Service tree - tree for new Europe

International Conference 20. 9. – 21.9. 2015

Tvarožná Lhota, Morava, Czech republic

Proceedings and posters

Inference organizing Committee:

- Mgr. Vít Hrdoušek (**contact below**) – organization food, sleeping, background facilities, excursion
- Mgr. Zdeněk Špíšek – organization speakers, posters and discussions
- Mgr. Ladislav Bakay – organization speakers, posters and discussions
- Prof. Boris Krška - expert services

Conference Program

Sunday 20. 9. 2015

14:00 - 14:30 Presentation of participants

Block I.

14:30 - 15:00 **Greetings of official representatives** (EU Commission, The ministry of the environment of the Czech Republic, South-Moravian region, LAG, Cenelc..), ***little folklor show***

15:00 - 15:20 **Introduction to the issue of cultivation and uses of *Sorbus domestica* -** Prof. Boris Krška, Mendelu Brno, CZ

15:20 – 15:40 **The history of cognition and uses of *Sorbus domestica***, Mgr. et Mgr. Vít Hrdoušek, LAG Strážnicko, CZ

15:40 - 16:00 **Utilization of *Sorbus domestica* L. in urban context and in landscape**, Prof. Ing. Viera Paganová, Ph.D., Slovak University of Agriculture, Nitra, SK

16:00 – 16:30 *slow-food Sorbus snack*

Block II.

16:30 – 16.50 **Generative reproduction of *Sorbus domestica*, Mgr.** Ing. Marie Benedíková, VÚLHM - Forestry and Game Management Research Institute, Kunovice, Mgr. Zdeněk Špíšek, Palacký University Olomouc, CZ

16.50 – 17.10 **Molecular diversity of Service tree in Europe**; J.P. George and Heino Konrad, BFW Wien-Department of Forest Genetics, AT

17:10 – 17:30 **Genetic variability of *Sorbus domestica* in the Czech Republic and in Europe**, Mgr. Zdeněk Špíšek, Palacký University Olomouc, CZ

17. 30 – 19:00 **Poster presentation (10 min per one)**

19:00 *Stylish dinner,*

19:30 little folklor interaction, degustation of products

20:30 – 21:30 Prolong discussion at posters ……

Monday 20. 9. 2015

Block III.

8:30 – 8.50 **In-vitro reproduction of *Sorbus domestica***, Ing. Jana ŠedivÁ, Ph.D., The Silva Tarouca Research Institute for Landscape and Ornamental Gardening (RILOG), Průhonice, CZ

8.50 – 9.10 **Service tree in the Hungarian forests,** Ing. Kiss Balasz HU;, Mgr. Ladislav Bakay Ph.D., Slovak University of Agriculture, Nitra, SK

9:10 - 9:30 **Service tree in Czech –Slovak border,** Ing. Andrea Uherková, Technical University of Zvolen, SK, Mgr. Zdeněk Špíšek, Palacký University Olomouc, CZ

9:30 – 9.50 **Fruit pomology and seed dormancy of service tree in Croatia**, Ing. Damir Drvodelić , Ph.D., University of Zagreb, HR
9.50 - 10:30 Slow-food Sorbus snack, **Exhibition of varieties** of service tree
10:30 – 10.50 **Service tree variety selection ;** Prof. Dr. György Végvári, Faculty of Horticultural Science, Corvinus University of Budapest, HU

10:50 - 11:10 **Pomology and fruit production of service tree**, Mgr. et Mgr. Vít Hrdoušek, LAG Straznicko, CZ

11:10 - 11:30 **Sorbus domestica in Ukrajina,** Dr Volodymyr Mezhenskyj, University Kyiv

11:30 – 11.45 Presentation of future project **„ One milion fruit trees“**

11:45 - 12:30 *Stylish service tree lunch*

12.45 - 17.00 **Excursions to selected sites** – gene pools, museum and trails, giant service trees on Žerotín hill, variety of service trees in the region Strážnicko.

17.00 The final meeting – conclusions , cooperation in EU projekt OP Danube

Contact: Mgr. et Mgr.Vít Hrdoušek, LAG Strážnicko, project manager
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Introduction

Dear guests,

in the whole Europe old trees are disappearing, especially the fruit ones. The old is being substituted by the new, modern and therefore interesting. The importance of old species and varieties of fruit is often forgotten and for this reason it is necessary to remind it to prevent disappearance of their unique qualities and beauties. Also in our country old fruit trees are ignored and in some places they are even systematically destroyed and their fruit is considered rather annoying waste. In the countryside, trees – often local regional species – were significant not only from pomological point of view, but they also played an important role as land border points, erosion control elements, landmarks or family trees linking the fates of individuals and families with the landscape. Old trees are also a unique biotope for many other organisms and a valuable biological and ecological feature of the countryside.

To this day, in Europe there are still areas where people have maintained their natural relationship to trees and nature. As an example we can think about the region of Slovácko on the border of Moravia and Slovakia. The place where, thanks to uninterrupted agricultural tradition, old varieties of apples, pears, plums and also more rare fruit varieties as mulberry, medlar, quince, dogwood or service tree fruit have been preserved. And it is the service tree, called "oskoruše" in the region of Slovácko that has become a symbolic tree of this region for its uniqueness and is recently experiencing its renaissance.

This conference builds on the collaboration developed when working on the book "Service Tree – Tree for New Europe" (Hrdoušek et al, 2014) and aims to acquaint public thoroughly with the service tree (*Sorbus domestica*), unique European fruit tree. The goal of our event is to promote this almost forgotten fruit tree with many „firsts"and get it in the knowledge of the whole Europe. To reuse again its landscape, food, wood and medical importance for our generation as well as for the one to come in Europe.

Vít František Hrdoušek, 2015

Fruittrees, exceptofthefruitbringalsothatgreat benefit ofmakingcountryside more fertile and healthy.. Theyprovideuswithdifferentbeatifulkindsofwood...
Thealleysprotectthefieldsalsofromtoo much dryingwinds... and fromblowingawayfrommeadowssnow blanket beneficialfortheharvest.

Growing and treatment of fruit trees take away opportunity for idleness and iniquities, intoxication, lasciviousness, thefts resulting from it. That is in another respect also an excellent means of cultivation and improvement of the human spirit and heart.
František Pixa, 1848

Still life with the service tree as represented in a mannerist way by the painter Giovanna Garzoni in 1640;probably it is an old variety of the service tree called ***"Parrocchiane"****from southern Italy.*

They have written about the service tree

The tree Cormier – "oskerušovník"– has been for centuries a donator of food, medicine and craft. What remained in the memory used to be passed down orally, but even that comes to be forgotten gradually. The trees that remain are a valuable heritage, both biological and cultural. Our mission now is to ensure preservation of "oskerušovník" in our agricultural land and put it in place of honour in the framework of today's economy.

Evelyne Moinet, 2009, France

Until now the presence of the trees *Sorbo* – "service tree"– at the foothills of Mount Vesuvio was almost ignored. The service tree is not even listed in the national inventory of genetic resources of fruit trees in the region of Campania. Despite the efforts of the public to restore the use of this traditional fruit, the prospects of preservation of the service tree on the slopes of Mount Vesuvius as well as in the rest of Italy are very small. As a consequence of the aging trees and aging farmers who grow them, the possibility of their use comes to disappear. Another threat is the expansion of the urban areas that progressively take over the agricultural land of the countryside.

Cristina Bignami, 2000, Italy

There are many good reasons to protect Speierling – "service tree". Besides their natural value, there are also landscape, ecologic, cultural and historical reasons as well as traditional economic interests that may save such species of tree.

BrütschetRotach, 1993, Switzerland

The service tree – "skorš" – has the most modest demands of all fruit trees; it is resistant to a number of pests and has a high nutritional value. This fruit can be a valuable raw material for food production even in peripheral dry and stony areas.

Mileticet. Paunovic 2012, Croatia

The first fruit wine in Europe was probably made of the service tree fruits. It is the only wild-growing tree that produces large quantities of eatable fruit and whose fruits can be dried for storage. „*Discourse on Fruit Wines*"

Charles Etienne, 1577, France

In Western Europe, especially in France and Germany, when the sporadic service trees are logged in the woods together with the chequer tree, peer tree and apple tree, they are included in the same group designated "Schweizer Birnbaum" – "Swiss pear". The Saxon book of the forestry school from 1868 provides us with information on the price of the service tree wood in that times: „The trunk of the service tree with the girth of 40 cm and the length of 4 m used to be sold for 56 golds. The price for quality service tree wood is high even today: for example, in Germany in 2000 the price for 1 m^3 was circa 1500 euro.

Wedig Kausch, 2000, Germany

The year 2008 is in the sign of the service tree – „Aschitzenbaum", the rarest tree of Austria whose numbers has been on the decrease for more than 100 years in the whole Central Europe as a consequence of ruthless forest management and lack of interest of people in landscape trees.

Thomas Kirisits, 2008, Austria

The service trees on the Moravian – Slovak border grow in the largest trees of their area. During a research ongoing in the last 10 years it came out that the service trees are disappearing and that a number of massive service trees is in bad health condition. The species does not regenerate naturally, there has been a lack of rejuvenation in the past 60 years which was caused by the change in the land management resulting in land consolidation and monoculture forest cultivation. There is significant influence of overpopulation of herbivores, in particular of the cloven-hoofed animals. On the other hand, a series of civic activities has come to life – planting service trees in the vineyards, along the roads and in bounds. The events such as "Sevice Tree Fest" are organised, making effort to acquaint the public with the values of such tree. This is the reason why I believe that such raising of public awareness will contribute to higher interest in the service tree both in our country and in Europe.

The opportunity of introduction *Sorbus domestica* as fruit tree

Boris Krška

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Introduction

Fast and busy lifestyle today and eating habits should be our nature and its laws example and role model.

Regions and areas where growing service trees are either solitary or group of trees on the edges of forests mostly still belongs to the areas where time flows slower and where today often confused Europe is still preserved traditional uses of crops and breeds of animals as an essential precondition biodiversity conservation of the original agricultural and landscape areas also for slow food subsistence and other original ways of using fruit. For us it may be an example of the White Carpathians some areas of southern Moravia and Litomerice or Europe Alentejo region of Portugal, where it is grown cork oak (Quercus Suber L.).

Sorbus domestica along with cork oaks are just such an easygoing and peaceful way of life converge and our forefathers planted these kinds for economic use not only for current generation but also for generations coming then, when the first harvest used the suns and latergrandsons. In addition to this filosophic-holistic model has *sorbus* trees other's strengths and some biological demands, which very well fit into the changing climate conditions, and they are a wonderful link between the use of plants as the fruit, and in forestry. Could we find in future another kind of this tree that mother nature offers us?

Basic assumptions cultivation and use of sorbus domestica

Service tree is an important xerophytic flora kinds. Relatily good grow during dry period, but when is hight water deficience some leaves or small fruits falldown. Plants good profit in plants commmunities *Quercetum frainetto-cerris*, prefers permeable soil with low percentage of nutrients and moisture. Soil with abundance calcium is not problem. Service tree prefer warmer continental climate, regions without long frozen period. Area around Mediterranean Sea is as so as good region for service tree growing.

Sorbus domestica is an important xerophytic plant species tolerant to drought quite well. In the period when is high water defiency some leaved or small fruits falldown. They grow well in a plant community *Quercetum frainetto-cerris*, on permeable soils, modest in nutrients and moisture, and even with an excess of calcium as other plants amounted problems. From the perspective of climate suits *sorbus* tree warmer continental type, where there are severe frosts, but grow well in the Mediterranean region. *Sorbus domestica* represent long-lived trees, with slow development and long periods of juvenile period, when in the early years of the onset of fertility is branching monopodial that is, at the time of intense growth. Later, after the suppression of apical dominance is symodial type of branching (Pananová and Bakay, 2010).

As was already mentioned, service tree provides and pleasure not only for fruit growers but also for foresters. The fruit contains about 20-22% of dry basis, large quantities of vitamins, especially B 2, vitamin A, vitamin C, 11 to 14% invert sugar (fructose dominates over glucose), malic acid is contained about 0.6%, it is also valuable contents fruits minerals , tannins and pectins it is therefore necessary to process and eat the fruits after their "maturing". After maturing, when they take place in the biochemical conversion are excellent for direct consumption, they are also used for the production of compotes and jams. Fruits are also pressed, their juice is produced either pure wine or it is added as an ingredient in the production of fruit juices, musts and wines, which retains its original bright colors and aromas. Matured fruits are also used to produce highly valued liqueurs or brandy. Dried fruits are ground on the so-called , Pracharanda,, which is used as a filling of pies mashed instead of poppy.

Blooms offers a rich bee pasture. Wood of service trees is extremely valuable and has one of the highest densities is hard russet suitable for joinery, and furniture making in general. Service trees sprouting buds can also be used in medicine, such as venous and lymphatic system regulator it is usefull also, in the treatment of venous edema and it treats lumps in the breast and armpit too.

Conservation process

For many years is in the White Carpathians paid attention to saving the gene pool of regional varieties of fruit trees. In addition to the traditional fruit is the southwestern part of the significant incidence of domestic service tree (*Sorbus domestica* L.), which is a typical solitary tree slopes in the foothills of the White Carpathians, especially around villages Straznice Radejov, Tvarozna Lhota, Knezdub and Hroznova Lhota. Many of them are seriously damaged by intensive management of agriculture.

In the years 1991 - 1992 was uccured on the initiative of CUNC White Carpathians mapping of the service trees, in which it was found about 130 trees,the health condition many of this trees was alarming. Re-checking in years 1996 - 1997 showed that more than a third of the trees were withered or survived on the grounds of this situation the organization launched the "Care *Sorbus domestica* L. trees in the southwestern part of the White Carpathians", in which were treated most endangered trees. At the same time, cooperation with professional organizations (MENDELU, Faculty of Horticulture in Lednice, Research Institute of Forestry and Wildlife in Kunovice) was established. In the area of the White Carpathians was collected seed material for growing seedlings, which would help the expansion of the fruit trees in the landscape. Service tree may find use in the Rural Renewal Programme, restoring biocorridors, even when planted on the meadows and in the forest.

The expansion of interest in the service tree, not only among laymen trying organization INEX - Association for Voluntary Activities White Carpathians, based in Tvarozna Lhota. The leader of this association is Mr. Vit Hrdoušek tireless, imaginative and dedicated promoter of cultivation, propagation and planting of service trees not only in Europe. At the end of the year 2003, it was opened "The service tree Trail" –six mile trail leading through the landscape of the White Carpathians, which takes visitors to the trees service tree. Annual tradition becomes a "Festival of service trees," always organised in the month of April

, in the year 2015 was already the fourteenth time. In the year 2005 was hanks to the organization opened its first museum of service trees in the world in Tvarozna Lhota, which might also extend the public interest in this rare tree species. Everything under the action of Mr.Hrdousek.

Focused on service tree as so as tree for forestry was study and mapping by Prudič Z. (1998), Benediková et al. (2009), Čížková et al. (1999), Moravia and Bohemia then Kubat, which were primarily the identification of long-lived trees for forestry use.

Preconditions successful re-expansion

For planted, distribution and re-expansion of service tree are important secure genotypes with these characters: regular fertility, good reproduction (compatibility with other kind of genus *Sorbus*) and attractive fruits. Biological preconditions are only one side of same coin. On the other hand are commercial reproduction tree, fruit production and education customers. In the Czech Republic these activities started Mr. Hrdoušek.

What is importance for develop planted service tree?

Reproduction of service tree

- Finding small increase genotypes for the rootstock service tree which weaken top-graft
- Testing rootstock of quinces (*Cydonia oblonga*) for service tree. First step testing rootstock Provencal provenience was successful. Affinity between rootstock and top-graft was positive.
- Testing selected genotypes of *Crataegus* with high probability survived. One of testing *Crataegus* was transported from Germany.
- Focusing on commercial reproduction in vitro. Preparing mass reproduction for farmers and foresters. Certificate methods was published for instance J. Malou (Malá et al. 2011). Today Mrs. J Šedivá from VÚKOZ Průhonice is interested in these methods.

Choosing of adaptive genotype of the service tree with attractive fruit

- Mapping and screening genotypes are almost done. For this stury were chosed clones with interesting genotypes from Germany, Sicily, Austria, Ukraine and Serbia.
- Founding characteristics fruit production, positive affinity between rootstock quinces and top-graft and short-term juvenile
- Focused on pomological classification for easier identification of genotypes growing in all area. First step in pomological classification was started in publication Hrdoušek et al. 2014.

Modern methods for planting of service tree

- For regular grower with interest in pomiculture purpose is necessary to create a modern growing technology. It is important to found ideal density of planting, cutting and new shaping educational ways to accelerate the onset fertility. This is necessary for commercial use of service tree, because we need fruits more quicker than after 12 years. This knowledge is possible to detect during testing planting for accelerate fertility.

Popularization and offer of products from service tree

- First step is education of customers, how used fruit. We found that the larges using of this fruits is in canning fruits, juice made, wineries and drying.
- In The White Carpathians already exist, local producers. Fruits from service trees are used for preparing of jams, ciders, fruit compotes and teas where is represented a certain proportion of service tree, but the large-scale processing of fruits is still in anticipation. This is necessary not only to find willing processors, but provide them a steady supply of fruits, so that their production was stable and could rely on growers of supply.

Foundation core collection of genetic resources service trees

- Neccessary for conservation of interesting genotypes presented pomological and morphological variability for next generation. Focused on interesting genotypes from Czech Republic. For this purpose was found two localities and during next 4 years seedlings will be prepare for planted.

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The history of the study and uses of *Sorbus domestica* in Europe

Mgr et Mgr. Vít Hrdoušek, LAG Strážnicko

Introduction

The paper presents the largest ever comprehensive knowledge gained from historical and medial sources about the service tree (***Sorbus domestica* L.)** in Europe collected in our compilation book Service tree – tree for new Europe.

The service tree in antiquity

Direct written record related to the service tree as a fruit dates back to ancient times when **Theophrastus (371 – 287 BC)** in his book thoroughly explains the variability of fruits and provides an accurate description of the service tree leaf, in Greek called **"Oia"** οὔα, ὠϊά, ὠά, οὖα, ἡ, and of the service tree fruit called ὄον. The description includes many details, it says for example that the leaves fall off in whole in autumn. In the translation by Kausch (2000) the said Theophrastus' description reads as follows: „*The service trees are of two sexes: the female one which bears fruit, and the male one which is not fertile. We tell them apart also by their fruits: their shapes vary from round to oval. Furthermore, we can distinguish the fruits by their taste: the round ones are rather fragrant and sweet, the oval ones are often not so fragrant and are sour.*" In another chapter there is a description of the way the fruit trees are grafted. In ancient Greece and Rome the production of must and wine from the service tree fruits together with peers, quinces or medlars was recorded. In the work "*De Agri Cultura*" (200 BC) by a Roman censor **Marcus Porcius Cato (234 – 149 BC**) there is a naming Sorbum, which in the form of *Sorbus* has been preserved as the name for the service tree until today and has even given the name to the whole genus of *Sorbus*. **Marcus Terentius Varro (116 – 27 BC)** in his book "*Rerum Rusticarum Libri Tres*" rate the service tree together with the quince among the apples and describes their preservation by drying cut fruit in the sun and storing it in dry cold place. **Virgil (70 – 19 BC)** mentions in his work "*Georgica*" production of wine from the service tree fruits by the Scythians in Southeastern Europe. **Pliny the Elder (23 – 79 AD)** in his book "*Naturalis historia*" (77 AD) gives a description of three types of the service tree and apart he distinguishes also the chequer tree (Ajasson, 1833). **Pliny the Younger (61 – 113 AD)** depicts the conservation of the service tree fruits in a large clay pot that must be insulated with plaster and buried two feet deep in the soil in a sunny spot (Kausch, 2000). Moreover, there is a description of fruit drying in the flow of fresh air. The Greeks together with the Romans spread fruit cultivation across the whole Europe and along with the wine they planted also the service trees (Rotach, 2003). There is also a description of propagation by seeds or cutting, when "*the offspring separated from the trees are alive, but they must have fibres from their mother's body*" (Tetera, 2006). In his work „*De materia medica*" **Dioscorides (40 – 90 AD)** points out that after drying the service tree fruits can be used for treatment of intestinal diseases – diarrhoeas; minced fruit can also be used instead of barley flour. Dioscorides' work became a foundation for medicine and botany for the following 1500 years. **Palladius (4th century AD)** in his work "*De re rustica*", known also as „*Opus agriculturae*", deals for the first time with orchard aspects. He literally writes: „*From the cores of large fruits high-grown trees of Sorbus Domestica can be grown, they grow strong and bear good fruit.*" Afterwards, he depicts the use of fruits for production of wine and vinegar and mentions primitive stratification and possibilities of their grafting onto the rootstocks of the hawthorn and medlar. He even offers advice to cultivators on how to achieve larger crop: by damaging the trunk and roots (Kausch, 2000). According to an ancient cookbook, whose author could also be **Apicius (50 BC?)**, the service tree fruits are in many

Italian households praised as a delicacy after eating the main course. The book recommends varieties with big red fruits. Furthermore, it provides instructions for preparation of salted service tree fruits. **Claudius Galen (129 – 200 or 216 AD)**, Roman physician of Greek origin known in the Middle Ages as Galen, preferred the service tree to the medlar and suggested „*to use the service tree fruits as a medicine, not as meat*".

In France the first mention of the service tree is registered in the 5th century when wine from the service tree fruits called „curmi" used to be produced: this name survived in the Irish word „cuirm", which means „beer" (Lieutaghi, 1975). Curmi from the service tree fruits was famous for causing alcohol intoxication and for a harmful influence on intellectual functions as a consequence of its long-term consumption (Moinet, 2009).

The study of local names in France reveals that the tree was spontaneously used a landmark since the Celtic settlement (Moinet, 2009). The service tree, called Sorbarios, is listed in the inventory of more than 100 plants recommended for courtly gardens in „The Regulation on the Imperial Courts" issued by **Charles the Great (742 - 814)**. The service trees should be planted in every court and their fruits were suggested to be used not only as a fruit but also as a medicine (Moinet, 2009). There is also a record from 802 as to the cultivation of the service trees in a fruit orchard in the cemetery of the Benedictine monastery of St. Gallen in Switzerland (Moinet, 2009; Brútch et Rotach, 1993).

The service tree in the Middle Ages

Dante Alighieri (1265 - 1321) cites the service tree as a bitter fruit as compared to the fig tree that has a sweet fruit:

«..ed è ragion, ché tra li lazzi sorbi
si disconvien fruttare al dolce fico. »
(Dante, Inferno, XV, 65-66)

Translation: "..with reason, for among the bitter sorbs it is not natural the sweet fig should come to fruit"

In the Italian literature of the 15th and 16th century we can learn about the use and cultivation (grafting) of the service trees, however, accomplished ancient and until then undisputed authors (Dioscorides, Theophrastus) are cited (often literally) in the first place, without update of the knowledge (Moinet, 2009). The oldest depiction of sale of this fruit dates back to medieval Italy, to Verona or Venice, and comes from the third quarter of the 15th century by Giovanni Cadamosta. The illustration apparently captures sale of large pear-shaped service tree fruits. The ability to protect from cholera and to heal stomach is attributed to the service tree fruits as it is stated in the accompanying text. The manuscript is stored in the Austrian National Library in Vienna (Kausch, 2000). Italian physician, naturalist, botanist and entomologist **Ulisse Aldrovandi (1522 – 1605)** was the founder of one of the first naturalist museums in the world in his native Bologna. Perhaps the first herbarium sheet of the service tree and a beautiful watercolour of the same has been preserved until today. The drawing for the publication, that he did not manage to publish anymore, is accompanied for the first time by the contemporary botanical name *Sorbus domestica* that was codified 200 years later by C. Linnaeus. Botanist **Pietro Andrea Mattioli** (1501-1577) published the Czech translation of his book "*Herbarium or Herbalist"* in 1562 in Prague with the publisher George Melantrich of Aventin. The herbarium was originally made as a comment of the above-mentioned Dioscorides' work "*De materia medica"*. Mattioli, however, kept extending the book constantly, so each successive edition from the period of his life was more comprehensive than the previous one. The German translation of this book was published in 1563, the Italian one in 1564 and the Latin one in 1574 in Venice.

In France in the 12th century there is a mention of the service tree in connection with so-called „energy revolution“ that was characterized, in particular, by the construction of mills, where mechanical properties of the service tree wood were appreciated (Moinet, 2009). A wonderful realistic representation of the service tree (see the figure on the front page of the chapter), probably the oldest one in the French art, can be found in the Bibliothèque nationale de France in the work “*The Grandes Heures of Anne of Brittany*” by Jean Bourdichon, made between 1503 and 1508. Charles Etienne in his “*Discourse on the fruit wines*” from 1577 describes the wine made from the service tree fruit as the oldest **fruit wine** used as a model for production of other fruit wines. **To England *Sorbus Domesticus* came from France in the 16th century** and is called “Service Tree” or colloquially “Witty Pear”. The name probably derives from its taste in unripe state.– *1508 (Moinet, 2009)*

In Germany, **Hildegarda of Bingen (1098 – 1179)**, Christian mystic, naturalist and physician, recommends the service tree as a fruit for medicinal purposes (Moinet, 2009). The first comprehensive description of the service tree can be found in printed books. In the edition of the book „*Hortus sanitatis*“ from 1485 by a German botanist and pharmacist **Johann Wonnecke von Kaub (1430-1504)** it is pointed out that the ripe service tree fruit must be cut before drying. The fruit can be used for healing intestinal disorders, moreover, in the book the service tree is compared to the medlar (*Mespilus germanica*). Bavarian botanist **Leonhart Fuchs (1501 – 1565)**, after whom the fuchsia plants are named, mentions the service tree in his Latin herbarium „*De historia Stirpium*“ (1542) among the fruit trees. Fuchs’ herbarium contains an illustration of the service tree accompanied by the description „Sorbus *datum* Spierling“. In the second edition from 1543 the same coloured woodcut is used with the description „Spierling CCCXXVII“. This is the first evidence of the German name of the service tree: **Spierling** (see figure). In the woodcut there is a representation of pear-shaped yellow fruits and also a particular representation of flowers or young leaves.

In Hungary the first documentary mention of the service tree as fruit species comes from 1055 from ***Nova hortum plantationum*** and deals with the origin of crop plants, centres of their cultivation from the earliest times (Surányi, 1985). Farmyards in the Roman province of Pannonia (today’s area of Hungary) produced large amount of fruit and wine together with the service trees (Gyulai, 2001). Seeds of the service tree have been found in a medieval well in the castle of Buda evidencing so the use of the service tree in this country also in the Middle Ages. Rapaics, 1940; Nyári, 2002 illustrate the fact that the service trees left as solitary became the **basis for fruit cultivation in the countryside**.

In Bohemia, the service trees are known from the 10 – 11th century when they used to be added to dishes – to porridges and sauces (Beranová, 2011). The oldest mention of the service tree in Czech dates back to 1517. **J. Černý** (1456 - 1530) in his book „*Medicinal book, which is called herbarium*“ writes the following: „*The service tree fruit, forest fruit, round, yellowish. The earth element reigns over it, hence its bitterness. It is a good dish for a wet stomach and intestines, it puts an end to fat disorders and stops fever from entering the head. It is a remedy for blood and food vomiting when having chill. Before eating it makes the food more consistent, after eating it makes it soften as bitterness causes contraction of the stomach.*” (Černý, 1981). The text is accompanied by an illustration of the service tree in blossom (see the figure). In 1554 Mattioli comes to Prague as the personal physician of the Archduke Ferdinand of Tyrol who significantly supported also the publication of the

herbarium (Bohatcová, 1993). For this reason the first print of Mattioli's herbal outside Italy was published in 1562 in the Czech translation by **Tadeáš Hájek z Hájku (1525 - 1600)** who completed it with his knowledge from Bohemia. In the description he clearly distinguishes botanical species: *oskeruše – woskeruše* (*Sorbus domestica*)*, jeřabina- ržeřabina* (*Sorbus aucuparia*)*, břek – břekyně (Sorbus torminalis)*. The scientific name ***Sorbus domestica*** is spread by print for the first time by means of this work. The interest in this publication was growing, so Daniel Adam z Veleslavína decided to publish new edition of the herbarium. Its translation was made by the professor of the Prague Medical Faculty, Adam Huber z Risenpachu. The woodcut illustrations had to be made new as Mattioli on his departure from Bohemia took the wooden blocks with him (see the figure). In another Czech translation of the herbarium from 1596 by **Adam Huaer from Riesenpach it is literally stated the following: „*The service tree is of two sexes, the male has round apples, the female oval ones.... Domestic or garden service tree is in Italy known tree, in Boemia it is rare and not known to all. In the garden of his Majesty Emporor in Prague several young trees can be found. The fruit is collected in spring, it is tied and hang out or laid down on straw or hay until it become bletted*".**

The service tree in modern times

The decline in growing the service trees can be noticed in the 18th century in records from France, Germany and Hungary. In 1793, the service tree can still be found in a French catalogue of goods as a tree suitable for alleys or wide streets; it is advised for its decorative appearance and fruits. Cultivation of the service trees in competition with intensive cultivation of the apple trees and vine in central France was maintained until the end of the 18th century – middle of the 19th century thanks to egalitarian tradition within inheritance land family law as evidenced by the regions of Sartre, Maine-et-Loire etc. with high concentration of toponyms "Le cormier" (Moinet, 2009). The service tree was a family tree for every purpose and was passed down from generation to generation; its wood, fruit and massive trees in the countryside had their value. At every little agricultural farm "*there are the service trees, quinces and medlars grown, even in small quantities*" as was written about the region of Sarthe to the west of Paris by J. Pesche in the middle of the 19th century. In the 19th century the wine from the service tree fruits becomes a mere substitute for the grape vine drunk by farm workers. In a lot of regions we can observe gradual disapperance of the service tree cultivation: in the middle of the 18th century in the region of Maine-et-Loire, Haut-Maine until the middle of the 19th century (in the region of Sartre). With the advent of the intensification of horticulture, foundation of production orchards and vineyards, the cultivation of the vine or pear and apple trees starts to be preferred to the service trees growing. Many service trees were also gradually destroyed during land consolidation. From the outcomes of the French Pomology Congress we can still in 1873 learn that the service tree fruits are amongst the fruits whose cultivation is recommended. In the following years, the service tree does not appear in catalogues anymore as it is not able to resist the competition of new varieties of apples and pears that have faster yield, bigger fruits, easier fruit processing and practical storage. The service trees were traditionally planted along hedges and roads, on the edge of gardens, on the boundaries of parcels etc., which did not comply with the new practice of fruit cultivation in intensive orchards. In such a way disappearance of the service trees cultivation was brought about. For this reason in France there cannot be found any fruit

orchard with the service trees in the modern sense, as it happens for the orchards with the apple and pear trees (Moinet, 2009).

Graph: Diameter of the trees in the region of Sarthe, where out of 600 trees the majority has the circumference of 160 – 200 cm which corresponds to the age of about 150 years and also to the period when still in the middle of the 19th century „the service trees were in fashion“ (Moinet, 2009).

In Germany, in the 18th century **Johann Ludwig Christian (1739-1813)**, pastor and pomologist from Kromberg, gives an accurate description of growing, variety and use of the service trees in the surroundings of Frankfurt am Main as a fresh or dried fruit and for the production of wine. Italian pomologist Tamaro in 1915 depicts the production of apple and pear cider (= fermented fruit juice), renowned in the surroundings of Frankfurt am Main, already only with addition of the service tree fruits that maintain the must clear and durable.

In Hungary, Rudinai Molnár István describes still in 1896 the service tree as a fruit tree without which the shelf life of the apple wine cannot be maintained. Also **Angyal Dezső** in the magazine *Ovocinár* (1905) cites the service tree as an excellent fruit tree given by grandparents to their grandchildren not only as a fruit tree but also as a source of income from the sale of its fruits. Later on it was not planted so often any more since the main problem was its late fertility as it is recalled in the book *„Prisoners of Good“* from 1908 written by **Géza Gárdonyi**: *„Do not plant the service tree, you will not live to its fruits“* (Bakay, 2013).

1. *Fig. First representation of sale of the service tree fruits by Giovanni Cadamosta, 15th century (reprofoto Kausch, 2000)*
2. *Fig. In 1553, Aldrovandi painted the service tree for the first time under the name Sorbus Domestica (Kausch, 2000)*
3. *Fig. Service tree twig from the work „The Grandes Heures of Anne of Brittany“ by Jean Bourdichon from France, dated 1503*
4. *Fig. The service tree represented in the 2nd edition of the Fuchs' herbarium from 1543 with yellow fruit and interesting flowers (Kausch, 2000)*
5. *Fig. First representation of the service tree in the Czech printed literature from 1517 (Černý, 1517)*
6. *Fig. Woodcut representing the service tree in the first edition of Mattioli´s herbarium from 1562 (Mattioli, 1562)*
7. *Fig. Coloured woodcut from the second Czech edition of Mattioli´s herbarium from 1596 (Mattioli, 1596)*

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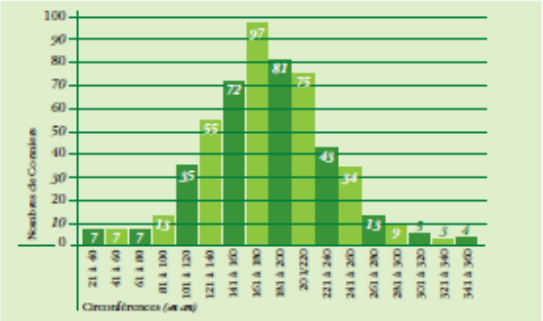

Nombre de cormiers suivant leur circonférence
(Inventaire SEPENES, déc. 2008)

Sorbus domestica L. in urban context and in landscape

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Introduction

In Slovakia *Sorbus domestica* L. (true service tree) is a part of the cultural landscape, where it is kept in cultivation mainly in the fruit growing and wine regions **(Fig. 1)**. This taxon belongs among the endangered species, which (due to the changes in utilization of landscape) gradually fell back from the species composition of the landscape greenery. Increasing mechanization of agricultural production, changes of the spatial structure of the orchards and vineyards, as well as the specific reproductive cycle of true service tree are the main reasons for decline of his taxon in the landscape.

Recently, the increasing attention is paid to *S. domestica* as a fruit bearing tree, which is a part of the regional gene pool of the fruit species. In Forestry it is interesting for timber production and increase of the species diversity in the mixed forest stands of warm oak communities. There is a lack of information about its utilization for plantings in urban areas, although there are warm and seasonally arid conditions that should be fit for this tree.

Results and discussion

Ecology and evaluation of the adaptive potential of Sorbus domestica

In Slovakia true service tree grows in the open landscape or in mixed oak stands, it even thrives in locations that have a negative water balance during the growing season (Paganová 2008). It is therefore assumed, that true service tree is tolerant to drought and high temperatures. In own research work we focused on experimental evaluation of the adaptive potential of *Sorbus domestica* to drought, mainly in the juvenile phase of growth.

The adaptive potential of *Sorbus domestica* has been experimentally evaluated under extreme conditions and its adaptability to water scarcity has also been assessed. The results of these studies have demonstrated that this species copes well under variable water conditions and adapts to hydrological changes in its habitat (Paganová & Jureková 2011, 2012).

The obtained results show that *Sorbus domestica* is relatively fast growing tree, which produces a lot of biomass. Lack of water resulted to decrease in accumulation of dry matter in above-ground organs **(Fig. 2 and 3).** Under the impact of drought this tree effectively invested to growth of underground organs and formed fine roots and thinner leaves (Paganová & Jureková 2014, Paganová et al. 2014). Even with a lower content of available water in the substrate it is able to maintain higher water content in the organs, including the leaves.

Is Sorbus domestica a suitable specimen for plantings in urban conditions?

Trees represent significant eco-stabilizing and aesthetic elements in urban areas. However, their use is limited by their adaptability to the extreme conditions of urban settlements. There is a need for a species of tree that could survive in extreme environmental conditions and provide the expected environmental and social benefits. Based on the information mentioned

abov, we consider *Sorbus domestica* to be prospective woody plant for plantings in urban areas, where are extreme microclimatic, soil and hydrological conditions. *Sorbus domestica* can be planted as a single tree with a large crown, as well as in rows with other greenery or within group plantings, where it displays distinctive seasonal colors. The adult trees usually grow to reach large dimensions and have a significant impact on local conditions; however, the application of true service trees is limited on streets or in pedestrian zones due to fruit droppings.

Analysis of the parameters of tree canopy of *Sorbus domestica* in the landscape

Within the field study the quantitative parameters of *Sorbus domestica* trees growing in the open landscape were evaluated. The aim of the study was the evaluation of the selected dendrometric parameters and assessment of their relationship to some phenotypes of *S. domestica* as well as identification of the dendrometric parameters that are significant for the selection of the phenotypes for urban conditions.

The highest values of crown diameter, but also the highest values of crown projection area had trees with umbrella-shaped and hemispherical crown. Individuals with large canopy provide shading to the largest area and should provide significant environmental benefits in urban conditions. On the other hand, trees with conical **(Fig. 4 and 5)** and spherical crown had the lowest mean values of the crown diameter. The crowns were more compact, without substantial irregularities in the canopy density. Such trees can be planted in urban areas with limited space.

The most significant parameter representing the growth habit of analysed individuals of *S.domestica* L. is crown diameter. This parameter has the highest statistically significant influence on differentiation of analysed trees in terms of crown architecture, as well as on other derived quantitative parameters (crown projection area and crown volume).

Selection of tree species for plantings in urban conditions is often determined by crown dimensions represented by crown volume. Crown volume defines the capacity of ecological impact of a tree on a site and its effect on the microclimate. Within the analysed group of trees, the crown volume as a parameter influencing the spatial disposition of trees is significantly correlated with diameter at breast height. It is a moderately strong relationship described by an exponential function. In the specific environmental conditions of open landscape, high values of the crown volume (above 2000 m3) were recorded not only for the thickest trees, but also for individuals with diameter oscillating from 80 to 90 cm (Paganová et al. 2015).

According to presented study, the crown architecture of *S.domestica* is less influenced by environmental conditions than diameter increment. This is very important information for establishment and future management of the qualified sources of reproductive material of *S. domestica*.

Conclusions

The results of our experimental research show that *S.domestica* has well managed its internal water status even under water scarcity.

The crown diameter and crown shape ratio (the ratio of crown length and crown diameter) are significant quantitative parameters that represent dimensional characteristics of the crown canopy of the service tree. Their application within selection of the phenotypes for urban

greenery is justified in relation to spatial volume and microclimatic influence of this woody plant in urban areas.

Phenotypes suitable for plantings in urban areas come directly from original stands in the landscape. Some of them can be used as plus trees for establishment of the selected and qualified sources of this tree species. In the near future we are going to carry out plantings of *S.domestica* on the selected areas in town Nitra. The objective is to evaluate establishment and growth of young saplings under conditions of urban settlements and verify the results of our experimental research in practical application.

Fig. 1 *Sorbus domestica* in the vineyard of Jelenec (Slovakia). The tree with umbrella-shaped crown, height 12.5 m, crown diameter 18 m, stem girth at breast height 2.68m

Fig. 2 and 3 One-year seedlings of *Sorbus domestica* maintained under differentiated water regime with the substrate saturation on 60% (Fig2) and 30% (Fig. 3) of the full water capacity.

Fig. 4 *Sorbus domestica* from Žemberovce (Slovakia) with conical shape of crown - phenotype, that is suitable for plantings in urban spaces (height 10 m, crown diameter 12.6m, stem girth at breast height 1.69m)

Fig. 5 Young, (8 years old tree) with ovate shape of crown, that is typical for *Sorbus domestica* in the juvenile stage of growth.

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Distribution and reproduction method of Service Tree

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Abstract

This report is focused on the generative and vegetative reproduction of Service tree (*Sorbus domestica* L.) and methods of its plantations. The introduction describes the importance, distribution, ecological and growing demands of this plant. Generative reproduction methods describe the stratification, sowing and seedling preparation. Vegetative reproduction methods are focused on stem cutting, root cutting and autoplastic transplantations. Part of this report documents the establishment of seed plantation in 2001 where 77 clones were collected (182 autoplastic transplantations trees). The origin of more than half (42 clones) of this trees is forest and rest (35 clones) grows as solitary trees.

Introduction

In the southeast of Moravia, the service tree can be found not only in agricultural countryside but also in forests. Forestry and Game Management Research Institute in Kunovice realized a project (Rescues gene pools chosen broadleaves growing in natural forests South Moravian vales and Moravian Carpats) in 1995 – 1999 which was dedicated to *Sorbus dosmestica* issue.

It was discovered, during mapping of *Sorbus domestica* in Moravia, that the future of this broadleaves was better secured in an agricultural landscape. The foresters (with only a few exceptions) do not take this tree into account, although there are several locations available for its first and second vegetation degree. The reproduction material is very important for conservation of this rare timber species. The very first experience with reproduction of service tree was described in the monography „Die Speiierling (Kausch, 2000). Forestry and Game Management Research Institute (VULHM) validated a methodology of seeds preparation, its stratification and growing. 15 000 of seedlings was produced during this project, which were planted in forests. The reproduction of the service tree was validated by autoplastic transplantation, too.

The service tree is heliophile, termophile plant, which prefers localities rich on nutrients and dry soil. On the other hand, this tree is able to grow in stony and calcareous soil. The service tree was detected in the Moravian Carpathians forests predominantly in the oak and beech-oak growth at altitudes from 160 to 480 meters above sea level. *Sorbus domestica* is very resistant fruit and timber tree which is possible to be planted in city centers (Paganová & Pagan, 1998). Trees are able to survive strong frosts as the eldest trees can prove because they survived 300 – 500 years in a good climate region.

Fruit from service tree was used as a home medicine in history for: hight volume of minerals, organic acids, pectin and tannins (Bignami, 1998). In the nature, forest fruit is popular part of diet birds and other animals. The serveice tree starts producing its first fruits after 8 – 12 years. Full grown trees produce fruits weighting 5 – 20 g. It usually yields twice in three years.

Trees distribution in the middle of Europe is on the borders of natural areas. In the Czech republic, the service tree grows in Czech central mountains, more often in localities in southeast of Moravia: Palava hills, White Carpathian (south to Vlára valley), Luhačovické and Hlucké hills, Vizovice mountains, Chřiby mountains and Zdánice forest. The service tree is the least distributed broadleaves in the Moravian Carpathians forests.

Generative reproduction

It is optimal to keep the clean seeds from mature fruits (no fermented) in a closed box in the fridge. High moisture and temperature around 4°C are important for the Stratification method. Seeds are very sensitive for fungal illness so it is crucial to use a closed box with wet filtration paper (or cotton wool). This method enables periodic checks which allow to continuously remove empty and dead seeds (fusariosis). It is possible to check moisture at the same time. Time of seed stratification differs from 13 to 19 weeks. The beginning of stratification needs to be adjusted for spring germinations. It is different for heating greenhouse, cold greenhouse or plastic greenhouse. The following chart compares different times for the beginning of stratification (for average 16 weeks).

Locality	**Heating greenhouse**	**Cold greenhouse**	**Plastic greenhouse**	**Outside**
Start of Stratification	1. – 5th November	about 15th December	1. -5th January	around 15th January
estimated sowing seeds	Beginning of March	Half of April	Beginning of May	Half of May

Germination is mostly in the range from 45% to 90%. It was verified that the seeds can be stored for three years at -20 ° C without significant decrease in germination. However, the germination energy usually decreases in the third year.

The best option is to sow germination seeds individually into special substrate (horticultural substrate) into peat-cellulose pots (the size 10 x 10 x 12 cm). It is possible to use small plastic pots. Seedlings grow 2-3 months in these pots. It is not recommended to sow directly into the soil because of frequent falling of the seedlings

Pre-cultivated seedlings in the greenhouse are suitable for further cultivation. They can be transplanted into deep containers then transferable to a sunny, initially more shade habitats with sufficient air exchange. It is also possible to put the pre-cultivated seedlings into open ground but it is necessary to take the slowdown in growth after transplanting into account. The seedlings from the greenhouse can reach to an average height of 170 cm (diameter about 120 cm) in one growing season. They are therefore suitable for planting on habitat, while there are not deformed roots in packagings. It should be noted that the service tree seedlings often suffer from fungal diseases in the first two to three years, which causes increased mortality or growth retardation in the subsequent planting on unsuitable habitat.

Vegetative reproduction

Reproduction of root and stem cuttings

The most common form of rejuvenation of service tree in the nature is recovery root shoots (Prudič, 1998). It ensures the maintaining of the *Sorbus domestica* in this place but not its dispersion. The ability of the service tree to produce root shoots can be used for breeding root cuttings. Necessary parts of roots are obtained from four to five-grown seedlings. Roots size is about 7 mm (cut length 5-8 cm) are stuck into a mixture of peat and sand, the upper part of the pulp is covered with 2-4 cm of soil. It is necessary to protect service trees from strong frosts with a layer of leaves or brushwood during winter. In early March, container with cuttings should be placed in a hot and sunny position, the best place is a greenhouse. Thus resulting seedlings are more balanced in their height than other seedlings (Dagenbach, 1981). Some trees are known to be able to produce root cuttings more easily than others. It can be problematical with old trees because it is quite difficult to dig their roots out.

It is possible to multiple service tree also by herbaceous cuttings in equipped garden plants. One-year, matured (axial) cuttings, with length of 10 to 15 cm are taken from the young seedlings or saplings. These are stored in a special substrate (mixture of peat and sand or Agroperlit 1: 1), where they root. It is necessary to stable the soil and high air moisture. This seedlings or saplings are planted in suitable containers and further cultivated. In the first year, seedlings grow to about 30-50 cm (Čížková, 1997).

Grafting and inoculation

Grafting or inoculation is most commonly used to maintain the properties of the selected service tree. Young service tree is exclusively used for seedling rootstock, other sometimes recommended species (*Sorbus aria*, crataegus, etc.) are proved to be completely inappropriate. Budding shoots or branches is ideal for grafting. It is necessary to collect the grafts no later than at the end of February. Inoculation is carried on sleeping eye for the choir in July-August. If not enough sap, Forkertovo inoculation is used.

Establishment of seed plantation

Genetic pool material was selected for generative and vegetative reproduction during inventarisation of distribution service tree in southeast Moravian region. In 2001, as part of ex situ rescue, seed orchard of service tree was planted in LZ Židlochovice, 77 clones were collected there (182 grafted). Out of these clones, 42 are native to forests and 35 from trees growing outside the forest. The orchard will serve as a basic material for natural forest areas 35 - South Moravian vales, 36 - Central Moravian Carpathians and 38 - White Carpathian Mountains and Vizovice Mountains.

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Does molecular diversity generally decrease from South to North? Contrasting results from a rare and scattered forest tree (*Sorbus domestica L.*)

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Abstract and theory:

During past ice ages, many tree species persisted with limited distributions in southern refugia where climate conditions were less severe. When climate changed towards warmer conditions and ice shields retreated, species started to spread northwards and populations increased in number and size. However, due to numerous stochastic processes (founder events, drift, etc.) populations often went through genetic bottlenecks, which resulted in loss of alleles and increased homozygosity. This phenomenon is more commonly known as ‚*southern richness and northern purity*‘ and was first outlined by G.M. Hewitt in 1999. As a consequence, populations that are located more distantly from their potential refugia are supposed to encompass less genetic diversity than those that are located nearby. We show here, that this pattern must not necessarily hold true for all tree species, especially when important evolutionary mechanisms have evolved, that might have helped to cope with small census size and limited availability of mating partners. We investigated the true service tree (*Sorbus domestica* L.), one of the rarest European tree species, regarding its range-wide genetic make-up and population structure.

In-vitro reproduction of *Sorbus domestica*

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Introduction

Sorbus domestica L. (service tree) belongs to the Rosaceae family, and is native species to Central Europe and South Europe, Asia Minor and the North Africa. It is cultivated as a fruit tree. The fruits are used mainly for the production of spirits, but also for the production of marmalade and fresh consumption. Trees are long-lived and provide hardwood (Zahradnický slovník, 2001). The service tree is a photophilous and thermophilic species, resistant to drought, with a high potential for use within the landscape arrangements (Paganová, 2008).

The service tree is a protected species in Hungary and Switzerland not in the Czech Republic and Slovakia (Jašková, 2009).

Results and discussion

Conventional propagation

Propagation of this species is mainly accomplished by seed. Stratification of seeds is necessary. Selected types can be successfully propagated by grafting on different rootstocks: e.g. on *Pyrus communis* (Bärtels, 1988), *Sorbus aucuparia* (Zahradnický slovník, 2001) or *Crataegus* (Hrdoušek et al., 2003). Vegetative propagation by grafting is difficult and not economically convenient (Scortichini, 1988).

***In vitro* cultures can be an attractive alternative for preserving clonal germplasm of recalcitrant species and an increase in reproduction rate of valuable genotypes** (Hartmann et al., 2011).

Micropropagation

The genepool of many noble hardwoods is subjected to extensive conservation efforts due to the rare occurrence, devastation of wild population, and a demand for quality hardwood. Tissue culture techniques, which enable an increased reproduction rate and conservation of valuable ornamental and rare genotypes, are an alternative to vegetative propagation methods (Šedivá, 2012). In the past years the organogenic micropropagation of the juvenile planting stock dominated, recently *in vitro* regeneration of proven mature trees extends to a wider range of genotypes within the group. Tree improvement and clonal propagation of noble hardwoods allows an increase in the availability and commercialization of selected genotypes carrying desired traits, mainly in rarely occurring species such as service trees (Ďurkovič and Mišalová, 2008). *In vitro* propagation allows large-scale production of plants and may provide rejuvenated plants with a high rooting capacity (Hackett and Murray, 1993).

Micropropagation protocol was reported in *S. domestica*, *in vitro* cultures were achieved from both juvenile and mature plant material (Arrillaga et al., 1991; Dujíčková et al., 1991; Meier-Dinkel, 1998; Miko et al., 2004; Nikolaou et al., 2008, Ďurkovič a Mišalová, 2009; Malá et al., 2011; Piagnani et al.,

2012). *In vitro* capacity is affected by the age of donor plants and clones. Malá et al. (2011) reported 70–80 % rooting frequency in the service tree after 4–6 weeks.

Micropropagation of service tree

In our institute in Průhonice (RILOG), the research on micropropagation of service tree has started in 2012. We established four genotypes from elite mature trees from Žerotín and Tvarožná Lhota localities (Hrdoušek et al., 2014). Young plants were derived successfully from *in vitro* cultures by organogenesis (from an apical bud, Fig. 1). Root induction ranged from 26 % to 83 %, dependence on the clone.

Conclusions

Results shows some possibility, that *In vitro* propagation allows large-scale production of plants service tree (*S. domestica)* and may provide rejuvenated plants with a high rooting capacity.

Future goals

Raising money for research In the research area:

Collect valuable genotypes of the service tree for fruit-growing under *in vitro* conditions.

Optimize micropropagation protocol for selected genotypes.

Fig. Proces of micropropagation of the service tree in RILOG Průhonice




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True service tree in Hungarian forests

Kiss Balázs (HU), Bakay Ladislav (SK)

Introduction

According to Bartha et Sonnenvend (2014) the true service tree has its place in Hungarian forests. It's a scattered broadleaved tree species, which prefers warm, xerophytic oak – turkish oak stands. From time to time some specimens can be found also in hornbeam – oak stands. It can be found scarcely in forest steppes or shrub lands, oak stands with acidic soil, where its ecological optimum is not present. In the last decades Hungarian foresters recognize the importance of true service trees and when a specimen is found in a stand it is kept as a seed tree. Two case studies are mentioned in the coming text. The first case study presents the findings of Bakay (2010) from his mapping of true service tree in Börzsöny and the second case study presents the true service tree orchard planted by Balázs Kiss in Pilismarót.

Results Case study 1:True service tree (*Sorbus domestica* L.) in the BÖRZSÖNY (L. Bakay)

In total we found in the mountains Börzsöny 39 localities with 158 specimen of true service tree. The most found specimens grew on S, SW, W slopes (Fig. 1.), which proofs the drought tolerance of the true service tree described by Paganová (2008).From the total amount of 158 specimen 22% (35 specimens) were seedlings or root suckers and only 38% (60 specimens) were fruiting. The monitored individuals had an average height 6, 13m, the average crown diameter was 4, 15m and the average trunk diameter in the height 1,3m was 15, 6cm. The highest specimen grows in the stand in the locality Ötperces pihenő with a height of 16 m. We determined 4 fruit forms from 60 fruiting specimen according the methods of Pénzes (1959) and Karpáti (1961): f. maliformis (29 specimen), f. pyriformis (25 specimen), f. micropyriformis (3 specimen), f. zemplinensis (3 specimen). The locality with the highest altitude was at Kecske-hát Bérc (610 m. a. s. l.), with a fruiting and vital specimen. The largest individual was found in Diósjenő in the locality Szőllőhegy (d1,3m=74cm) in urbanized landscape. The largest individual in stand was present in the locality Hársas (d1,3m=34,5 cm). After the evaluation we found that the locality with the highest abundance of true service individuals was Madaras oldal in the forestry district Királyrét. We found 15 mature individuals. The results from the view of position of individuals in the stand were following: 23% were classified as 1 (seedlings and root suckers); 13% were individuals with low potential to reach the canopy layer 2; 22% were classified as individuals with a potential to reach the canopy layer; the majority of individuals (30%) was in the canopy layer and only 13% of individuals were above the canopy layer. From the view of population biology only those individuals can fruit which are in the canopy layer or above it. From 39 localities 20 didn't show any presence of seedlings or vegetative reproduction by root suckers due to the fact that the individuals didn't fruit. The fruiting stage of a true service tree individual can be influenced only by a change of light conditions in the stand, which can be done by thinning or cuts. The fruiting stage of the true service tree individuals is the vital part of the conservation

– seeds are spread around effectively with help of forest fauna. Close to nature management and nature protection policy in these stands allows circle cuts. In the forests of Börzsöny Ipoly Erdő Zrt. Decided to implement circle cuts around scattered broadleaved trees as true service tree and wild service tree to improve their population biology. This pilot project was started in the 1990s in the forestry district Királyrét and seems to be very effective due higher abundance of young wild service trees and true service trees. The forestry district Királyrét managed the area with the most individuals of true service trees .

Our results show similar findings as Benedíková et Kyseláková (2005): Inventarization: all true service tree individuals have to be marked, with a given mark agreed by the local forestry district, localization with GPS tools In young stands selective thinning is important to create optimal light conditios for yound true service tree individuals, which have a low growth potential in the youth and can be easily overgrown by other forest species. Older pine (Pinus sylvestris L., P. nigra Arnold)or larch (Larix decidua Mill.) stands with higher amount of infiltrated light under the canopy layer can provide good growing conditions for true service tree individuals. In adult stands a circle cut around the true service tree individual is essential. The diameter of the circle cut must be minimally 2/3 of the height of the canopy layer. Increased light induces fruiting of the individual, what is a basic condition for its generative reproduction. The active variant would include monitoring of the individuals and supporting their growth and fruiting. We have to keep in mind that the true service tree produces a high amount of root suckers which can take over. These suckers are mostly grazed by deer, so on exposed slopes it is the only way to conserve a true service tree individual to build a fence around the existing root suckers. Close to nature management of forest can have negative effects on scattered broadleaved tree species. As Spiecker et al. (1996) writes new trends in forest management lead to the fact that forest stands are taller and darker, caused by transforming stands from coppice forests to stands with generative renewal. This trend demonstrates a need of forestry interventions and active in situ conservation methods in stands with the presence of true service tree individuals.

<u>Results</u> Case study 2: The true service tree (*Sorbus domestica* L.) in the Danube Bend (Kiss Balázs)

How it started: In 1985 i was responsible for the delivery of planting stock for the forestry company Pilisi Parkerdőgazdaság. The Hungarian Ministry of Agriculture gave us the task to give a report about the status of the true service tree population int he area managed by the forestry company. This report was forwarded to prof. Schmeling, an true service tree enthusiast teaching at the University in Göttingen. The first mapping showed scarce results. Just 5 adult specimens were found. The first action awakened in our forester colleagues' curiosity towards this specie, which lead to 125 monitored true service tree specimens at the end of the millennium. So my task was to monitor and evaluate the properties of these trees. Dendrometrical and pomological data were collected and the results lead to a recommendation, that it would be worthy to graft individuals with favorable properties for a true service tree orchard. The fruit is used in Germany for making dried fruit, but the distillate is better known and requested. A 2 ha area was chosen for the orchard and due to high numbers of deer it had to be fenced. The saplings were planted in a 7 x 7 m-grid in 24.-25.

April 2002.The total number of planted saplings was 355. I was supported by my colleagues, who marked each true service tree int he nearby forests. I started to graft in 2008, the grafting technique chosen was cleft grafting. The plan was to make 45 grafted plants from one mother tree. In 2008 i ve done 2 mother trees, in 2009 one mother tree and 2011 also one mother tree. In 2012 a new idea came in. In 2012 my colleague started to prepare his book about the true service tree, where he presented his findings. He monitored not only the Hungarian territory but also the whole Carpathian basin. This made my to start a conservation project, where I decreased the number of grafted plants from one mother tree to 9. So I increased the 9 Hungarian mother trees with 9 more and 6 mother trees from abroad. My goal is to gather those mother trees, which have large fruits, but i m also opened for new ideas and suggestions.More grafted specimens from the orchard gave fruit, but this year (2015) frost damaged the flowers. This orchard is part of an ongoing process, but its number one goal is conservation, but t gives also opportunities for different research.

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Distribution and charakteristics of service tree (*Sorbus domestica* L.) at Slovak and Czech site of the White Carpathians

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The White Carpathians

The White Carpathians (Czech: Bílé Karpaty; Slovak: Biele Karpaty) are a mountain range on the border of the Czech Republic and Slovakia, part of the Carpathians. This land is affected by human activity for hundreds of years, so lanscape character has been changed. Meadows and grasslands represent big part of this country. Most of the area belongs to the Biele Karpaty Protected Landscape Area, both at Slovak and Czech site.

Servite tree and its use

Service tree (*Sorbus domestica* L.) is a broad-leaved deciduous tree from Roseaceae family, which is considred to be the biggest fruit tree in Europe. We recognize 2 ecotypes of the species – service tree as a solitaire individual, which grows in an open landscape (high of the tree is 15 – 20 m) and service tree as a tree in the forests (high of the tree can be 30 m). Lots of individuals grows at the edge of th forest or at balks, so i tis difficult to type them.

In the past, mainly wood and fruits from the tree were used. Tree has a pomiferus fruits (1,5 – 4 cm long), which vary in shape and colour and are the biggest ones from all *Sorbus* fruits. One tree can give from 500 to 1200 g of fruit per year (HRDOUŠEK et al., 2014). They are used in medicine, food processing, (marmelades, wines, dried fruit) and for first-rate spirit production. Wood of service tree has colour of sand, sometime in red shade, in colour and cahracteristics is similiar to *Sorbus torminalis*, which is more common one. It is the heaviest wood from the european tree species with specifical heaviness 800 kg/m³ (KAUSCH, 2000). In the past the wood was used for making the furniture, houshold utillities, decorative articles, shuttles and other accessories. Nowadays, service tree is grown in woods thanks to foresters, who want to use its quality timber.

Service tree in the White Carpathians – Slovak site

The research at Slovak site was realized in counties of Trenčín and Nové Mesto nad Váhom in 2012 (UHERKOVÁ, 2013), that means 15 cadasters in White Carpathians , it´s fothills and in a valley of river Váh (called Považské Podolie). The mapping of service tree continued also in 2013 and 2014 wihin the White Carpathians´ Fruit Treassure Project in 21 cadasters (JAKUBEC et al., 2015). In totally, research was realized in cadasters: 1. Stará Turá, 2. Lubina, 3. Bzince pod Javorinou, 4. Moravské Lieskové, 5. Nová Bošáca, 6. Zemianske Podhradie, 7. Bošáca, 8. Ivanovce, 9. Melčice - Lieskové, 10. Štvrtok, 11. Adamovské Kochanovce, 12. Chocholná - Velčice, 13. Drietoma, 14. Kostolná - Záriečie, 15. Horná Súča, 16. Dolná Súča, 17. Nemšová, 18. Horné Srnie, 19. Krivoklát, 20. Vršatské Podhradie, 21. Mikušovce, 22. Červený Kameň, 23. Lednica during 3 mapping seasons.

Thanks to the local people, foresters, preservationits, botanics and pomiculturists 224 individuals of service tree was found in 2012. These trees had a girth of a trunk 40 cm at minimum. The biggest appearance of the species was found in Moravské Lieskové (53 individuals). Abundant in service tree presence were also cadasters of Bošáca (48 individuals) and Chocholná - Večice (26 individuals). In the rest of cadasterd it was determined less than 20 individuals.

Other 174 individuals was determined in the project White Carpathians´ Fruit Treassure, so the number of this species in the White Carpathians is 383 individuals at minimum. Most of the trees founded during the project grows in cadasters Nová Bošáca (40) and Bzince pod Javorinou (35). There were no discoveries of the species in 5 cadasters. Registred trees have been growing usually in opend landscape, as solitairs or landscape dominants. The rest of the individuals have been recorded in forests, its margins or in old orchards without management. The most monumental and probably the oldest tree was registred in Zábudišová – Bošáca cadaster. This tree is called Zicháček´s service tree and its trunk girth is 4,2 m. The second biggest tree with the trunk girth 4 m grows in Moravské Lieskové cadaster. In term of the high of serviec trees, most of the noticed ones belonged to the cathegory 10,1 - 15 m (42.9 % of idividuals) and the biggest ones were dicsovered in Horná Súča cadaster (18,5 - 22 m). The trunk girth was 1,01 - 2 m (56,7 %) within the most of them.

Last but not least, the shape of fruits was noticed (BIGNAMI,1998) and classified into cathegories: flattened, spherodial, pyriform, conical, egg-shaped and elliptical. 48,6 % of fruits in the Slovak site of the Whit Carpathians was cathegorizied as conical ones. Spherodial shape was the most second frequented shape (20,9 %). In 2012 only 6% of noticed individuals had no fruits (fertile year), but in 2013 and 2014, it was 54% .

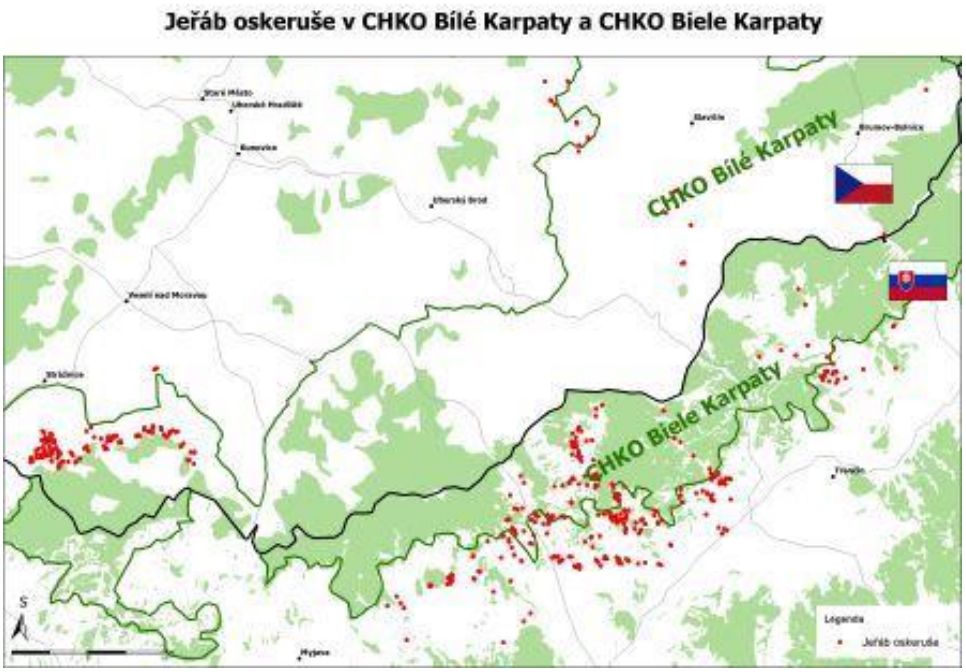
Service tree in White Carpathians – Czech site

On the Czech Union for Nature Conservation (ČSOP) initiative the research on service tree distribuition was realized in the seasons 1991 – 1992. In this research, approximately 100 of trees have been studied. Re-controll in 1996 – 1997 have shown, that more than one third of individuals was in the bad health condition or almost gone. That was the reason to start the project ´Service trees tretment in south-west part of White Carpathians´, so the most endangered trees have been treated. Moreover, the cooperation with the Forestry and Game Management Research Institute started.

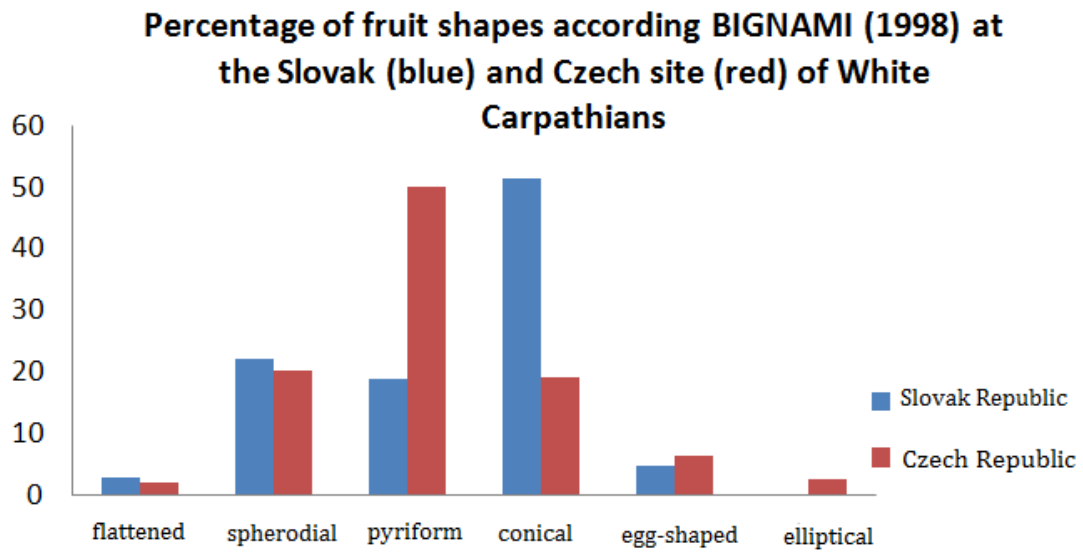
Following research was relized from 1997 to 1999 (ČÍŽKOVÁ, 1999). These mapping seasons were focused on service tree using in forestry. More detailed survey was realized in 2008 (ŠPÍŠEK, 2009) and was focused on the Service tree presence both in the forests., as well as in the open landscape. Totally, 180 individulas of service tree, with trunk diameter at least 15 cm, is in evidence.

This species is present mainly in southern part of White Carpathians (88,3 %), in cadasters Petrov, Radějov, Tvarožná Lhota, Kněždub, Hroznová Lhota, Hrubá Vrbka and Kuželov. Service tree is rare in the middle and nothern part of White Carpathians Landscape Protected Area, in cadasters Pitín, Sidinie and Luhačovice. The biggest tree of Moravian site of White carpathians, called ´Adamec´s Service tree´, grows in the vineyard of Žerotín hill. It is 11 m height, 18 m wide tree with trunk girth of 4,65 m in 2013 (HRDOUŠEK et al. 2014).

Map no. 1: Distribution of Service tree at the Slovak and Czech site of The White Carpathians (Z. ŠPÍŠEK)



Most of the trees are solitairs, growing on grasslands, balks or old vineyards. It is rare to find Service tree in the forest, and if, mainly in open ones or at the edge of them. At the Czech site, also the variability of ross was explored and classified into these cathegories: peeled in scales 15 %, peeled in strips (43,3 %), cube-grooved 41,7 %. In 2008 the research was focused also on shape variability of fruits, while the sample came from 158 trees. Fruits were cathegorised into 6 shape types (BIGNAMI, 1998): pyriform (49,9%), spherodial (203%), conical (19%), egg-shaped (6,4%), elliptical (2,5%), flattened (1,9%) (ŠPÍŠEK, 2009). The healt condition according to reserach from 2005 – 2011 got worse. The juvenile individuals are missing in the area (ŠPÍŠEK, 2011; HRDOUŠEK et al. 2014).



Comparison of the presence and charactestistics of Sorbus domestica

Research showed that service tree grows in similiar biotops at the both sites of White Carpathians. Solitairs growing in an open landscape are more frequented than trees in closed forests. This can be considered as an evidence, that service tree have been used as a fruit tree. The most interesting is fruit shapes comparison (BIGNAMI, 1998). Fruit from Slovak and Czech trees varies mainly in the pyriform and conical shape. Pyriform one is dominanta at the Czech site, meanwhile conical one at Slovak site. Both making up approximately half of all individuals at both sites. Elliptical shape was not found at slovak site, but it represents ,% of fruits at the czech site.

There is a lack of juvenile trees at the both sites of the White Carpathians and the older ones are in bad health condition. Most of them reuire care giving.

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Physiological properties of service tree (*Sorbus domestica* L.) seeds as affected by fruit size

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Materials and methods

Service tree fruits were collected from solitary tree in area of Vukomeričke gorice (Kravarsko) in autumn during 2011. 150 fruits were collected for analysis and were grouped on the basis of weight like small (5-10 g), medium large (11-15 g) and large (16-20 g). The length (mm) and width (mm) of fruits was measured using digital caliper and fruit weight was measured with laboratory balance "Sartorius" (accuracy 0.01 g). The seeds from fruits were separated manually with the help of little knife and number of full seeds in every fruit was determined. After drying the seeds on air-dry space the weight of each of 309 seeds, which were obtained from 150 fruits, was measured. The seeds were then used for stratification on 30.03.2012. The seeds were moistened before the stratification and placed on an absorbing filter paper before using them for stratification. Every seed was coded for recognition of its origin. The seeds were placed on moistened filter paper with covering of another layer of moistened filter paper to avoid draining problem. Stratification was carried out at temperature of 3ºC and lasted in total for 120 days in accordance with rules of ISTA for overcoming seed dormancy from species of genus *Sorbus* L. The moistening of filter paper was continued as per need during the stratification time. After 120 days at the end of stratification period the weight of each seed was measured to calculate the percentage of water absorption. The daily monitoring of seeds was performed in order to determine the moment of seed shell bursting and radicle emergence till the length of 2 mm (*sensu stricto*) during entire stratification period. The increase in length after radicle cracking was taken on daily basis using digital caliper. The radicle length after 120 days of stratification is described in detail in current study. The Statistical analysis was performed with statistical package SAS 9.2.

Results

The descriptive statistical data for some morphological characteristics of service tree fruits with different weight is shown in table 1. Statistically significant differences were determined in length (mm) and width (mm) of fruits with different weight ($p<.0.0001$). Small fruits showed statistically significant difference ($p<.0.0001$) having highest fruit shape index (0.98) in comparison with medium large (0.94) and large (0.91) fruits, and thus can be concluded that small fruits have more round shape. Number of full seeds in fruit was statistically significantly ($p<.0.0001$) highest in large fruits (2.62 piece) in comparison with medium large (1.81 peace) and small (1.46 peace) fruits.

Statistically significant difference ($p<0.0006$) was obtained in length of seed radicle from fruits with different weight after 120 days of stratification. Seeds from large fruits had statistically significant higher length of radicle (3.89 mm) than seed from small (2.88 mm) and medium large (3.27 mm) fruits. Considering the percentage of water absorption after 120 days of stratification no significant difference was obtained in seed from fruits with different weight ($p=0.2896$). Weight of one air-dry seed was statistically significantly different considering fruit weight ($p<0.0006$). it was noticed that seed weight increased with fruit weight. No statistically significant difference was obtained in mean germination time (MGT) from fruits with different weight even if seeds from large fruits germinated four days earlier than seeds from medium large fruits and 3 days earlier than seeds from small fruits. Mean germination time for seeds from all fruits was in average 107 days.

In the case of seeds form small fruits positive and statistically significant ($p<0.05$) correlation was obtained between radicle length after 120 days of stratification and percentage of water absorption ($r=0.46$). Negative and significant correlation ($r=-0,48$) was obtained between radicle length after 120 days of stratification and time needed for beginning of seed germination as well as between percentage of water absorption and seed weight in air-dry condition ($r=-0.32$). Positive and small ($r=0.39$) but statistically significant ($p<0.01$) correlation was obtained also between percentage of water absorption and time needed for beginning of seed germination.

For seeds from medium large fruits negative and significant ($r=-0.49$) correlation was obtained between length of radicle after 120 days of stratification and time needed for seed germination as well as between percentage of water absorption after 120 days of stratification and time needed for beginning of seed germination ($r=-0.33$). Difference was significant at $p<0.01$. Although negative and small, but statistically significant ($p<0.001$) correlation was obtained between percentage of water absorption after 120 days of stratification and seed weight in air-dry condition ($r=-0.32$).

For seeds from large fruits negative and high correlation was obtained between radicle length after 120 days of stratification and time needed for seed germination ($r=-0.79$). Correlation between percentage of water absorption and time needed for seed germination was negative and significant ($r=-0.45$). Differences were significant at $p<0.001$. There is positive and small, but statistically significant ($p<0.01$) correlation between radicle length after 120 days of stratification and percentage of water absorption after 120 days of stratification ($r=0.29$), and negative and small between percentage of water absorption after 120 days of stratification and seed weight in air-dry condition ($r=-0.26$).

After 120 days of stratification at 3ºC seed from large fruits (16-20 g) had highest percentage of germination (83.7 %). With the help of Hi-quadrat test statistically significant difference ($p<0.001$) was obtained in germination of seeds from fruits with different weight wherein seed germination from large fruits was statistically significant higher than seed germination from medium large (59.4 %) and small (56.2 %) fruits show in figure 1. It can be concluded that laboratory seed germination of service tree increases with the size of fruits.

Conclusion

Statistically significant differences were achieved in length and width of service tree fruits with different weight. Small fruits had statistically significant higher fruit shape index (0.98) than medium large (0.94) and large (0.91) from which can be concluded that small fruits have

more roundish shape. Number of full seeds in fruit was statistically significant higher for large fruits (2.62 piece) than medium large (1.81 piece) and small (1.46 piece) fruits. Within all fruits positive and very high correlation was obtained between fruit length and width (r=0.92), fruit length and weight (r=0.93) and fruit width and weight (r=0.98). There is negative and statistically significant correlation between fruit weight and fruit shape index (r=-0.47). Statistically significant difference was obtained in length of seed radicle from fruits of different weight after 120 days of stratification. Seeds from large fruits had statistically significant bigger radicle length (3.89 mm) than seed from small (2.88 mm) and medium large (3.27 mm) fruits. Weight of air-dry seed increases with fruit weight. No statistically significant difference was found in mean germination time (MGT) from fruits of different weight although seed from bigger fruits has germinated 4 days earlier than seed from medium large fruits and 3 days earlier than seed from small fruits. Average time of seed germination for all fruits was 107 days. On seed from all fruits negative and significant correlation (r=-0.66) was found between radicle length after 120 days of stratification and time needed for beginning of germination. With increase of seed weight in air-dry condition percentage of water absorption statistically significantly decreases. After 120 days of stratification at 3ºC, seed from large fruits (16-20 g) had highest percentage of germination (83.7%). Laboratory germination of service tree seed increases with fruit size.

Sorb tree variety selection at the Corvinus University of Budapest

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Introduction

Nowadays people are getting more and more interested in the fruits that are currently not in the production. One of these species is sorb-apple (*Sorbus domestica*). We would like to promote our fruit production to become richer with an almost forgotten fruit species.

The collection-work started in 1990. We collected propagation material all over Hungary. In our experiments the internal values of the fruits were measured and propagation studies were done

Materials an methods

The collection of the species was begun on the basis of the map of Kárpáti (1960) and local signs. Fruits and propagation material were collected.

The studies were morphological and the internal values were also measured. With the help of ICP-AES the cation compound of the fruits was also examined and compared with the results of apple and pear varieties.

The number of seeds per fruit was counted, and the germination ability was studied.

The fruit of *S. domestica* is very characteristic for the species, it size makes it discernible from *S. aucuparia*. This monotypic species does not show in most of its characteristics any difference, but the fruits can be very different. Hybridisation of *Sorbus domestica* with other *Sorbus species* is not known. This is very peculiar in the genus of *Sorbus*. Some separate varieties on morphological and anatomical basis (Terpó, 1987), Kárpáti (1960) writes about "forma"-s separated by the form and size of the fruit. The plants with wild cherry-size fruits are considered to be the basic species, the bigger ones are cultural varieties resulted from conscious selection.

Results and discussion

The trees of the collected genotypes are 15-20 m tall. The samples were picked at 3 different places: around Erdőbénye (North part of Hungary), Hévíz (at the lake of Balaton) and in the old elite orchard (Queen Elisabeth Base Plantage) of our University.

They all fit well in the system of Kárpáti (1960):

- **forma *domestica*: 1,5 – 2 cm fruits in diameter**
- **forma *pyrifera*: 3 cm fruits in diameter, pear shape**
- **forma *pomifera*: 3 cm fruits in diameter, apple shape.**

The 5th genotype belongs to forma *domestica*, to forma *pomirera* the number 2, 3, 4, 8. Number 2 and 7 are intermediate forms, number 6 is forma *pyrifera*. For good measure it has to be mentioned that the first genotype occurs as S. *macrocarpa* in a register book. This name is probably originating from the systems of Risso (1826) and Roemer (1847) (in Kárpáti 1960). They both specify more systematic units, like: *microcarpa, macrocarpa, elongata, albida* and *serotina*.

In our studies concerning internal values, it was proved that in the ripe fruits there are monosacharids. The fruits have pleasant sweet-sour taste that meets special demands. When overripe, the fruit is mellow (but still enjoyable) and it loses its ground and cover colour.

There is a considerably high cation content in the fruits, that is always higher than the nutrient content of apples and pears. Concerning propagation it was proved that on quince, *Crataegus*, pear and other *Sorbus* species the result of budding was doubtful, but on self seedlings it was about 100 % successful. Number of seeds are characteristic of the genotypes. In the genotypes 2, 7, 8 there were more seeds than is the others, these are suitable for rootstock production. The samples seem to be self-fertile but from the few number of seeds the following conclusion can be drawn: the embryos either malformed or we have to talk about *parthenocarpia*. This seems to be more probable as in the nature between the trees can be even kilometers, and as we know they are insect pollinated. The germination ability of the seeds is good, at least 80 %. In this characteristic there was no difference between the ecotypes.

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Pomology of Service tree

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The pomology of the service trees has not been comprehensively studied yet. In the following text available information regarding historical classification of the service tree types, cultivars and local varieties is treated. Moreover, there is a description of pomological types and varieties found in Europe. After further study and evaluation tests, it could be possible to recognize amongst them valuable fruit varieties.

THE OLDEST HISTORICAL INFORMATION

Pliny the Elder (23 – 79 AD) in his work "*Naturalis historia*" (77 AD) describes four types of the service tree fruits: round, conical and oblate, and as the fourth type he indicates *torminalis* – wild service tree (Ajasson, 1833). The famous and cited herbarium of the Italian doctor, Pietro Andrea Mattioli, that was translated in Czech by Tadeáš Hájek z Hájku (1525 – 1600) states about the service tree the following: „*Wosskerusse dwogiho gest pohlawi, totiž Samec a Samice a samým owotcem dělj se rozeznáwagj nebo Samec má Jablíčka okrouhlá a wonná, Samice obslužná gako wegce pobněgssi k hrušce chuti příkré a trpké a netak wonná*." (*Kočí 1926*). In this work the author wrongly considers the plant as dioecious, however, he correctly distinguishes apple-shaped fruits (*maliformis*) and pear-shaped fruits (*pyriformis*). To present day this simple pomological distinction between apple-shaped cultivars (*pomifera*) and pear-shaped cultivars (*pyriformis*) is generally applied (Hayne 2002).

ITALY

At the beginning of the 18th century the botanist and mycologist **Pier Antonio Micheli** (1679 – 1737) described and depicted various service tree cultivars for the Grand Duke of Tuscany. Rich variety distinction is illustrated by the fruiterer **Domenico Tamaro** (1859-1939) in his work „*Trattato di frutticoltura*" (Tamaro, 1915).

Table: Overview of the service tree cultivars from the 17th century by the botanist Micheli, as compiled by Cristina Bignami (1999) according to their representation.

Table: Overview of the service tree cultivars known in Italy at the beginning of the 20th century (Tamaro, 1915).

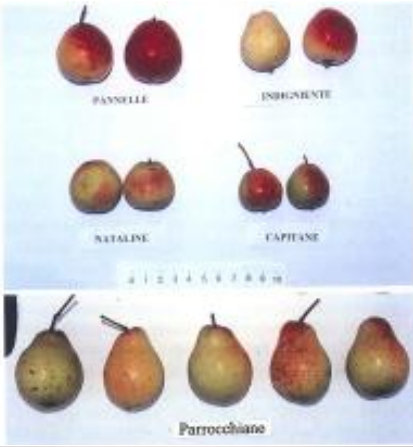
Apple-shaped service tree fruits	**Pear-shapped service tree fruits**
Sorba lazzeruola selvatica ottobrina (Canevazzi et Marconi, 1892) - wild small-berry variety, looking similar to hawthorn (*Crataegus azarolus*), ripening in October	Sorba pera settembrina maggiore (Canevazzi et Marconi, 1892) – ripening in September, larger
Sorba mela ottobrina maggiore (Canevazzi et Marconi, 1892) – service tree with maturity in October, larger fruits	**Sorba lunga mezzana** (Canevazzi et Marconi, 1892) – long, medium-sized
Sorba mela ottobrina (Canevazzi et Marconi, 1892) - service tree with maturity in October, medium-sized fruits	**Sorba pera ottobrina regata** (Canevazzi et Marconi, 1892) – ripening in October, marked with lines/grooves; small fruit with dark skin affected with russeting, ripening in winter in pantry
Sorba capitano di Somma (Pasquale) – fruit is roundish upside down (??), maturing between December and January	**Sorba pera tortora** (Canevazzi et Marconi, 1892) - small fruit, dark skin affected with russeting, ripening in winter in pantry
Sorbo a Panelle (Pasquale) – from the mountain Somma, the fruit is at maturity in August	
Sorba agostino (Pasquale) - growing in Naples, called also *Surovo agostegno*; small fruit, almost roundish, on one side red, maturing in August	
Sorbo autumnale (Pasquale) – autumnal service tree; flat-roundish fruit, on one side yellow, on the other side red; three times larger than *Sorba agostino*, ripening in September	
Sorba tardiva - late service tree, egg-shaped fruit, ripening in winter	
Sorba Varecchiare – located near the mountain Somma, at maturity between December and February	

Historical descriptions of the varieties have been compared to the fruits obtained from the field researches conducted mainly in southern Italy (Bignami, 1999). It appears that some varieties have been preserved until today. At least the following 5 varieties: **“Capitane”, “Panelle”, “Indignente”, “Parrocchiane”, “Nataline**” (sometimes synonym for „Parrocchiane“) are still cultivated by means of selection and grafting, especially in the region of Campania (in the surroundings of Mount Vesuvius) and in Sicily (Bignami et al., 2001; Bignami et Bertazza, 2005). The picking season of the varietal types of the service tree fruits falls in Italy usually later than the one of the naturally occurring types. Fruit picking in the region of Campania and in Sicily is carried out from September to November, when the varieties “Parrocchiane” (Bignami, 2000) and “Tardiva” (Hrdoušek 2015) are ripening.

Short description of the varieties still grown in the Italian region of Campania near Mount Vesuvius (Bignami, 2000):

Shape/maturity	August	September	October
flat-roud	Sorba tonda agostina (2) Sorba mela agostina (3)	Mezzane, tonde e chiatte (2) Sorba mela settembrina (7)	Sorba mela ottobrina (10) (11) Sorba mela ottobrina (23) Sorba mela ottobrina (26)
roundish	Grosse, tonde agostine (1)	Mela grossa settembrina (3) Sorba tonda mezena (11) Settembrina tonda (5) Sorba lazzeruola ottobrina affumicata (25)	Sorba lazzeruola salvatica ottobrina (7) (6) Sorba mela ottobrina (13) Sorba rossa tonda ottobrina (14) Sorba lazzeruola ottobrina (17) Sorbe tonde bianche ottobrine (19) Sorba mela ottobrina mezena (20)
conical	Sorba Lunga Agostina (1)	Lunghe, mezzane (4) Sanguignola settembrina (8) (9) Sorba pera maggiore (12) Sorba pera settembrina (8)	Sorba pera mezana ottobrina (9) (12) Sorba pera ottobrina (21) Sorba pera ottobrina (22) Sorba pera culinnazi ottobrina (27)
oblate			Sorba pera minore rossa (16) Sorba selvatica ottobrina (18) Sorba a gocciola ottobrina (24)
pear-shaped		Sorba zucchetta (6) Sorba pera settembrina (4)	Sorbe pere ottobrine rifte (15)

- **Capitane**: large size: 3,3 x 3,8 cm, weight: 20 - 33 g, conical or flat-conical shape (depends on the location and season), waxy yellow-green skin with a red blush on 40 – 70 % of the surface, low number of lenticels; picking season: October.



- **Indignente**: large size: 3,4 x 3,6 cm, weight: 22 - 27 g, bluntly-conical shape of the fruit, gentle waxy yellow skin with a red blush on 50 % of the surface, high number of large rusty lenticels, picking season: end of September.

- **Panelle:** very small size: 3,7 x 4 cm, weight: 30 - 40 g, oval egg-shaped fruit, yellow skin with a red blush on 30 % of the surface, low to mean number of large lenticels; picking season: beginning of September.

- **Parrocchiane**: large size, weight: 20 - 25 g, pear-shaped, light yellow waxy skin covered with a small orange blush, mean number of lenticels, picking season: November.

- **Nataline***:* middle – large-sized: 3 x 3,2 cm, weight: 17 - 20 g, bluntly-conical shape, gentle waxy skin, yellow with a red blush on 50 % of the surface, mean number of large rusty lenticels, picking season: September.

Picture: Fruit of the "Indignente" variety *(Hrdoušek, 2007)* *Picture: Fruit of the "Pannelle"* variety *(www. agraria.com)*

Germany

In Germany, concrete historical data about varieties are missing, however, a number of local varieties can be found growing especially in Bavaria and Hesse. In Hesse, Mr. Heiko Fisher has been grafting diverse local varieties of the service trees already for 15 years and he uses them for the production of various products. He uses conical-shaped fruits from large trees to prepare puree; large nicely coloured apple-shaped fruits (grafted onto the medlar) are used for direct consumption, unripe fruits for cider and fruits affected with rust are used for the production of spirits. He makes use also of the service tree fruits maturing in October.

Fig.: Fruits from the service trees growing in the surroundings of Kronberg in Hesse, Germany (Hrdoušek, 2012).

At present, the service trees with the largest fruits have been already for 10 years maintained and grafted by the Bavarian State Institute for Viticulture and Horticulture in **Veitshöchheim** near **Würzburg.** Local varieties – "**Sossenheimer Riesen"** and "**Red Spätling"** – are propagated by means of grafting by the above institute (Doppler, 2006).

• **Sossenheimer Riesen** " – the trees are grafts of local seedling, they bear fruit on short-holed trees reaching relatively abundant crop; large-fruited conical-shaped cultivar with the fruit stalk in a slight hole, with a red blush, noticeable wax layer and dispersed lenticels. In Bavaria the fruits mature in September and have diameter of 4,5 cm and weight up to 40 g. (Kausch, 2000).

Fig.: Fruits of the "Sossenheimer Riesen" variety compared to common fruits (Kausch, 2000).

• **Red Spätling** (**Bovenden Nordlicht**) – the trees are grafts on short-holed trees, they bear fruit later, the crop is not so abundant; the trees have attractive autumn colour; apple-shaped to subtly-conical fruits that are shiny, bright yellow, with a red blush; calyx hole slightly recessed; fruits with weight of around 30 g are fragrant and rather sweet.

*Fig.: Fruits of the "**Red Spätling"** variety (Kausch, 2000).*

France

In France, only fragmentary records of the service tree varieties' names have been preserved, as more than 100 years has passed since their intentional cultivation. The fruits were distinguished according to the criterions like shape, dimension, colour and purpose of use – for direct consumption or for the beverage "**cormier**", i.e. cider from the service tree fruit. In recent times, various authors have attempted to describe the service tree varieties, but the nomenclature differs depending on the scope of observation. **Duhamel du Monceau (1765)** distinguishes "*sativa*" variety of the service tree, that is used for grafting, which is further subdivided into the following types:

- *service tree with large **red fruits,** pear-shaped*
- *service tree with large **fruits with a pale red blush**, almost pear-shaped*
- *service tree with fruits **on one side red**, pear-shaped*
- *service tree with fruits **on one side red**, oblate shape*
- *service tree with small **reddish fruit**, pear-shaped, **late**.*

The catalogue of the fruit trees made by Andre Leroy d'Angers (about 1903) introduces the following varieties of the service trees:

- ***medium grey** – **rusty** oblong fruits*
- ***medium pink** conical fruits*
- ***medium red round** fruits*
- ***large grey** – **rusty** oblong fruits*
- ***large pink** conical fruits, for wholesale use*
- ***large** rounded **red** fruits*

Beautiful representations of bronze and "grey" service tree fruits can be found in the book "*Traité des arbres forestiers*" (1824) by J. H. J. Saint-Hilaire (Moinet, 2009). The fruits with greyish rusty colour, that are mentioned in the 19th and at the beginning of the 20th century, have been cultivated in different shape forms until today. Their size is of 2,5 – 3,5 cm and the whole surface is covered with russeting that does not preclude their consumption. This fruit does not suffer from scab so much. Currently a number of interesting local varieties is grown in diverse regions of France. Greater attention is paid to the service trees in the region of Sarthe and Burgundy where is also located the cultivation school of Mr. Varioti or the one of Mr. Bountry.

Fig.: Service tree fruits with greyish rusty colour; apple-shaped, pear-shaped (Moinet, 2009).

Ukraine

Surprisingly, on the edge of the expansion area in Ukraine new varieties of the service trees are maintained and bred. In the framework of a field research, 12 cultivars have been identified. In Transcarpathian region near Uzhgorod local cultivars are maintained in villages whose names are born also by the same varieties, for example Barvinok 1, Barvinok 2, Medvedivska with fruits weighing 14 - 15 g, rarely even 25 g (Mezhenskyj, 2012).

- **Barvinok 1** (the name given by prof. V. Zajac) – slightly pear-shaped green-yellow fruit with a red blush, weight: 15 g
- **Barvinok 2** (the name given by prof. V. Zajac) – round green-yellow fruit with many lenticels, weight: up to 25 g
- **Medvedivska** (the name given by prof. V. Zajac) - pear-shaped green-yellow sligthly glossy fruit, weight: 14 g

In other parts of Ukraine the service trees grow only in botanical gardens. In the botanical garden in Kiev there are also trees of the cultivar called "**Botanichna**" that has fruits with average weight of 17 g (Mezhenskyj, 2012).

Crimea

In the framework of the mapping organised in the 50s of the 20th century by K. P. Popov, pomological types from the city of Krasnokamensk near Gurzuf were chosen and grafted on the terraces of the Nikita Botanical Graden (personal communication, I. Černobaj, 2013). In such a way a collection of a number of quality service tree cultivars was created, however, many trees were destroyed. The trees that have been preserved in the countryside of Crimea are valuable genotypes and have been described in terms of their variety. At present the service trees varieties of this area are further propagated and grafted by means of budding onto the service tree seedling that is usually 2 years old. Also hybridization between varieties is carried out there. After hand pollination the trees acquire the same type of the fruits as in the case of open pollination. The fruits of such varieties with diameter of 15 – 35 mm mature from the second half of September until the end of October (Černobaj, 2010).

Nikita (P-№ 15, Černobaj, 2010): small tree with height of 4,5 m and thick compact spherical crown; large irregular apple-shaped fruit with 2 – 6 seeds. The colour is pale yellow with greenish tinge and a small varied blush. High fertility.

Nikita 520 (P-№ 26, Černobaj, 2010): big tree with spreading crown, very large flat pear-shaped fruit with yellow skin and a slight blush, in multiple fruit there are 8-12 fruits; maturing in the first half of October; regular high fertility.

- **Sladkaja** (P-№ 51, **Č**ernobaj, 2010): middle-sized fruit, 13 - 18 pieces in multiple fruit, oblate pear-shaped fruit with maturity at the end of September, it does not stick hard to the trees, when slightly ripened the fruit already loses its bitterness and is sweet and pleasant to eat.

- **Limonnaja** (P-№ 34, **Č**ernobaj, 2010): not so large trees with spreading crown, yellow pear-shaped fruit without blush. In multiple fruit with 6 – 10 fruits with 5 seeds on average. High fertility.

- **Rubinovaja** (P-№ 6, **Č**ernobaj, 2010): midlle-sized trees, large yellow pear-shaped fruit with marked pink blush; in multiple fruit there are 1 – 5 fruits, maturing in October, Extraordinary fertility.

- **Taurida** (P-№ 33, **Č**ernobaj, 2010): high trees, large pear-shaped fruit; in multiple fruit there are 8 – 12 fruits, yellow-coloured with greenish tinge, the blush from barely noticeable to intensively red; ripening at the end of September to the beginning of October. High fertility.

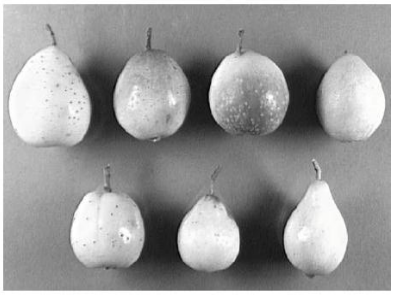
Some large-fruited varieties on the terraces of the Nikita Botanical Garden are identified only by numbers (personal communication, Černobaj, 2009). In the Nikita Botanical Garden in Crimea a collection of other quality service tree cultivars –"Malorechenskaja", "Obilnaja", "Sochnaja" etc – has been grown, whose documentation could not be obtained (Špíšek, 2013).

Hungary, Slovakia and the Czech Republic

In Hungary, fruits of the trees in the cultural landscape have usually more than 15 mm in diameter, which is the result of cultural selection (Végvári, 2000) and probably also of grafting carried out since the Middle Ages (Nyári, 2000). Detailed morphological classification of the fruits has been drawn up in Hungary by **Pénzés (**1956 in Majovský 1992), name modified by Hejným (2003).

- variety *maliformis* (Kirchner et Eichler): small roundish pomes, 25 mm
- variety *pyriformis* (Kirchner et Eichler): pomes 30 x 25 mm, distinctly pear-shaped, 30 x 23 mm; distinctly pear-shapped, yellow
- variety *micropyriformis (*Pénzés): small pomes 29 x 23 mm, roundish, pear-shaped
- variety *obtusipyriformis* (Pénzés): pomes 35 x 30 mm, stocky-like pear-shaped
- variety *zemplinensis (*Pénzés): pomes 40 x 25 mm, distinctly pear-shaped, yellow with a red blush

Miko et Gažo (2004) use the above classification also for Slovakia. The same is said to be used also in Slovenia (Trnkoczy, 2013). In the book New flora of the Czech Republic "*Nová květena České republiky*" (Dostál, 1989) and in the book Flora of the Czech Republic "*Květena ČR*" (Hejný, 2003) the varieties according to Pénzes are presented. In the latest study on the morphological variability of the service trees in the Czech and Slovak Republic it has been found out that the distinction by Bignami (1999), that is based on the shape, further corresponds to the range of variability of the fruit shape (Miko et Gažo, 2002; Špíšek, 2009; Uherková, 2013). Pénzes (1959) does not make direct distinction between flat round-shaped fruits and the egg-shaped ones.



Obrázok 3: Variabilita tvaru plodov jarabiny oskorušovej - *Sorbus domestica* L. v sledovaných lokalitách v roku 2001 (Miko - Gažo, 2002)

Picture: Variability of the service trees fruit shape found in Slovakia (Miko et Gažo, 2002).

Moravian-Slovak border

On the Moravian-Slovak border on the south of the White Carpathians a great pomological variability of the fruits has been found, in particular in the surroundings of the villages of Strážnice, Tvarožná Lhota, Kněždub a Bzenec. In 2010 – 2014 various pomological types of the service trees were classified. The fruits of those trees have similar type of fruit. Several transition forms have been also found. None of the trees of the described varieties has been grafted.

Tab: Pomological types and described varieties of the trees growing on the Moravian-Slovak border that are interesting in respect to their pomological features

•	**Červenající pozdní**
•	**Soudkovitá raná**
•	**Červenka raná**
•	**Zelenka**
•	**Žlutice**

Pomological type	**Typical features of the fruit**	**Described local variety**	**Weight [g] (average out of 10 pieces at maximum of their maturity, 2014)**	**Specific features**
Pupkatá	*roundish to slightly conical*	**Pupkatá**	14,8 g	Large-fruited type, decorative,

Potbellied	*shape, large calyx, distinct lenticels*	*Potbellied*		suitable for transport
		Pupkatá tvrdá *Potbellied hard*	18,7 g	Suitable for transport and ordinary storage (within approx. 14 days), large crop only in cone years, higher propensity to scab
Lesklá *Glossy*		**Lesklá** *Glossy*	13,2	Good taste, good fertility – bearing fruits also outside cone years
		Delikátní *Delicate*	9,5	Excellent taste, soft skin, necessary to process it quickly: within 7 days from its picking
Červenající *Blushing*	*flat-conical to roundish shape, ribbed fruit*	**Červenající pozdní** *Late blushing*	15,5	Late type, decorative, less prone to scab, lower fertility
Soudkovitá *Bulbous*	*flat-round to slightly conical shape*	**Soudkovitá ranná** *Early bulbous*	16,5	Early variety, slightly rusty at the fruit stalk and calyx , suitable for transport
Homolková *Caned*	*conical to oblate shape*	**Červenka raná** *Early reddish*	16,8	Decorative, suitable for universal processing, bearing fruits also outside cone years
		Zelenka *Greenish*	**18,6**	Large-fruited, suitable for universal processing, higher propensity to scab, bearing fruits also outside cone years, average taste
		Žlutice *Yellowish*	16,1	Rather soft skin, suitable for universal processing

Fig.: Various fruit varieties as found and described near the town of Strážnice: "Greenish" from the village of Hroznová Lhota, "Flushing" from the village of Tasov and "Delicate" from the hill Žerotín on the Moravian-Slovak border (1, 2013)

Conclusion

The service tree fruits have been historically selected and cultivated according to their **dimension and colour, taste, maturation period and disease resistance**. The largest fruit can be discerned in certain centres where the service trees are grown: in southern and central Italy, in central Germany and also in Crimea. In those regions different varieties are locally distinguished until today. Diverse varieties have been preserved also in other countries, for example in France or central Europe, which is evidenced, however, only by fragmentary information and their naming. In the whole area where the service tree is diffused we notice that until today its fruit differ significantly from the pomological point of view.

It is necessary to carry out another systematic study of this rare and endangered European fruit tree: field research, collection activities and consequent pomological analyses that would demonstrate the qualities of individual local varieties, types and cultivars.

It is appropriate to dedicate work also to intentional crossbreeding aimed to obtain better-quality varieties as regards both fruit quality and picking season. The service tree as draught-resistant and shade-intolerant species can in future play a specific role in food management in various parts of Europe.

ARCHE NOAH Seed Savers

www.arche-noah.at

Introduction WHAT WE'RE ABOUT

ARCHE NOAH ("Noah's Ark") is an Austria- and Brussels-based not-for-profit Seed Savers´ association founded in 1990, which currently conserves and disseminates about **6,500 endangered cultivated plants**. Our activities are financed through donations and through our members, which regroup **14,000 gardeners and farmers from numerous European countries.** Our mission is to maintain and spread agricultural plant diversity.

Results and discussion

The loss of crop diversity...

...**is undeniable and systematic.** Due to the industrialisation of agriculture, 75% of all crop varieties have become extinct during the last century alone, mostly due to the homogenisation of high-yielding plant varieties. According to the State of the World's Plant Genetic Resources for Food and Agriculture (1997), over 67% of the wheat fields in Bangladesh were planted with the same cultivar ("*Sonalika*") in 1983. By the 1990s, in Ireland, 90% of the total wheat area was sown with just six varieties. Of the 7,098 apple varieties that were documented in the U.S. at the beginning of the twentieth century, approximately 96% have been lost. Similarly, 95% of cabbage; 91% of field maize; 94% of pea; and 81% of tomato varieties are lost. In Mexico, only 20% of maize varieties reported in 1930 are known today; while in the Republic of Korea, only 26% of the landraces of 14 crops cultivated in home gardens in 1985 were still present in 1993. (Source: *The Law of the Seed*, Vandana Shiva 2013)

ARCHE NOAH takes action !

Challenge 1: Stop the ongoing loss of crop diversity

Our answer: Manage biodiversity through conservation and sustainable use

ARCHE NOAH implements both biodiversity management strategies: plants are conserved "*ex situ*" in our Seed Archive, and more importantly also "*in situ",* through ongoing cultivation and further development of regional varieties, on our premises and within the network of Seed Guardians.

Seed archive

This is where seeds take a break: in the ARCHE NOAH seed archive, more than 6,500 different cultivated plants are waiting for their next performance. The ARCHE NOAH seed archive preserves seeds, bulbs, and parent plants of more than 6,000 endangered vegetables, grains, and other crop plants, with about 300 in living field collections.

Fruit collections

Fruit trees live for a long time, but not forever! Only collection missions, careful characterisation, maintenance in several places and the passing-on of knowledge can prevent very rare, local varieties from becoming extinct.

Due to the long life span of fruit trees, many local varieties have survived over time, although little attention has been granted to them. Indeed, most trees today are ancient and urgently need to produce "offspring". ARCHE NOAH pomologists – as fruit experts are called – research, document, advise, and graft, in order to halt the impending loss of old varieties. The ARCHE NOAH fruit collection currently encompasses several **fruit conservation orchards** with hundreds of trees and berry bushes in different regions, as well as a **fruit database** with more than 900 varieties and 3,200 mapped trees. Service tree collection is not made yet.

A Network of Seed Guardians

The cooperation with seed guardians allows ARCHE NOAH to decentralise the management of endangered old and local varieties and ensures the continuous flow and use of those plants. Hundreds of members of ARCHE NOAH act as private "seed guardians" by cultivating endangered varieties in their home gardens and farms, and taking long-term care of them. Such a network of active gardeners ensures that **diversity is managed through usage.**

Challenge 2: Develop plants fit for organic and low-input agriculture

One size does not fit all: seed users can and do have a wide array of demands when it comes to plants. This is why seed users' needs are at the heart of the participative plant breeding programme run by ARCHE NOAH.

Our answer: Research & Participatory plant breeding

The development of newly adapted crops from genetic resources complements and contributes to our goal of satisfying seed users' needs, while also ensuring the long-term survival of underutilized crops.

ARCHE NOAH is therefore dedicated to developing "new" varieties from "old seeds" that are adapted to our modern needs.

Challenge 3: Satisfy consumers' appetite for diversity

Our answer: Make crop diversity digestable

Consumers are hungry for product quality, taste, sustainability or specific nutritional value. A growing number of farmers and producers supply this market. ***Markets and events*** - ARCHE NOAH events attract more than 30,000 visitors every year. ***Seminars and workshops*** - Through ARCHE NOAH seminars and workshops we share knowledge and experience and develop innovative ideas. ***Farmers for diversity*** - ARCHE NOAH cooperates with organic farmers to bring diversity back into agriculture and in our markets.

Challenge 4: Improve policy coherence

For decades, European policies have accepted the loss of crop diversity as a collateral damage to the priority awarded to industrial farming, mechanised cultivation methods, corporate interests and subsidising the decline of small-scale farming.. Those which impact crop diversity the most are:

The Common Agriculture Policy (CAP) - Food quality schemes (geographical indications, organic agriculture) - Seed and Plant Marketing Laws - Intellectual Property Rights – Plant Variety and patent Protection - Biosafety Law (breeding techniques as GMOs) - Biodiversity Policies.

Our answer: A voice for diversity

Consultation and coherence between these various law-making areas is key to achieve the goals set out in environmental but also social and economic policies. To improve policy coherence in such a way that favours crop biodiversity, ARCHE NOAH stands up for policies that promote biodiversity, ensure nutritious and tasty food and protect small scale agriculture in Europe and beyond.

Phenological garden of the *Sorbus domestica* L. at ÚKSUP Dolné Plachtince

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Introduction

Sorbus domestica L. (true service tree) is a scattered broadleaved woody plant that is tolerant to drought and heat and is particularly widespread in the Mediterranean region, with the center of natural distribution in the Balkan and Apennine peninsula. Its area of distribution extends to North Africa and Asia Minor and it also can be found in Central Europe, in Germany, Austria, the Czech Republic, Hungary, Switzerland, Slovakia, and Slovenia (Haeupeler & Schönfelder 1988, Hemery et al. 2009). The true service tree grows mainly in the oak forests in these locations and in forest-steppe stands (Kárpáti 1960; Ellenberg & Klötzli 1972; Namvar & Spethmann 1985; Brütsch & Rotach 1993; Májovský 1992); it even thrives in locations that have a negative water balance during the growing season (Paganová 2008). The adaptive potential of *Sorbus domestica* has been experimentally evaluated under extreme conditions and its adaptability to water scarcity has also been assessed. The results of these studies have demonstrated that this species copes well under variable water conditions and adapts to hydrological changes in its habitat (Paganová & Jureková 2012).

The Phenological garden of *Sorbus domestica* in Dolné Plachtince was established in 2011 with the aim to evaluate the phenological activity and growth parameters of Slovakian and one Austrian provenance. It contains 9 Slovakian provenances and 1 Austrian visible in Tab.1. The saplings were planted in rectangle spacing 8 x8 m.

Material and methods

The locality Dolné Plachtince is in the wine-growing region of Modrý Kameň in the district Veľký Krtíš and was selected as an optimal area for the establishment of the Phenological garden of *Sorbus domestica*. The selected plot has an south-western exposition with an elevation of 228 m.a.s.l., with a moderate slope (5 %). The plot is sheltered from north and east. The soil type is cambisoil and the soil texture is silty clai loam with pH 6,2. Ilimerization of the upper soil layers is present (TÓTH, 2003). It has a typical valley climate, dry or moderately wet, with an annual average temperature 8,5ºC and precipitation of 620 mm (TARÁBEK, 1980). These conditions represent the ecological optimum for *Sorbus domestica* (BAKAY et al. 2010). Annual increments and total height are measured at the end of the vegetation period each year.

Results and discussion

We didn't find statistical difference (Tukey HSD test 95% confidence level, p value=0,6095) in the height of Sorbus domestica 5 years old saplings (**Tab.1**). The average height of 5 year old saplings was 160 cm (max. 310 cm). The largest variation in the height of measured plants was in the provenance Jalakšová. Low variance and good increments were observed in the provenance Žemberovce, where progenies from 3 mother trees were tested, what is similar to the findings of Bakay et Paganová (2010) and Drobná (2012). The provenance with the highest increments of saplings was Čebovce and the provenance with the least increments was Pukanec. This can be caused by the fact, that the locality Pukanec in on the northern border of the distribution of Sorbus domestica in Slovakia. The yearly increment and growth parameters are important tools for selection as presented by Paganová et al. (2015).

Conclusion

The investigation didn't show significant differences between heights of *Sorbus domestica* saplings 4 years after planting, although slight differences were visible. To get better insight in to this topic further observations and evaluations are necessary, what demonstrates the importance of these kinds of plantings. Also selection of optimal ecotypes can be done only by monitoring as much saplings as possible.

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Cormus domestica (L.) Spach. in Kyiv

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Introduction and taxonomy

Most botanists treat *Sorbus* in the broad sense, including *Aria, Chamaemespilus, Cormus,* and *Torminaria* as sections or subgenera [1, 2, 3]. Other authors produced strong evidence for dividing *Sorbus* s. l. into the separate genera *Aria, Chamaemespilus, Cormus, Sorbus* s. str., and *Torminalis* [4, 5, 6]. We agree with the splitting of the genus *Sorbus* s. l. into the genera *Aria, Chamaemespilus, Sorbus* s. str., and *Torminaria*, therefore in this presentation we will use for Service tree a name *Cormus domestica* (L.) Spach, but not more popular *Sorbus domestica* L.

The Service tree is native to Western, Central and Southern Europe, northwest Africa, and southwest Asia. In Ukraine *Cormus domestica* is rarely cultivated in both gardens and parks [7].

Results

First introduction

Academician Mykola Kashchenko, who founded his Acclimate Garden in Kyiv in 1913, began his investigation with new fruit and ornamental trees, included service trees to the list of introduced plants. In 1922 the Acclimate Garden was established in the new place, and after this event, *Cormus domestica* together other interesting plants fill up plant collections in Kyiv [8]. Unfortunately in 1975 this garden was ceased to exist.

Following Lypa`s information on growing of *Cormus domestica* is believed to date from 1940 [9]. He reported that the service trees had been destroyed by frost during severe winters.

***Cormus domestica* in Botanical Garden of the National University of Life and Environmental Sciences of Ukraine**

According to Tsykaliak [10] Service tree is rare enough species under culture. In Kyiv these trees are only in acad. O. V. Fomin Botanical Garden of Taras Shevchenko National University, Botanical Garden of the National University of Life and Environmental Sciences of Ukraine, and M. M. Hryshko National Botanical Garden.

In 2015 we investigated these sites. According to the Catalogue of woody plants of Botanical Garden of the National University of Life and Environmental Sciences of Ukraine [11] height of Service tree is 18 m, and trunk diameter is 30,5 cm. It is hardy under Kyiv climate with absolute temperature minimum -32,2 °C. Well-adapted tree is drought resistant, generates germinating seeds and self-growing seedlings.

Now this 75-year old tree with trunk diameter 46 cm under bifurcation of stem.

Cormus domestica in M. M. Hryshko Botanical Garden

According to printed in 1997 Catalogue of plants of M. M. Hryshko Botanical Garden [12] there are three Service tree groups in this establishment. The first group is presented by 15 trees of unknown origin and age in the collection of Fruit Department, the second group consists of a tree raised from the seed received from Botanical Garden of the National University of Life and Environmental Sciences of Ukraine, and the third group numbers three trees from Nikitskyi Botanical Garden. The trees of the last-mentioned groups were set down in 1960 and 1980, respectively.

Now there are only 6 trees of *Cormus domestica* in row plantation along a garden path with both apple and rowan trees alternately. These Crimean trees were planted in 1956 (Svitlana Klymenko, pers. com.). Robust 60-year old trees are 15 m in height, and trunk diameters are mainly 46–69 cm. Trees fructification is abundant. As a comparison, native Crimean service trees have reached 12 m in height and 32 cm in diameter [13].

In the Arboretum there is an individual tree planted in 1960 in the middle of Fagaceae trees. It is 13-stemmed tree, 12 m in height. The diameters of three biggest stems are 23–28 cm. This plant is very poorly fruit-bearing. Probably it is a consequence of lack of cross-pollination. But a single tree in the collections of acad. O. V. Fomin Botanical Garden has heavy crop of fruits.

Conclusion

Cormus domestica in Kyiv Botanical Gardens are winter hardy and drought resistant plants. This is a valuable material for ornamental and fruit purposes.

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Service tree (*Sorbus domestica L.)* in the project White Carpathians´Fruit Treasure

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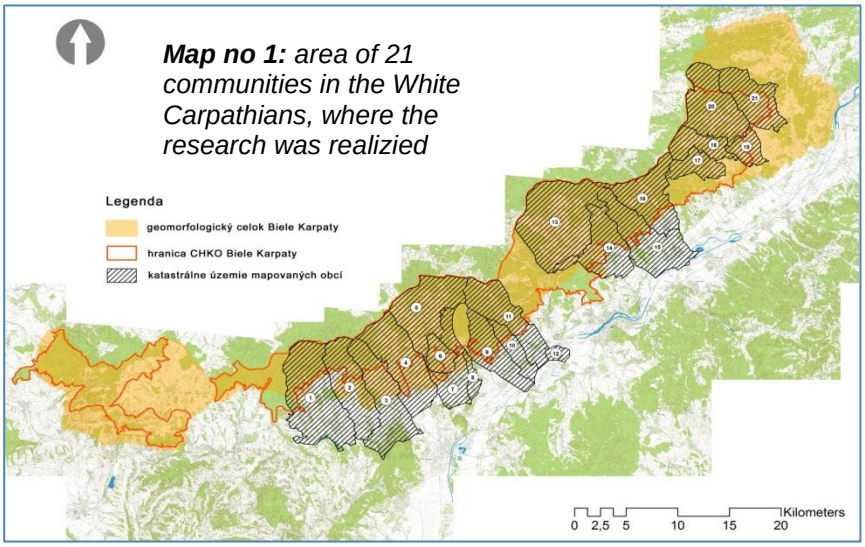
White Carpathians´Fruit Treasure

Project White Carpathians´Fruit Treasure was realized by the State Nature Conservancy of the Slovak Republic from 1.10.2013 till 28.2.2015 in a cooperation with few subjects, including Faculty of Ecology and Environmental Sciences in Technical University of Zvolen. The main aim was to preserve fruit obsolete varieties and landraces (*Malus domestica* Borks., *Pyrus communis* L. emend. Burgs.) and research of presence of Sorbus domestica L. in the White Carpathian´s region. The field research took place in the the area of51 637 ha, which included 21 communities (from S to N): *Stará Turá, Lubina, Bzince pod Javorinou, Moravské Lieskové, Nová Bošáca, Zemianske Podhradie, Bošáca, Ivanovce, Melčice – Lieskové, Adamovské Kochanovce, Chocholná – Velčice, Kostolná – Záriečie, Horná Súča, Dolná Súča, Nemšová, Horné Srnie, Krivoklát, Vršatské Podhradie, Mikušovce, Červený Kameň, Lednica*. Territories of all the communities except of Kostolná – Záriečie belong to the White Carpathians Protected Landscape Area. They differ in land cover and land structures with the presence of fruit trees.

Mapping of obsolete varieties and landraces

The field research during the summer and winter seasons in 2013 and 2014 was the basis of the project. The variety diversity of *Malus domestica* Borkh. and *Pyrus communis* L. was explored in different land structures – as the soliters, alleys or orchards, both in private gardens and open landscape. Except of this, the database of obsolete varietes and landraces was created according to a pattern from Swiss organization ProSpecieRara.



Map no 1: *area of 21 communities in the White Carpathians, where the research was realizied*

Setting up of primary and secondary collection of fruit trees

Determined varieties became a part of a **primary collection** – the Orchard of obsolete varieties and landraces founded in the White Carpathians. The orchard is situated in Stará Turá. Thanks to cooperation with volunteers, 138 trees of 69 varieties was planted there. **Secondary collection** is made of 56 apple and pear trees, which where chosen and cured in cooperation with its owners.These will represent the in-sittu protection.

Creation of a common platform – the association ´GenoFond´ (genepool) and organization of evaluating conference

Setting up the **GenoFond** association means, that activities, which are leading to varieties protection, will continue. This association conects individuals, NGOs, institutions or companies.

Evaluating **international conference** White Carpathians´ Fruit Treasure took place in October 2014 in Vršatské Podhradie. It presented not only the project ativities, but also actions and research of other organizations, companies or communities. On the second day of conference the organizes made the participants familiar with the tradition of fruit growing in Bošáca valley.

Promotional activities with the public

The public was a part of the project since its beginning. People could see and learn old varieties and landraces on fairs, exibitions and other event, we were a part of. We organized also the varieties-popularization lectures on elementary and high schools. The topic was elaborated in few publications printed within the project, including informative flyers, posters, booklets and also fruit matching game.

Distribution and characteristics of Service tree (*Sorbus domestica* L.) within the project

Evidence of Service tree in the White Carpathians was also part of the project. This species was not found in 5 out of 21 communities at all. During the research, characteristics as the perspectivity, presence of fruits, picking maturity, height of a trunk, graft presence, *Venturia inaequalis* attack, circuit of a trunk and heigh of a tree, period of a tree. Within the project research the biggest amonut of service trees was noticed in the communities Nová Bošáca (40), Bzince pod Javorinou (35) and Bošáca (18). When we compare the health condition of trees, 38% of individuals was healthy, 49% was perspective and 12% was non-perspective. 54% of individuals was without fruits. The graftting place was visible only at 4% of trees, so that we predict, that most of the service trees are seedlings. These were grown directly on the place we have found them, or were moved there from other areas. According to the circuit of a trunk, the most of the individuals (40,4%) belong to the cathegory 1,01 - 2 m. Only 1 tree had the circuit bigger than 4 m. As a result of the reserach can be said that young individuals of service tree are rare in White Carpathians. On the other hand, older trees require bigger care.

Jam and extracts of *Sorbus domestica* L. fruits as a potential sources of phenolic compounds

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INTRODUCTION

Fruits of *Sorbus domestica* L. (service tree) have been widely used as nutritious food and also as traditional adstrigent, diarrheic and antidiabetic agents. However, there are only few reports on their antioxidant potency.

As a part of broad research, the aim of this study was to define phenolic profile and antioxidant activity of water and methanolic extracts as well as jam of fresh fruits.

PLANT MATERIAL AND EXTRACT PREPARATION

Plant specimen was collected in October 2013, in Bosnia and Herzegovina in village Vranjak. Grafted tree (diameter at 1.3 m is approx 0.6 m) with fruits (diameter 2,5 cm aprox.), was planted around 1930 year. The specimen voucher *S.domestica* L. 1753 (No. 2-1566) was identified and deposited at the Herbarium of the Department of Biology and Ecology (BUNS Herbarium), Faculty of Sciences, University of Novi Sad, Republic of Serbia.

Methanol and water extracts were prepared according to following procedure: fresh fruits (40 g) were grinded and extracted by maceration with 80% aqueous methanol during 72 h at room temperature or with boiling, distilled water during 1 h at room temperature. After the filtration, the solvents were evaporated *in vacuum* at 40 °C. Jam was prepared according to traditional recipe by cooking 100 g of fruits with 25 g sugar in boiling distillated water (100 g) distilled for 30 min. To prepare jam extract 20 g of jam was weighed out and evaporated *in vacuum* at 40 °C. Crude residues of methanol,water extracts and jam were dissolved in hot, distilled water (1 g/mL). Extracts were then filtered out using Büchner funnel and evaporated *in vacuum*, yielding 15.32% ,12.06% and 48.79% for methanol, water extracts and jam, respectively. Dried extracts were dissolved with distilled water to obtain 30% (w/v) stock solutions for evaluation of the antioxidant activity.

METHODS

Antioxidant potential of extracts was determined using standard spectrophotometric assays [3] related to 2,2-diphenyl-1-picrylhydrazyl radical ($DPPH^{\bullet}$), hydroxyl radical ($HO^{\bullet}$), and nitric oxide (NO) scavenging ability, as well as estimation of reducing power (FRAP assay). Standard antioxidant propyl gallate (PG) was used as a positive control.

Determination of selected phenolics in methanolic and water extract was carried out according to previously described procedure [1] .

CONCLUSION

- LC-MS/MS analyses of selected phenols resulted in determination of 10 of 45 compounds. Among examined compounds, quinic acid (precursor of phenolics) was the most dominant in both samples, followed by protocatechuic and ferulic acid.
- In applied antioxidant tests, methanolic extract showed the highest antiradical activity
- Obtained results strongly support the use of *S.domestica* fruits in food and potential medical preparations and encourage further studies

ACKNOWLEDGEMENTS

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Sorbus domestica in Italy: traditional uses and present knowledge

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Service tree (*Sorbus domestica*) has been a quite popular plant in Italy. Once cultivated for fruit and wood in fields and near farmhouses this species is currently neglected and there is a lack of information about diffusion and conditions of the old plants. Some cultivar were known, but this knowledge has been almost completely lost during the XXth century. Rural land abandonment and cut for wood have reduced the number of plants and are threatening valuable genetic resources. The EU RESGEN29 project (http://www.ueresgen29.unifi.it/) and regional projects allowed: - the exploration of study areas in Emilia Romagna, Molise, Lazio, Campania and Sicily; - the acquisition of information on the state of conservation of plants and traditional uses; - the characterization and collection of several accessions with the aim of *Sorbus domestica* germplasm conservation and exploitation.

Diffusion and state of conservation

The exploration of several Italian areas showed that wild service trees are present almost everywhere but not frequent. The plants cultivated for the fruit are rare and threatened by land abandonment, changes in style of life and scarce knowledge of fruit and uses by the new generations.

In northern Italy a revival of fruit use for old and new products (liqueurs, jams) is promoted. In Molise the traditional uses of the fruits are well remembered, but not practised anymore; the survival of the plants relies on the traditional kind of agriculture. In Campania Sorbus domestica is still cultivated at the base of Monte Somma and Vesuvius, as a component of mixed orchards traditionally and extensively cultivated or almost abandoned. The number of trees is declining, but is higher than in the rest of Italy; the memory of varietal names is still preserved and some cultural practices (pruning, fertilization, soil management) are applied. In Campania and Sicily the fruits still receive attention for the commercial exploitation.

Historical evidence in Italy

Plants and harvest near the Vesuvius in Campania Service tree is an old presence in Italy. In Roman times, Virgil describes in the Eneide the production of a fermented drink (cider). Drawings are present in Aldrovandi herbarium, Micheli and Cadamosto manuscripts. A pomological description of 27 different ‘varieties’ is reported in Micheli’s manuscripts.

Germplasm characterization, evaluation and collection

Pomological traits – More than forty accessions were inventoried, with wide variability of fruit traits. Conic shape and medium size prevailed; time of harvest ranged from the beginning of September to November. In Campania, five varieties are still cultivated; they have been selected and propagated by grafting in past centuries and are identified with names ('Panelle', 'Indignente', 'Capitane', 'Parrocchiane’, 'Nataline‘) known since the XIXth century.

Sorbus domestica in Italy: traditional uses and present knowledge

Fruit composition

The fruits have high sugar (mainly fructose), organic acid (mainly malic) and total polyphenol content. During over-ripening, a small decline of acids and a sharp decrease of polyphenols occur.

Changes in fruit composition affect the use: unripe fruits can be used to produce fermented drinks (cider); bletted fruits can be employed for fresh consumption, jams, liqueurs and schnaps

Conclusions

- The germplasm variability in Italy can offer good opportunities of exploitation;
- Nevertheless the perspectives of conservation are uncertain, because of plant and farmers aging and, in the Vesuvius area, of the urban expansion eroding farm land.
- Agronomical, environmental, cultural and landscape value, highlights the opportunity of coordinated activities for the safeguard and exploitation of this threatened resources.