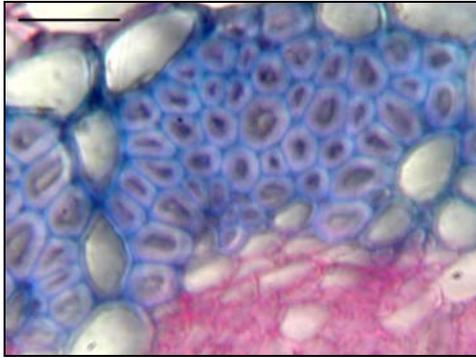


Fig. 13



Fig. 14

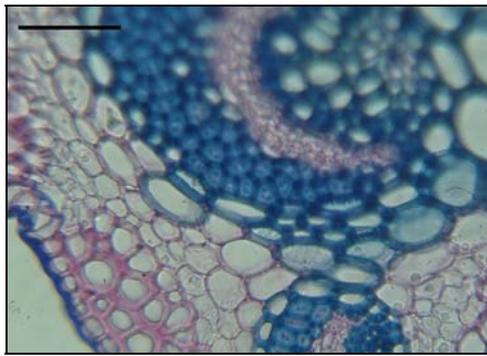


Fig. 15

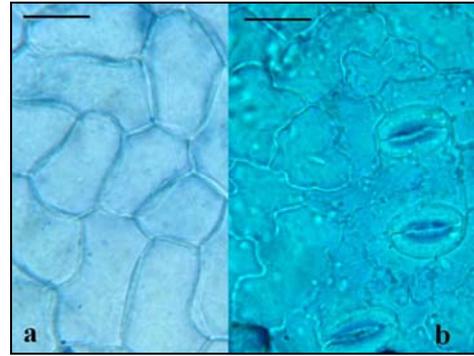


Fig. 16

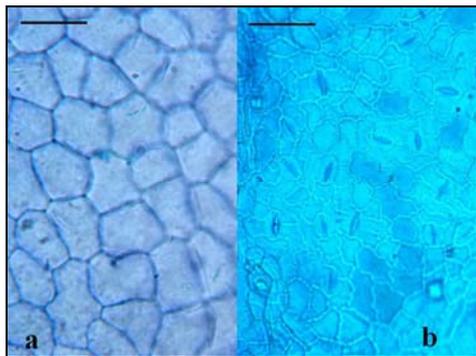


Fig. 17

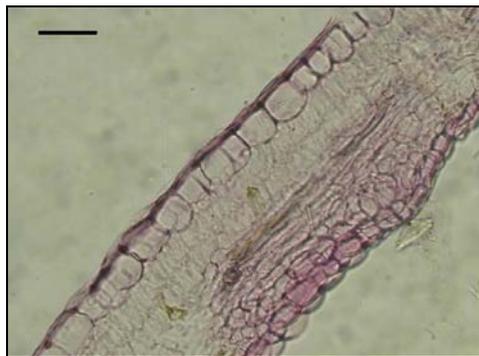


Fig. 18