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## THE ANATOMICAL STUDY OF *SORBUS AUCUPARIA* AND *SORBUS DOMESTICA* LEAVES

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**Key words:** *European rowan (Sorbus aucuparia L.); service tree (Sorbus domestica L.); anatomical study*

*European rowan (Sorbus aucuparia L.) and service tree (Sorbus domestica L.) are trees or shrubs of the Rose family (Rosaceae). The fruits of these plants have been studied most of all. The purpose of our research was to determine anatomical and diagnostic features of European rowan and service tree leaves, which were harvested in May 2012 in the Botanical Garden of Kharkiv National University named after V.N.Karazin. The preparation and research of microslides were conducted by the pharmacopoeian method. Diagnostic microscopic features of the raw material were fixed using a "Granum" microscope with magnification of  $\times 40$ ,  $\times 100$ ,  $\times 400$  times. Photographs were made with a Sony DSC-W80 camera. As a result of the research the following common anatomical and diagnostic features of the leaves of European rowan and service tree have been found: the leaf blade is hypostomatic; simple unicellular filiform trichomes are located on both sides of the leaf blade; the leaf is of the dorsoventral type; the palisade parenchyma has one-, two-layer; in the rachis there is one central collateral bundle and 4 small lateral bundles, in the basal part of the petiole there are 3 large and 2 small bundles of the collateral type. The distinctive anatomical and diagnostic characteristics of the raw material studied have been determined: in service tree at the edge of the leaf blade on the teeth there are multicellular glands with the brown content, which often fall off; on the lower epidermis of the leaf blade of European rowan simple trichomes with the brown content are rarely found; the cells of the upper epidermis of the service tree leaf are round-winding, sometimes with bulges, in European rowan they are straight-rounded.*

Among the large number of native and introduced woody fruit plants the plants of the Rowan genus (*Sorbus L.*), the apple subfamily (*Maloideae Focke*), the Rose family (*Rosaceae Juss.*) are of special interest in scientific and historical sense. The *Sorbus* genus was formally established by Carl Linnaeus according to the literature data. This genus appeared in 1735 in his book *Systema Naturae*. C. Linnaeus distinguished a separate genus of *Sorbus* based on two types, namely *Sorbus aucuparia* and *Sorbus domestica*. Nowadays the *Sorbus* genus comprises 50 (by some data about 80) species, hybrids and forms. The results of studying the rowans species composition from the flora of Ukraine testify that the *Sorbus L.* genus is presented by two native and 35 species introduced in culture (according to species system by E.C.Gabrielyan). The natural habitats of European rowan (*Sorbus aucuparia L.*) are the European part of the former USSR, the Crimea, the Caucasus, Eastern Europe, Asia Minor, South Africa; service tree (*Sorbus domestica L.*) grows in the Crimea, the south of Western Europe, the Mediterranean [3-5, 9].

The aim of our research was to determine anatomical and diagnostic features of European rowan and service tree leaves, which will be used for standardization of the plant raw material.

### Materials and Methods

For anatomical study leaves of European rowan and service tree were used. They were harvested in May 2012 in the Botanical Garden of Kharkiv National Uni-

versity named after V.N.Karazin. The preparation and research of microslides were conducted by the conventional methods [1, 2, 6-8, 10]. For microscopic study the plant raw material fixed in the mixture of glycerol-ethanol-water (1:1:1), and the air-dry raw material boiled for clearing in 3-5% aqueous solution of caustic alkali for 2-3 minutes avoiding the excessive softening were used. After boiling the material was washed 2-3 times with distilled water and the drug was prepared from the leaf surface in chloral hydrate solution. Diagnostic microscopic features were fixed using a "Granum" microscope with magnification of  $\times 40$ ,  $\times 100$ ,  $\times 400$  times. Photographs were made with a Sony DSC-W80 camera.

### Results and Discussion

The cells of the upper epidermis of a service tree leaf are round-winding, sometimes with bulges, and European rowan has the straight-rounded ones. The leaf cuticle of both rowan species is plicate, stomata are absent. There are simple unicellular trichomes with incrassate walls on the plate. Rosettes are formed around trichomes from 6 epidermal cells (Fig. 1). Cells of the epidermis are above veins with straight walls and they are smaller than other cells of the upper epidermis. Service tree has teeth of multicellular glands with the brown content, which often fall off at the edge of the leaf blade (Fig. 2). The lower epidermis of the leaf blade of both types of rowans is represented by cells smaller in size than cells from the upper epidermis and have slightly sinuous walls. Stomata are of the anomocytic type. The cuticle is wrin-

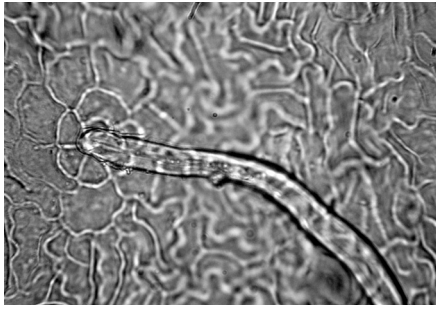


Fig. 1. The rosette around trichome on the upper epidermis of the leaf blade of service tree.

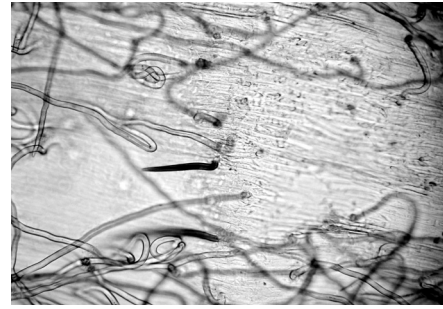


Fig. 4. Simple trichomes on the lower epidermis of the leaf blade of European rowan.

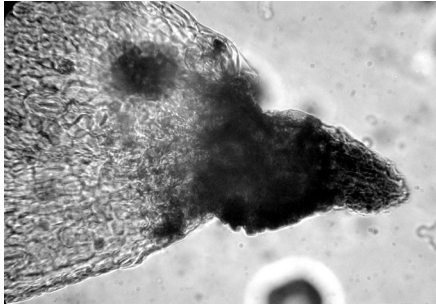


Fig. 2. Glands at the edge of the leaf blade of service tree.

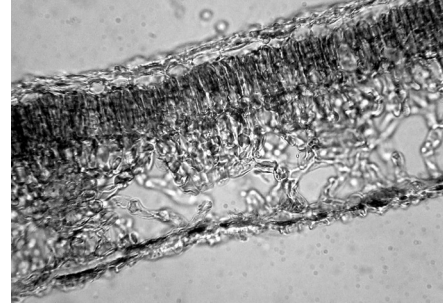


Fig. 5. A transversal cut of the leaf blade of service tree.

kled (Fig. 3). There are many simple unicellular, filiform, curved as loop trichomes, some simple trichomes of European rowan have the brown content (Fig. 4).

The leaf blade of European rowan and service tree is dorsoventral, hypostomatic. The palisade parenchyma is one-, two-layered, the spongy parenchyma has 3-4 layers with large intercellular spaces (Fig. 5). Central and lateral veins are surrounded by calcium oxalate crystals. Crystals are of different sizes, prismatic and cubic shapes. The conducting bundle is of the collateral type. From the side of the phloem the sclerenchyma is well developed, above the xylem there is also an area of the sclerenchyma.

Epidermal cells of rachis and petiole of fibrous tissue are elongated along the axis. Stomata are of the anomocytic type. In the mesophyll cells there are plenty of calcium oxalate crystals of various sizes, sometimes they are arranged in rows. There are also simple filiform trichomes curved as a loop. The structure of the rachis and petiole in length changes equally in both types of rowans. Cross-sections of the petiole in the basal and middle parts are different in shape, size and number of vascular bundles. The petiole of service tree has the triangular falciform shape in the basal part and in Euro-

pean rowan it is of a rounded shape with 5 vascular bundles (3 large and 2 small) (Fig. 6); in the middle part it is rounded with a shallow notch from the adaxial side. Vascular bundles are covered by the xylem toward the centre. Under the epidermis 4-5 layered collenchyme is located. The sclerenchyma is developed by individual areas above bundles from the side of the phloem. There are druses and crystals of calcium oxalate in parenchyma cells. Some parenchyma cells are with the brown content. In the middle part the petiole takes a rounded shape, 2 lateral bundles meet with the central bundle, and 2 others are located lower (Fig. 7). Closer to the place of growth of leaves the petiole of service tree has oval three-cornered shape, in European rowan it is of a rounded shape with small tubercles from the adaxial side (Fig. 8). The areas of the sclerenchyma are well developed; they form almost a continuous ring. The pith is presented by parenchyma cells, which are slightly sclerified. The upper part of the petiole has one large central vascular bundle and 4 small lateral bundles (Fig. 8). At the upper part the rachis has a rounded shape with a groove from the adaxial side. Under the epidermis there is a two-layer collenchyma. In the centre a collateral bundle is located and there are two small

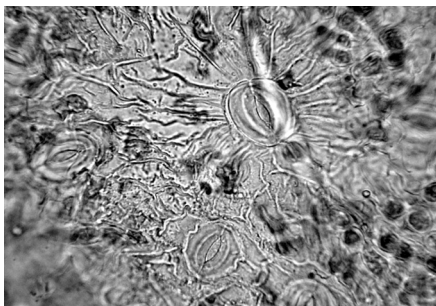


Fig. 3. Stomata on the lower epidermis of the leaf blade of service tree.

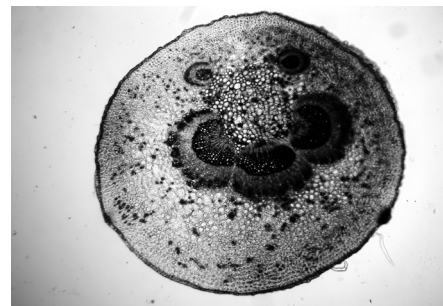


Fig. 6. A transversal cut of the basal part of the leaf petiole of European rowan.

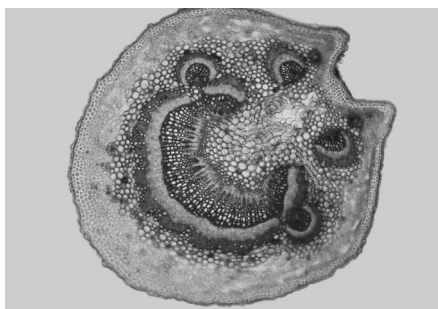


Fig. 7. A transversal cut of the middle part of the leaf petiole of European rowan.

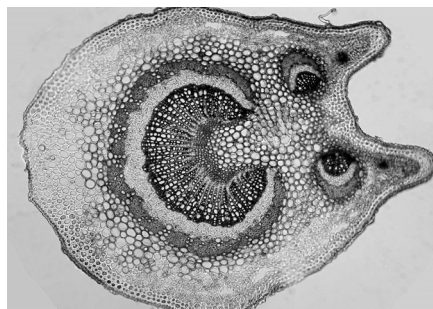


Fig. 8. A transversal cut of the upper part of the leaf petiole of European rowan.

bundles on both sides from the groove. The sclerenchyma is well developed. In the lower, middle and upper parts of the rachis in the subepidermal layers of the parenchyma there are many cells with the brown content. On the cross-section cut the petiolute of the leaf has a rounded-oval shape with a small furrow. There is one central vascular bundle of the collateral type. The sclerenchyma is developed unevenly in separate areas. Parenchyma cells contain crystals of calcium oxalate, individual cells include the brown content. The subepidermal collenchyma is the 3-layered one.

#### CONCLUSIONS

1. As a result of the research conducted the following general anatomical and diagnostic features of the leaves of European rowan and service tree have been determined. The leaf blade is hypostomatic (stomata are situated only on the lower side of the leaf); simple unicellular filiform trichomes are located on both sides of the leaf blade; the leaf is of the dorsoventral type; the

palisade parenchyma is one-, two-layered; in the rachis there is one central collateral bundle and 4 small lateral bundles; in the basal part of the petiole there are 3 large and 2 small bundles of the collateral type.

2. The distinctive anatomical and diagnostic characteristics of the raw material studied have been revealed: in service tree at the edge of the leaf blade on the teeth the multicellular glands with the brown content, which often fall off, are observed; simple trichomes with the brown content are rarely found on the lower epidermis of the leaf blade of European rowan; the cells of the upper epidermis of the service tree leaf are round-winding, sometimes with bulges, and European rowan has the straight-rounded ones. Two species of rowans also differ by the form of petioles.

3. Leaves of European rowan and service tree are the prospective raw material for further pharmacognostical study.

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#### АНАТОМІЧНЕ ВИВЧЕННЯ ЛИСТЯ *SORBUS AUCUPARIA* ТА *SORBUS DOMESTICA*

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**Ключові слова:** горобина звичайна (*Sorbus aucuparia* L.); горобина домашня (*Sorbus domestica* L.); анатомічне вивчення

Горобина звичайна (*Sorbus aucuparia* L.) та горобина домашня (*Sorbus domestica* L.) – дерева або кущі з родини розові (*Rosaceae* Juss.). Найкраще вивчені плоди цих рослин. Метою нашого дослідження було встановлення анатомо-діагностичних ознак листя горобини звичайної та

горобини домашньої, які заготовляли у травні 2012 р. у Ботанічному саду Харківського національного університету ім. В.Н.Каразіна. Виготовлення та дослідження мікропрепаратів проводили за фармакопейною методикою. Діагностичні мікроскопічні ознаки сировини фіксували за допомогою мікроскопа «Granit» при збільшенні  $\times 40$ ,  $\times 100$ ,  $\times 400$  разів. Фотознімки робили за допомогою фотоапарату Sony DSC-W80. В результаті досліджень встановлено наступні спільні анатомо-діагностичні ознаки листя горобини звичайної та горобини домашньої, а саме: продиховий апарат аномоцитного типу, листкова пластинка гіпостоматична; прості одноклітинні ниткоподібні волоски розташовані з обох боків листкової пластинки; лист дорзовентрального типу; палисадна паренхіма – одно-, дворядна; у рахісі є 1 центральний коллатеральний пучок і 4 малих бічних пучки; у базальній частині черешка – п'ятипровідні пучки коллатерального типу. Виявлені відмінні анатомо-діагностичні ознаки сировини: по краю листкової пластинки горобини домашньої на зубцях спостерігаються багатоклітинні залозки з брунатним вмістом, які часто відпадають; на нижній епідермі листкової пластинки горобини звичайної рідко зустрічаються прості волоски з брунатним вмістом; клітини верхньої епідерми листка горобини домашньої округло-звивисті, іноді з чоткоподібними потовщеннями, горобини звичайної – прямолинійно-округлі.

#### **АНАТОМИЧЕСКОЕ ИЗУЧЕНИЕ ЛИСТЬЕВ *SORBUS AUCUPARIA* И *SORBUS DOMESTICA***

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**Ключевые слова:** рябина обыкновенная (*Sorbus aucuparia* L.); рябина домашняя (*Sorbus domestica* L.); анатомическое изучение

Рябина обыкновенная (*Sorbus aucuparia* L.) и рябина домашняя (*Sorbus domestica* L.) – деревья или кустарники из семейства розоцветные (*Rosaceae*). Наиболее изучены плоды этих растений. Целью нашего исследования было установление анатомо-диагностических признаков листьев рябины обыкновенной и рябины домашней, которые заготавливали в мае 2012 г. в Ботаническом саду ХНУ им. В.Н.Каразина. Изготовление и изучение микропрепаратов проводили по фармакопейной методике. Диагностические признаки сырья фиксировали с помощью микроскопа «Granit» при увеличении  $\times 40$ ,  $\times 100$ ,  $\times 400$  раз. Фотографии делали с помощью фотоапарата Sony DSC-W80. В результате установили следующие общие анатомо-диагностические признаки листьев исследуемых рябин, а именно: устьичный аппарат аномоцитного типа, листовая пластинка гипостоматичная, простые одноклеточные нитевидные волоски расположены с обеих сторон листовой пластинки; лист дорзовентрального типа; палисадная паренхима одно-, двухрядная, в рахисе есть 1 центральный коллатеральный пучок и 4 малых боковых, в базальной части черешка – пятипроводящие пучки коллатерального типа. Выведены отличительные признаки сырья: по краю листовой пластинки рябины домашней на зубцах наблюдаются многоклеточные железки с коричневым содержимым, которые часто отпадают, на нижней эпидерме листовой пластинки рябины обыкновенной редко встречаются простые волоски с коричневым содержимым; клетки верхней эпидермы листа рябины домашней округло-извилистые, иногда с четкоподобными утолщениями, рябины обыкновенной – прямолинейно-округлые.