ONLINE ISSN 2069-7430
ISSN-L 1841-4737
PRO LIGNO
www.proligno.ro
Vol. 11 N° 3 2015
pp. 31-37

ANATOMIC INVESTIGATION OF HUNGARY'S COMMON SHRUB SPECIES

Eszter ANTALFI
PhD student. - University of West Hungary, Sopron, Hungary
Address: 4. Bajcsy-Zs. street, Sopron 9400 Hungary
Email: eszter.antalfi@skk.nyme.hu

Sándor FEHÉR
Associate prof. - University of West Hungary, Sopron, Hungary
Address: 4. Bajcsy-Zs. street, Sopron 9400 Hungary
Email: sandor.feher@skk.nyme.hu

Abstract:
In Hungary a huge part of wooden plants are shrubs. Flora of hungarian forests is among the richest in Europe. Many plants can be classified as shrubs or trees as well, circumstances during their development define what they will become. The diverse world of shrubs and weeds delights the eye under 20-30 meter high trees. From these there are some well known which basically everybody recognises is lilac (Syringa vulgaris), elderberry (Sambucus nigra), dog-rose (Rosa canina), single-seeded hawthorn (Crataegus monogyna) and common buckthorn (Rhamnus cathartica). To get these species better known – and occasionally foreshadowing their wood industry usage in some way – it is expendient to familiarize ourselves with their microscopic structure and characteristics. Nowadays there are several imaging methods known, however for examining floral tissue the optical microscope is still the most common one to be used.

Key words: *rose; elderberry; lilac; single-seeded hawthorn; common buckthorn; shrub; histology.*

INTRODUCTION

In the last few years several illustrated books dealing with tree and shrub species were published. In most international literature however the species are not formed for local circumstances, many native plants are missing (Godet 1986, Bartha 1999) This literature mainly contains morphologic and biological characteristics, and they are missing xylotomic identities (Allen 1992). Professor Pál Greguss was dealing with the anatomic description of Hungarian shrubs in the fifties (Greguss 1945, Greguss 1959). The technology and technic level of that era made illustration and description of these species not possible on that level as it is adequate today. They tried to complement the lack of good quality cuttings with drawings, not without any result. According to this the aim of my research is to provide detailed anatomic description of the shrub species mentioned later (rose, elderberry, lilac, single-seeded hawthorn, common buckthorn).

EXAMINATION MATERIAL AND METHOD

On the anatomic investigation of wood those methods are used which we nowadays call up-to-date, for example optic microscope investigation. Methods of taxation are divided into several groups based on the use of different tools (Mihalik 1999).

We call it a macroscopic examination if we only use our senses (vision, smelling, touching etc.) during the investigation, or if we are only using different manual magnifiers (Molnár 2004). In this case we only get a very limited amount of information about the xylem, which can be sometimes deceiving as well. To define the species exactly the microscopic characteristics of the xylem can provide reliable (Butterfield *et al*. 1997, Sherwin 2001). To be able to do the microscopic identification cuttings have to be made from all three anatomic directions if possible. From vascular plants, trees and shrubs it is usually difficult to get thin, appraisable cuttings. Some kind of pre-treatment is needed. According to that I cooked and softened the samples on a Bunsen-burner in a beaker with a little glycerine added. Glycerin softens the xylem making cutting easier and the quality of the cuttings will be better as well. Cooking time is approximately 10-15 minutes, but it fundamentally depends on the hardness of the wood and also changes proportionally with the size of the sample. I prepared 15-17μm thick cuttings of the pre-treated samples with a Leitz wetzlar sledge microtome in all three anatomic directions.

I did the observation of identification marks with a NIKON YS2 type optical microscope and took pictures with a TS VIEW type camera. The image appearing in the viewing field, fluorescent diaphragm or monitor of the light microscope can be captured on analog film. Pictures can be taken with any camera that has a suitable mount to be attached to the microscope (Molnár 2001).

The samples needed for microscope investigation are from the Botanical Garden of the University of West-Hungary (Living Plant Collection). Sampling was done from the shrubs taken out during planned maintenance of the botanical garden.

EXAMINATION METHODS

From the images taken during the optic microscope examination more information on native shrub species of lilac, elderberry, rose, single-seeded hawthorn and common buckthorn can be gathered thereby realising a better and deeper knowledge of native wooden plants. From the results of the examination we can derive conclusions about the usage of these species. We believe that the industrial use of these species is not possible because of their growing characteristics, but they can have an important role among wood carvers, carpenters, and at creating different pendants.

Dog-Rose *(Rosa canina)* is a healing spice originating from Persia. It is common on forest edges and shrubberies. It attracts attention with its white and light pink flowers in spring and with the burning red colour of its accessory fruits in fall. It has several Hungarian folklore names for example: bicskefa, ebcsipke, gyepű, parlagirózsa, or tüskefa (Greguss 1945). The rose is a ring-porous wood having strong growth-ring borders. The broadest vessels are directly at the growth-ring border. Because of their close alignment they are often appressed or flattened. Its wide medullary rays are clearly visible (1st image). Schweingruber (1990) describes the anatomic characteristics of *Rosa canina* similarly. There are bigger vessels in its early wood sometimes forming pore-rings. Diameter of the vessels can vary depending on the origin (2nd image).

On its tangential surface the width of the medullary rays vary between 1-5 cell lines, their height sometimes even reaches 30 cell lines (3rd image). The tangential surface of the cells is round or oval. There are several kinds of medullary ray cells on its radial surface, and full vessel breaches are visible as well (4th image). Vessels of the rose have big cavities, they are elliptic, and sometimes are twice or three times longer than their width. They have thick walls, pit ditches can be found often in them. In wider vessels sometimes there are spiral cell wall expansions. Wood fiber is short and pointed at the end. There are more fiber tracheids in them than wood fibers, their walls are thicker as well. Wood parenchima cells are rectangular.

Elderberry *(Sambuscus nigra)* is a member of the elder *(Sambucus)* genus. Its range is mainly Europe, Northern-Africa and Western-Asia. Its abundance can be explained with its excellent adaptation to the circumstances of human-interfered and secondary habitats. They most often are 3 to 10 meter high statuesque shrubs with young shoots being green and older ones having grey bark. Their small flowers are cream-white and have a distinctive scent (Greguss 1945).

Elderberry is a diffuse-porous shrub, the vessels are in groups of two to six forming a pore-ray. The number of ray-rows being next to each other vary from 2-4 (5th image). Vessels in the early wood are bigger, the growthring-borders are harshly separated. The thickness of the medullary rays vary widening on the growthring-borders a bit. On the anatomic image of Schweingruber (1990) there are clearly more vessels visible than on our (Hungarian) samples. The growthring-borders are harshly separated. Its vessels form a pore-ray, however there are not only 2 to 4 vessels grouping here but even 2-6-8 (6th image). On its tangential surface the medullary rays are spindle-shaped, running at the same distances from each other. Their width is most commonly 3 to 4 cell lines, their height varies between 5 and 35 (7th image). On the radial surface there is not much wood parenchima, their wall is thin. Full vessel breaches appear on several spots, these are round or elliptic (8th image). There are many simple ditches on the fiberwalls. They is also common on wood parenchima cells the size of them is bigger around the vessels as well.

Common lilac *(Syringa vulgaris)* is native to the Balkan. The turkish could take pleasure in their beauty at first, it got to Europe from there. Its range is Southern-Europe. Common lilac is a bigger shrub growing to the size of 3 to 7 meters. Its flowers are usually purple, sometimes white (Greguss 1945). On its cross section in the earlywood their big vessels form a pore-ring consisting of 2 to 3 rows. It the latewood vessels have thinner cavities, which are smaller as they get close to the growthring-border. The vessels in the earlywood are multangular, sometimes converging to circular or elliptic forms. The growthring-border is sharp, thin, a bit wavy. Its wood is sensitive, so it sometimes forms secondary growth-rings as well. Wood parenchima occurs only seldom (9th image). The medullary rays on the tangential surface are 1-3(4) cell line wide, their height varies between 3 and 25 (10th image). In the radial direction the medullary ray cells consist of standing and laying cells, they are rectangular, their outer wall is wavy (11th image). There are full vessel breaches on the vessels, sometimes spiral cellwall expansions are visible as well. There are many pit ditches on the wall of the fiber tracheids. Wood parenchima cells are covered with simple ditches. Spiral cellwall expansions were drawn differently by Greguss (1945). They can appear on cells with bigger or smaller walls as well. Simple ditches can be seen on the drawing as well (12th image).

Single-seeded hawthorn *(Crataegus monogyna)* grows in the central and southern parts of Europe, mainly on the edges of forests and shrubberies of the plains. Its current range is Central- and Southern-Europe, as well as North-eastern Africa and Western-Asia. The single-seeded hawthorn is a medium-height thorny, thick shrub or small tree growing to 5 - 8 meters with an irregular spreading crown (Greguss 1945).

On its cross section it is visible that the vessels of the single-seeded hawthorn are arranged diffusely, there is no difference in size between earlywood and latewood they are mostly multangular in shape (13th image). Its growthring-border is radially squashed, spreading out along the medullary rays a bit. On its tangential surface the width of the medullary rays vary between 1-2 cell lines wide, and 2-25 cell lines high

(14th image). On the *Crataegus monogyna* specimens examined by Schweingruber (1990) the height is only 15-20 cell lines, but 1-4 cell line wide. These cells are much shorter, but wider (15th image). Parenchima cells appear often. On its radial surface the fiber tracheids have a softer structure, their direction is evenly ordered. Wood parenchima cells are common. Vessels and vessel-like tracheids have similar shape and dimensions. Spiral cellwall expansions occur on the vessel walls. The wall of the fiber tracheid is thinner, and covered with pit diches (16th image).

Common buckthorn *(Rhamnus cathartica)* is typical native plant in tropical, subtropical and temperate regions of Europe, Western- and Northern-Asia. In North-America it was only planted as an ornamental plant. It is usually 2-3 meters high, its bark is grey at a young age, turning brown later and it can be scaly as well (Greguss 1945).

The vessels form a multirow pore-ray in the cross section of the earlywood. In the latewood the vessels group in flamelike shapes. This pattern is an important distinctive mark of the buchthorn. Its vessels are multangular with various sized cavities. The growthring-border is sharply visible (17th image). On the cross section images of Schweingruber (1990) the flame like patterns are more clearly visible although there can be fewer vessels found in the earlywood. The shape of the vessels are more elliptic than on our samples. The growthring-borders are sharply separated here as well (18th image). On the radial section the medullary rays have obtrusively the same height. There are only a few wood parenchima cells around the growthring- border. Full vessel breaches can be seen on the vessels.

The wall of the vesselparts is thick, covered with pit ditches but their number is fewer here. Their circular or elliptic vessel breach is small (20th image). The size of the tracheids equals the size of the wood fibers. The ends of the fibers are pointed or dull. Wood parenchimae are rectangular, their size varies.

SUMMARY

Because of their growth characteristics most of the shrub species does not reach a size enough to be suitable for industrial usage. However smaller scale uses like carving, lathering, or making pendants can occur. The color and pattern (the aesthetic appearance) of the wood will be the key factor upon their use.

The anatomically investigated shrub species showed that there can be minor differences in the microscopic structure compared to the results of earlier examinations like this. This is normal since wood structure is influenced by growth circumstances. However there is no considerable difference among the microscopic species characteristics. The minor differences appear mostly in the frequency, size and cross section shape of the vessels. A very distinctive histologic sign for dog-rose (*Rosa canina*) is for example the radial elongation of big cavity vessels (1st image). On the contrary neither the research of Greguss (1959) nor the ones of Schweingruber (1990) showed such a great radial elongation, than our examinations.

THANKS

I would like to thank the co-workers of the Botanical Garden of the University of West-Hungary, who made the sampling of shrub species possible.

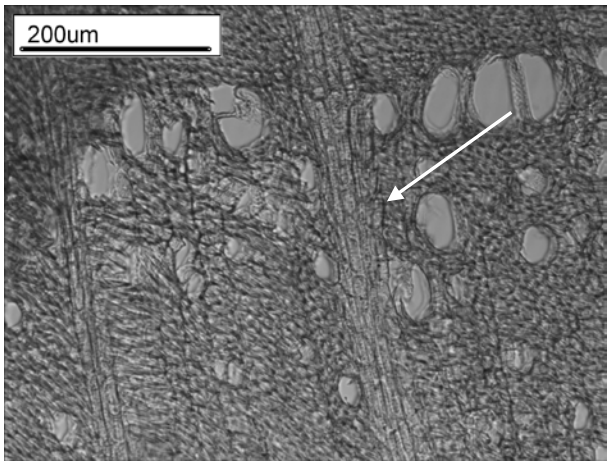

Fig. 1.
Cross section image of rose, medullary ray (100x).

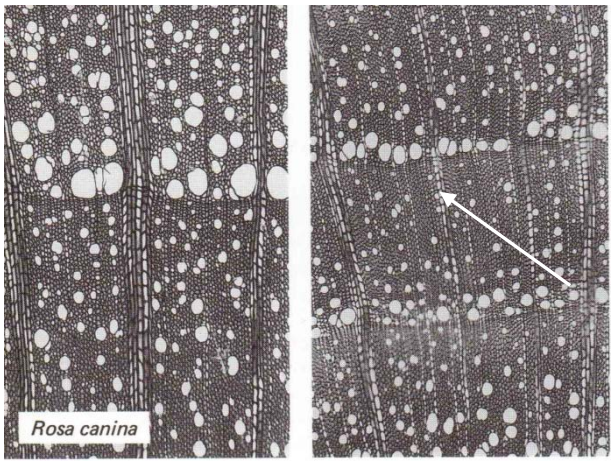

Fig. 2.
Cross section image of rose after Schweingruber, growthring-border (40x) (Schweingruber 1990).

ONLINE ISSN 2069-7430
ISSN-L 1841-4737
PRO LIGNO
www.proligno.ro
Vol. 11 N° 3 2015
pp. 31-37

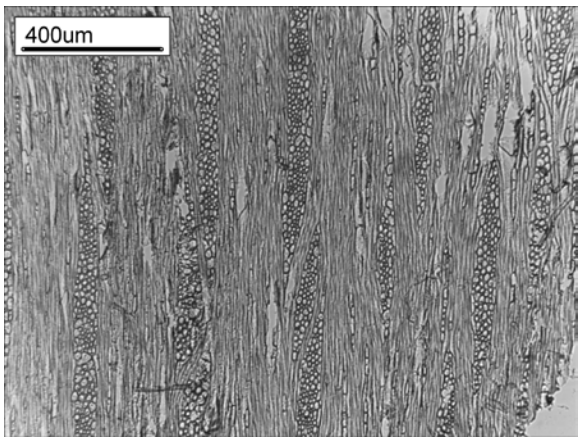

Fig. 3.
Tangential section image of rose, medullary ray (40x).

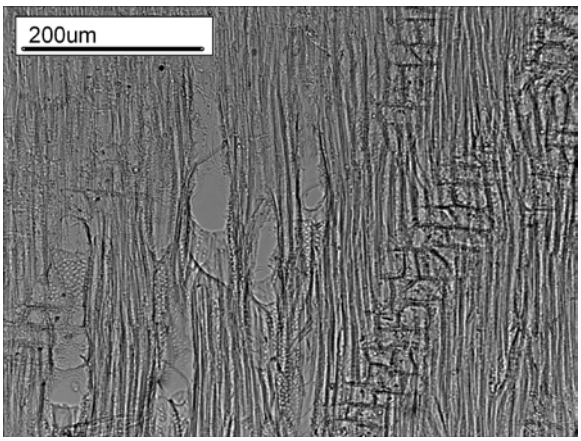

Fig. 4.
Radial section image of rose, full vessel breach (100x).

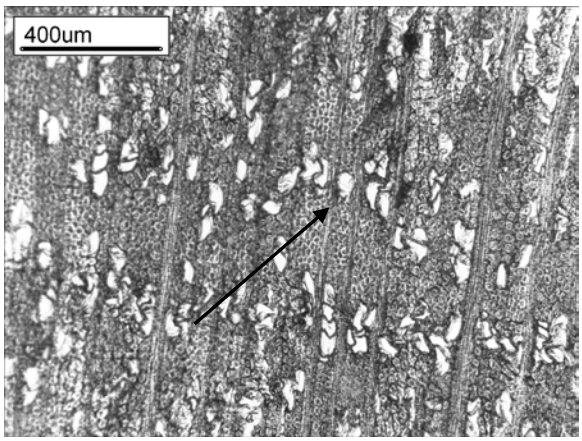

Fig. 5.
Cross section image of elderberry, vessels (40x).

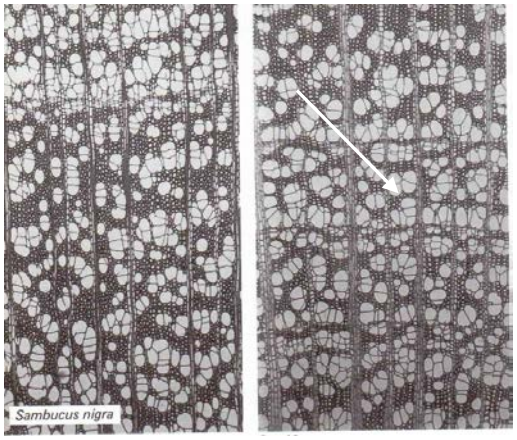

Fig. 6.
Cross section image of elderberry after Schweingruber, growthring-border (40x).

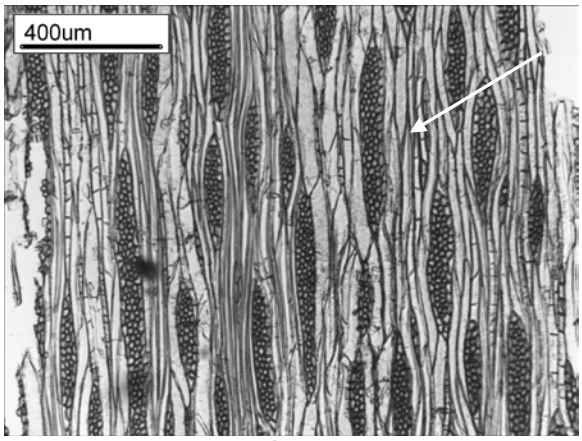

Fig. 7.
Tangential section image of elderberry, medullary ray (40x).

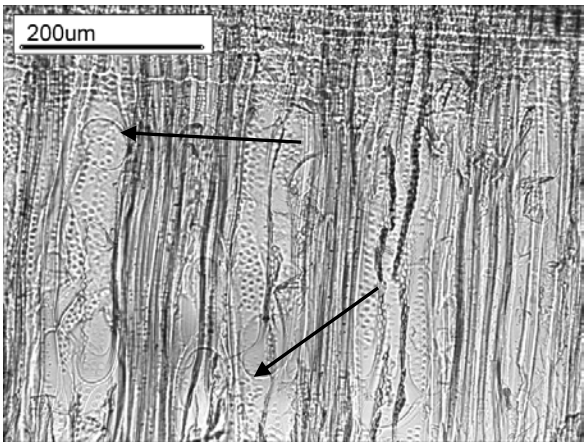

Fig. 8.
Radial section image of elderberry, full vessel breach (100x).

ONLINE ISSN 2069-7430
ISSN-L 1841-4737
PRO LIGNO
www.proligno.ro
Vol. 11 N° 3 2015
pp. 31-37

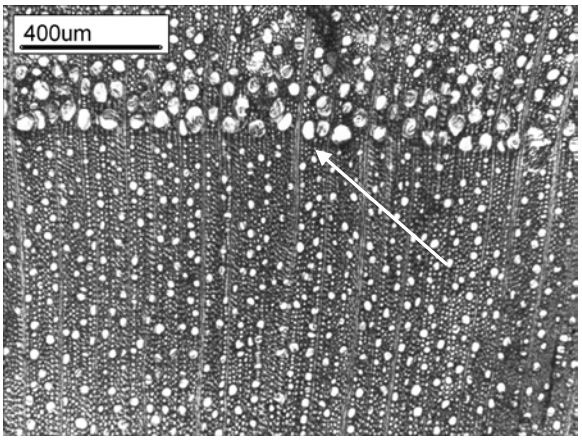

Fig. 9.
Cross section image of lilac, growthring-border (40x).

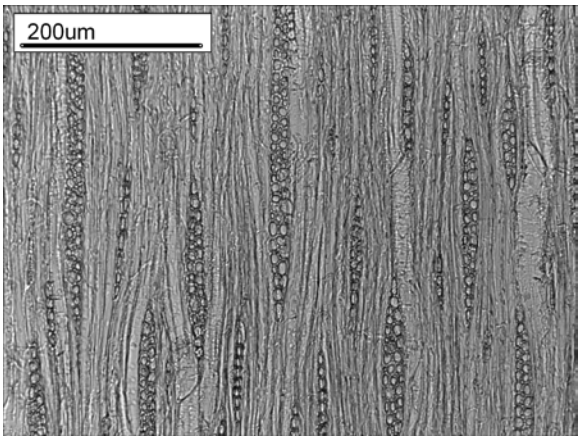

Fig. 10.
Tangential section image of lilac, medullary ray (100x).

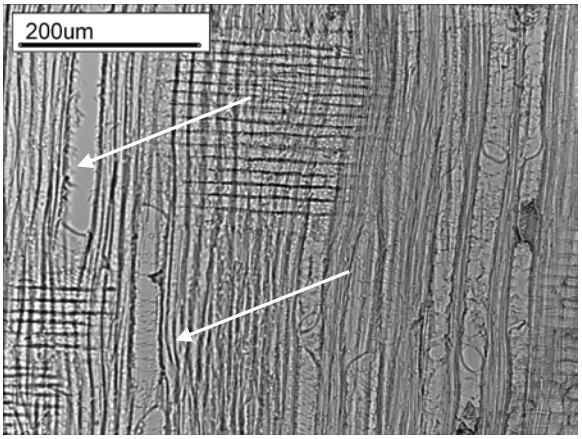

Fig. 11.
Radial section image of lilac, spiral cellwall expansion (100x).

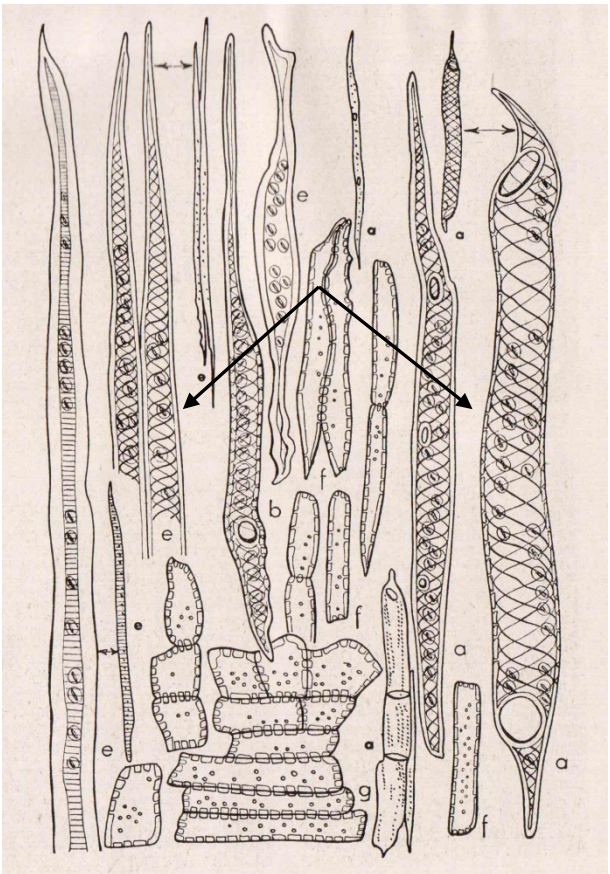

Fig. 12.
Spiral cellwall expansion of lilac based on the drawing (Gregus 1959).

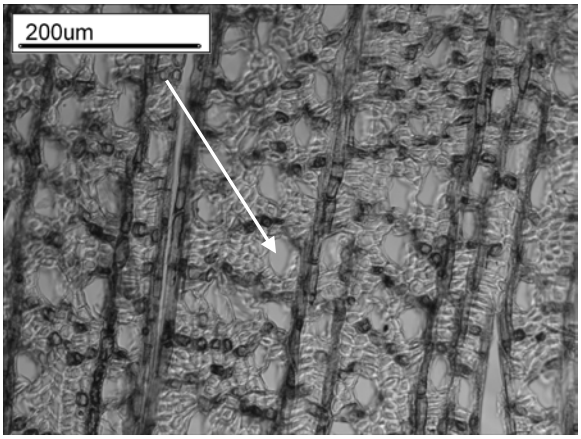

Fig. 13.
Cross section image of single-seeded hawthorn, vessels (100x).

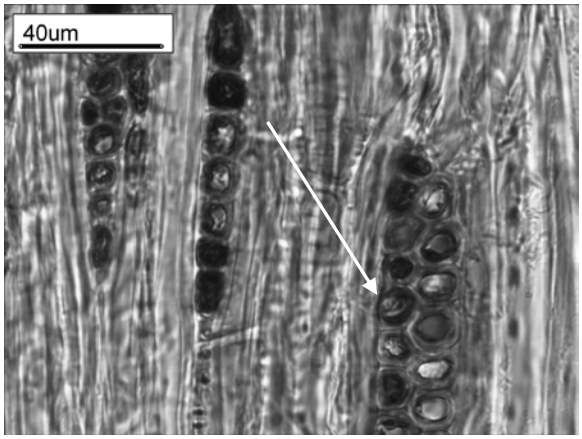

Fig. 14.
Tangential section image of single-seeded hawthorn, two cell line medullary ray (400x).

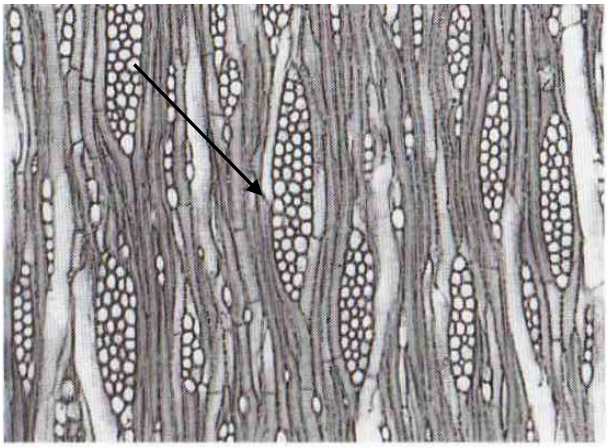

Fig. 15.
Single-seeded hawthorn medullary ray image of Schweingruber (70x) (Schweingruber 1990).

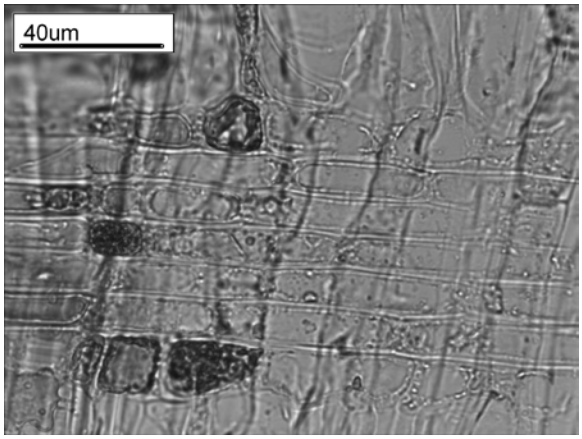

Fig. 16.
Radial section image of single-seeded hawthorn (400x).

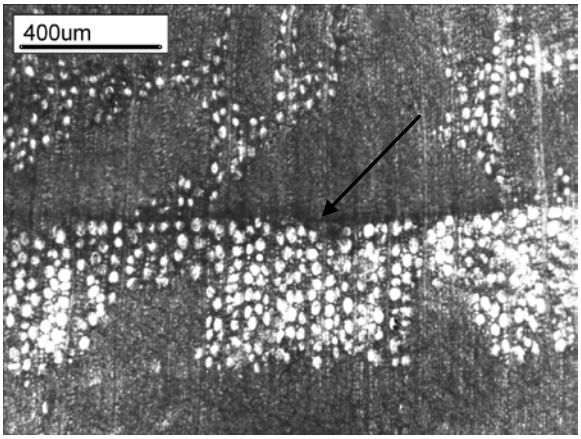

Fig. 17.
Cross section image of buckthorn, growthring-border (40x).

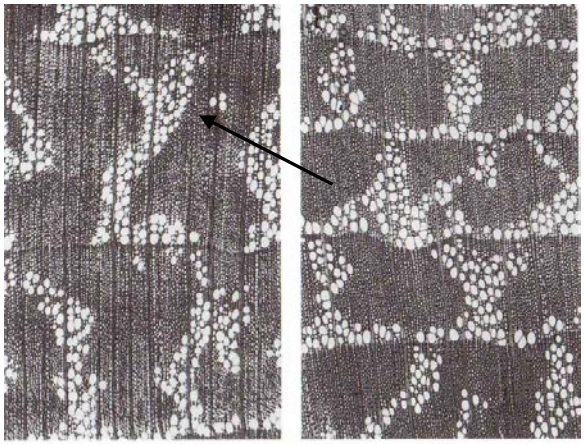

Fig. 18.
Schweingruber's cross section image of buckthorn, flame shape of the vessels (40x) (Schweingruber 1990).

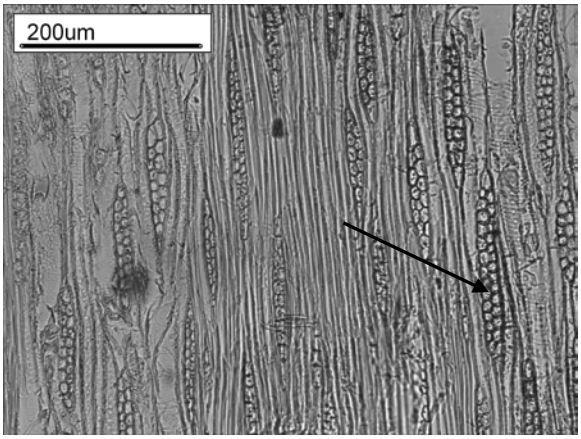

Fig. 19.
Tangential section image of buchthorn, medullary ray (100x).

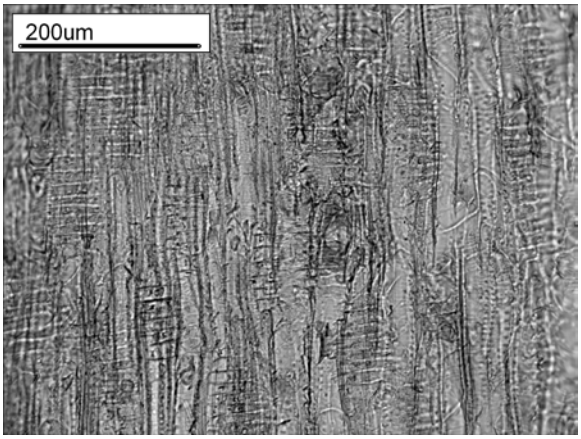

Fig. 20.
Radial section image of buckthorn (100x).

REFERENCES

Allen JC (1992) Trees, Dorling Kindersley Ltd., London.

Bartha D (1999) Tree and shrub species in Hungary (Magyarország fa-és cserjefajai), Mezőgazda kiadó, Budapest.

Butterfield B, Meylan B, Peszlen I (1997) Three Dimensional Structure of Wood (A fatest háromdimenziós szerkezete) English - Hungarian Edition. Faipari Tudományos Alapítvány. Budapest.

Godet JD (1986) Baume und Staucher, Arboris Verlag, Hinterkappelen, Bern.

Greguss P (1945) Identification of the Central European broadleaved trees and shrubs on anatomical basis (A középeurópai lomblevelű fák és cserjék meghatározása szövettani alapon), Az országos magyar természettudományi múzeum kiadása, Budapest.

Gerguss P (1959) Holzanatomie der europaischen laubhölzer und straucher, Akadémiai Kiadó, Budapest.

Mihalik E, Nyakas A, Kálmán K, Nagy E (1999) Plant anatomy practices (Növényanatómiai praktikum), JATEPress, Szeged.

Molnár L, Bárbiel R (2001) Microtechnics for light and electromicroscopy (Fény és elektronmikorszkópos mikrotechnika), Dialóg Campus Kiadó, Budapest-Pécs.

Molnár S (2004) Wood science (Faanyagismerettan), Mezőgazdasági Szaktudás Kiadó, Budapest.

Sherwin C (2001) Comparative Wood Anatomy, Springer, USA.

Schweingruber FH (1990) Anatomie europaischer Holzer, Berne, Stuttgart.