

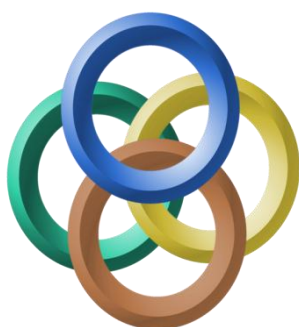
**1st European Fruit Research
Institutes Network Shell Fruit
Species Meeting**

ABSTRACT BOOK



10-11 November 2015

NARIC Fruitculture Research Institute
Budapest, Hungary



eufriin



**1st European Fruit Research Institutes Network Shell Fruit
Species Meeting**

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NARIC Fruitculture Research Institute
Budapest, Hungary

Local Organizing Committee:

dr. Géza Bujdosó

Krisztina Szügyiné Bartha

Ferenc Izsépi

Virág Varjas

About EUFRIN

EUFRIN is an informal, voluntary organization of university departments and research institutes that specialize in research, development, and extension on temperate fruit crops and which are based within countries of the European Union, Switzerland, and Eastern Europe.

It was set up and held its first meeting in Bonn in 1993, attended by representatives of Germany, France, Netherlands, United Kingdom, Switzerland, Belgium, Denmark, Greece and Italy. In the years since, many more countries have been invited to, and have joined EUFRIN. The current number of represented countries stands to 22 (Membership of and Participants in EUFRIN)

The Board of EUFRIN consists of up to two voluntary representatives from each member country and in addition, the chairpersons of each of its Working Group.

EUFRIN is open to requests for membership of any country of the European Union, and those eligible for participation in COST actions. If you are interested in participating in EUFRIN, please contact the Secretary.

The EUFRIN Board meets annually in one of the participating countries. These meetings are aimed to review the status of activities of the Working Groups; to discuss and establish new Working Groups; to plan and carry out joint activities, such as EU bids, organization of workshops, etc. A common feature of these meetings are updates on EU funding programs, as well as talks given by members of the Board. Each year, members of the Board commit themselves to a topic to be delivered the following year. This provides for an excellent opportunity to discuss fruit research within the European context. The members of the Board have a commitment to disseminate the goals and ideas generated within EUFRIN to other researchers and interested parties in their respective countries, via articles in specialized press, communication via national Scientific Societies, at meetings and conferences, etc.

The Board elects, on a three-year rotation a Chairperson, a Secretary, and an Organising Support Member. These three act as the coordinating nucleus of the Board.

NARIC Fruitculture Research Institute

The NARIC Fruitculture Research Institute founded on 1st January 2014 is the legal successor of Research Stations located in Budapest, Érd, Cegléd, Fertőd and Újfehértó of the Horticultural Research Institute's Fruit Growing Department founded in 1950. Main activities of the Research Institute are to breed and domesticate pome fruit species, stone fruit, shell fruit, soft fruit species and rootstocks as well as to adapt orchard systems among Hungarian climate conditions, to examine fruit sites for the new orchards. Our main breeding aims are production safety, increasing tolerance / resistance to diseases and pests and to produce fruits having outstanding taste, aroma and market value. The breeding programs started at foundation of the Institute are helped by biotechnological laboratories and ex-situ gene bank collections. As results of the breeding work 61 apple cultivars, 1 pear cultivar, 25 sweet cherry cultivars, 19 tart cherry cultivars, 20 apricot cultivars, 9 European plum cultivars, 8 Persian walnut cultivars, 6 almond cultivars, 6 European chestnut cultivars, 2 hazelnut cultivars, 10 strawberry cultivars, 7 raspberry cultivars, 4 blackberry cultivars, 2 black and 2 red currant cultivars, 6 quince cultivars, 3 medlar cultivars, 5 goosberry cultivars and 1 black chokeberry cultivar as well as 20 rootstock cultivars have been registered on the National Variety List. Furthermore, value of our breeding work is increased by nine cultivars had been patented in the territory of EU and other four cultivars in the territory of Hungary.

Beside of cultivated fruit species breeding and comparative studies of annual flower species propagated by seeds and rose cultivars are running on the Department of Floriculture. Today there are approx. 122 registered annual flower cultivars and 229 rose cultivars from our breeding program in the production.

The virus-free Nuclear Stock Plantation is maintained by the Institute, which is base of the Hungarian nursery production. Maintenance and development of the plantation is a national interest, which is realised by micropropagation and virus elimination laboratory of woody plant species found at the Institute.

The results got by researchers are disseminated during the growers meetings more times yearly. The researchers take part in the Hungarian and international scientific life actively, they publish their results in the scientific books, newspapers and magazines for growers.

We have strong relationships with research institutes and companies in all countries having important fruit growing in the European Union, as well as in the United States of America, Chile, China and Japan. There is a keen interested in our cultivars not just in Hungary, but in some European counties.

Our results are from trials of Research Stations and fruit sites with special ecological conditions, which confirm statement of prof. Mátyás Mohácsy made in 1957, that "The trial is the base of more – better fruit growing".

Program

**Programme
of
the 1st EUFRIN Shell Fruit Species Working Group Meeting**

10th November 2015.

8:00 a.m. Meeting at the Hotel GRIFF (1113 Budapest, Bartók Béla út 152), travelling by train to the Research Institute

9:15 a.m. Opening of the Meeting

9:20 a.m. Opening speeches

Mr. Prof. dr. Barnabás Jenes, director general of the National Agricultural Research and Innovation Center

Mr. Dr. Zoltán Erdős, director of the NARIC Fruitculture Research Institute

9:40 a.m. The Hungarian Shell Fruit Industry: actual situation, possibilities in the future
Géza Bujdosó, NARIC, Fruitculture Research Institute, Hungary

Morning section

Chair of the section: Zsolt Szani

10:00 a.m. Updating the information on disease problems of walnut cultivation in Turkey
Hatice Ozaktan, University of Ege, Turkey

10:20 a.m. Effects of frost treatments to Hungarian bred Persian walnut cultivars
Krisztina Bartha-Szügyi, Veronika Hajnal, László Szalay, Géza Bujdosó NARIC
Fruitculture Research Institute, Hungary*

10:40 a.m. Pomological evaluation of a double selected walnut population
Géza Bujdosó, Ferenc Izsépi, Roland Schmalzer, Krisztina Bartha-Szügyi NARIC
Fruitculture Research Institute, Hungary*

11:00 a.m. Walnut Cultivation in Iran
Kourosh Vahdati, University of Tehran, Iran

11:20 p.m. Possibilities for hazelnut-truffle co-culture
Andrea Gógán-Csorbai, Saint Stephan University, Hungary

11.40 p.m. Hazelnut and almond genetic resources conservation, characterization and use
Loretta Bacchetta, Andrea Brunori, ENEA Casaccia Div, Italy*

12:00 a.m. Lunch break

Afternoon section I.

Chair of the section: Anita Solar

2:00 p.m. Pistachio cultivation in Iran
Amanollah Javanshah, Iran Pistachio Research Institute, Iran

2:20 p.m. Nut production in Serbia

Dragan Milatovic (University of Belgrade), Slavica Colic (Institute for Science Application in Agriculture), Serbia*

3:00 p.m. Bacterial bark canker diseases on walnut in Hungary

Anita Végh, Imola Tenorio-Baigorria, Gergely Borsos, Géza Bujdosó, Ferenc Izsépi, László Palkovics Corvinus University of Budapest, National Agricultural Research and Innovation Center Hungary*

3:20 p.m. Current state of chestnut (*Castanea sativa* Mill.) cultivation and occurrence in the Modrý Kameň area (Slovakia)

Michal Pástor (Technical University in Zvolen), Ladislav Bakay (Slovak University of Agriculture in Nitra), Tibor Benčať (Technical University in Zvolen), Slovakia

3:40 p.m. Nut tree crops research at IRTA (Spain)

Xavier Miarnau, Mercè Rovira, Neus Aletà, Antònia Ninot, Laura Torguet, Antoni Vilanova, Agustí Romero, Ignasi Batlle, Simó Alegre, IRTA Spain*

4:00 p.m. Germplasm evaluation, conservation and breeding of nut crops in Romania

Mihai Botu, Achim Gheorghe, Sina Cosmulescu, University of Craiova, Romania*

4:20 p.m. Coffee break

<p style="text-align: center;">Afternoon section II.</p>

<p style="text-align: center;">Chair of the section: Miljan Cvetkovic</p>

4:40 p.m. Nut crops in Slovenia: current state, research and development

Anita Solar, Gregor Osterc, Jerneja Jakopič, Ana Slatnar, Maja Mikulič – Petkovšek, Robert Veberič, Franci Štampar, University of Ljubljana, Slovenia*

5:00 p.m. Nuts in Bosnia-Herzegovina – crops on the margins of fruit production

Mićić Nikola, Đurić Gordana (University of Banja Luka, Faculty of Agriculture, University of Banja Luka, Genetic Resources Institute), Cvetković Miljan (University of Banja Luka, Faculty of Agriculture), Bosnia and Herzegovina*

5:20 p.m. The trends of nut crops variety registration and protection in Europe

Zsolt Szani, National Food Chain Safety Office, Hungary

5:40 p.m. Research on nut tree crops at DISAFA-UNITO

Roberto Botta, University of Torino, Italy,

6:00 p.m. Structure of nuts production in Macedonia

Viktor Gjamovski(¹Institute of Agriculture-Skopje), Tosho Arsov, Marjan Kiprijanovski (Faculty of Agricultural Sciences and Food) Macedonia*

6:20 p.m. Closing of the day, travelling back to the hotel

11th November 2015.

8:30 a.m. Meeting at the Hotel GRIFF, travelling to the Experimental Fields of NARIC Fruitculture Research Institute

10:00 a.m. Visiting the Fruitculture Research Institute (experimental fields), meeting with the representatives of the Hungarian Horticultural Propagation Material Nonprofit LTD.

11:30 a.m. Round table meeting

12:30 p.m. Lunch break

2:00 p.m. End of the program.

Abstracts

THE HUNGARIAN SHELL FRUIT INDUSTRY: ACTUAL SITUATION, POSSIBILITIES IN THE FUTURE

Géza Bujdosó

National Agricultural Research and Innovation Centre, Fruitculture Research Institute

It is possible to grow Persian walnut, almond, hazelnut, and sweet chestnut among Hungarian climate conditions, however Hungary is located on the Northern border of safe shell fruit species growing area.

The most grown shell fruit species is the Persian walnut, which commercial orchard surface doubled during the last 10 years. Today this fruit species is cultivated on 6 100 ha producing around 9 000 t dried fruits in shell yearly. Good market possibilities are behind the large increase of Persian walnut production in Hungary, the walnut shows an increasing trend in the future as well. The Hungarian growers use Hungarian bred varieties selected from the local population (such as Alsószentiváni 117, Milotai 10, Tiszacsécsi 83) only, which have early ripening time among the varieties grown on the northern Hemisphere of the Earth as well as these varieties have large fruit size. The Hungarian walnut season starts around 10th September.

Unfortunately, the novel bred hybrid varieties having large production on the lateral buds (such as Milotai bőtermő, Milotai intenzív) have high susceptibility to *Xanthomonas arboricola* pv. *juglandis* (Xaj) therefore they have small importance in the nursery and in the commercial production at the moment. Other hybrid varieties like Bonifác, Milotai kései and Alsószentiváni kései have better tolerance to the Xaj, but their tolerance is less compared to the standard varieties selected from the local population. 30% of the Hungarian Persian walnut production is from Szabolcs-Szatmár-Bereg county, followed by Somogy county, which gives 10% of the total Hungarian production.

Sometimes there is an increasing trend to establish new almond orchards, when the growers can check the prices on the markets. Almond is a fruit species derived from the Mediterranean Sea, therefore the almond production is risky, the Hungarian winters are too strong for female buds of this fruit species. Only one chance is to grow almond among Hungarian climate conditions to find fruit sites on the top parts of the hills, where the minimum winter temperature is not lower than 18 degrees below zero. This is the reason, why there are less than 200 ha of commercial almond orchard producing around 150 tonnes of dried fruits in shell annually. The selected Hungarian varieties (especially Tétényi bőtermő, Tétényi rekord, and Tétényi rekord) adapted well to the Hungarian climate conditions, therefore those varieties are used by the growers.

There is a decreasing trend in the Hungarian hazelnut production because it is risky among our climate conditions. There are around 100 hectares of hazelnut commercial orchard surface countrywide producing 70 tonnes of fruits. The growers produce clones of global varieties (such as Római mogyoró K.1., Fehér lambert, Cosford K.2., Nagy tarka zelli K.5) adapted well to the local climate conditions.

Also the Hungarian chestnut production based on selected varieties (Nagymarosi 22, Nagymarosi 37, Nagymarosi 38, Kőszegszerdahelyi 29, Iharosberényi 2) from the local population shows a decreasing trend. The total agroforestry orchard surface is less than 400 hectares producing around 400 tonnes of fruits and the total yield decreases year on year because of chestnut canker.

UPDATING THE INFORMATION ON DISEASE PROBLEMS OF WALNUT CULTIVATION IN TURKEY

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Turkey is the fourth country in respect to walnut production all around the World after China, U.S.A. and Iran with the production of 200.000 tons per year. Turkey has a major importance in respect to walnut growing among the European Countries. Walnut plantations can be observed in each region of Turkey. In deed, Commercial walnut orchards has been started to establish in Turkey in 1990s. The production of walnut transplants of Turkey is approximately 2.0-2.5 million transplants per year. The most important threats of walnut cultivation is plant pathogenic problems. Bacterial and fungal pathogens have been threatened the Persian walnut (*Juglans regia*) production in all over the world. There are three major disease problems of walnut orchards in Turkey such as anthracnose caused by *Gnomonia leptostyla*, Walnut blight, caused by *Xanthomonas arboricola* pv. *juglandis* (Xaj), and brown apical necrosis (BAN) on walnut fruits caused by Xaj in association with some fungi. Anthracnose is widespread where walnut trees are grown in Turkey and can cause serious losses. Control of anthracnose is achieved by chemical sprays in late spring and early summer, prior to and during ascospore discharge. Dithiocarbamate fungicides are effective besides copper-based pesticides to reduce anthracnose. Bacterial blight of walnut, caused by Xaj is present in all main areas of walnut production in the Western part of Turkey. Copper based compounds have been the only means of control for more than 40 years. Data indicates that copper resistant strains of the walnut blight pathogen are not killed by standard copper applications under field conditions. 19 walnut (*J. regia*) cultivars/selected clones in Turkey were investigated for their resistance to the disease by immature nuts ad seedling tests. According to the test results on nuts and seedlings of different varieties of walnuts, the commercial cultivars Chandler, Hartley and local cultivar Şebin were recorded as highly susceptible to Xaj, while cv. Franquette was classified as less susceptible, this was followed by cv. Pedro. First observations on BAN in Turkey was realized within the scope of EU FP7 COST Action 873 in 2008. The etiology of BAN was determined by monitoring the changing of the population of causal agents which were responsible for the disease. Symptoms were first visible in the first half of June and since then, the microorganisms associated with BAN has started to cause remarkable yield reduction because of premature walnut fruit drop. The disease severity increasingly continued until the mid of August. In this study, it was indicated that the major causal agent of BAN was Xaj, and fungal agents such as *Fusarium equiseti*, *F. verticillioides*, *Alternaria alternata* seemed to be involved in the induction of BAN, causing secondary infections, and growing as saprophytes on bacterial-infected tissues, thus enhancing disease symptoms and severity. At the end of the field observations, it was indicated that Hartley was the most susceptible variety to the disease The result of this study indicated that Copper oxychloride was the most effective chemical against to the main causal agents of BAN.

EFFECTS OF FROST TREATMENTS TO HUNGARIAN BRED PERSIAN WALNUT CULTIVARS

Krisztina Bartha Szügyi¹, Veronika Hajnal², László Szalay², Géza Bujdosó¹

¹National Agricultural Research and Innovation Centre - Fruitculture Research Institute

²Corvinus University of Budapest, Faculty of Horticultural Science, Department of Pomology

Nowadays, it is very important for every grower to make fruit growing among safety conditions. For this the knowledge of ecological demands of every fruit crop and cultivar is essential to find its optimal growing site. Hungary is located on the Northern border of walnut production. The ecological adaptation capacity of walnut is weak, therefore naturalization is often unsuccessful. The walnut is a Mediterranean fruit species, but among Hungarian climate conditions it can survive -30°C without suffering frost damage. However after shooting the buds may suffer frost damage at -2 to -3 °C, because the early spring frost often occur among Hungarian climate conditions. In autumn after leaf fall the frost hardiness is formed gradually parallel with the decreasing outside temperature. To the development of frost hardiness of cultivars suitable for growing and adapted to the Hungarian climate conditions the well-developed shoots and the optimal nutrition supply of the plantation are needed. During examinations we used climate chamber. The results influencing factors are the used materials, temperature of treatments and the length of cold treatment. When the outside temperature decreased the temperature of treatments must be decreased as well. The one year old shoot samples were collected once in a month in bearing orchard between October 2014 to March 2015. The examinations were made at Corvinus University of Budapest, Faculty of Horticulture, Department of Pomology. Three different temperature of treatments were chosen per month according to the outside temperature. From the collected data the LT₅₀ values (the lethal temperature which 50% buds suffering frost damage) were computed. Examined cultivars were the Hungarian cultivars; Milotai 10, Alsószentiváni 117, Tiszacsécsi 83 are grown on the largest orchard surface in Hungary among walnut cultivars. The novel bred cultivars were Milotai bőtermő, Milotai kései, Milotai intenzív, Alsószentiváni kései and the Californian bred cultivar, Chandler. Based on our preliminary result in three month the same results were detected by the Milotai 10 and Milotai intenzív. Also Milotai bőtermő and Milotai kései cultivars had similar frost hardiness, but in certain months they had higher tolerance of frost than Milotai 10. Between Alsószentiváni 117 and its hybrid (Alsószentiváni kései) were measured significant difference in March. The length of deep dormancy period of Alsószentiváni 117 cultivar was shorter than Alsószentiváni kései cultivar. The lowest LT₅₀ value, -26,4 °C was detected by Tiszacsécsi 83 in January. Among examined cultivars Tiszacsécsi 83 cultivar had the highest tolerance in the whole period of examination. The frost susceptibility of Chandler cultivar was the highest in October and November, but January and February the frost hardiness of this cultivar was really closed to the Milotai 10. The frost hardiness of Chandler cultivar formed much slowly than the other examined cultivars.

POMOLOGICAL EVALUATION OF A DOUBLE SELECTED WALNUT POPULATION

Géza Bujdosó¹, Ferenc Izsépi¹, Krisztina Szügyiné Bartha¹, Roland Schmalzer², Péter Szentiványi¹

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The Persian walnut (*Juglans regia* L.) is the most important shell fruit species in Hungary. Growing of this species became very popular in the last 10-15 years, today there are 6 100 ha commercial walnut orchards countrywide. The most grown variety is 'Alsószentiváni 117', its growing ratio is approximately 40% in the Hungarian orchards, followed by 'Milotai 10' with up to 73% growing rate. As a part of the walnut breeding program of the NARIC Fruitculture Research Institute, a pomological evaluation of a double selected walnut population was done to select new promising walnut hybrids.

The examination was made at the National Agricultural Research and Innovation Centre – Fruitculture Research Institute between 2012 and 2014. The experimental orchard was established by Prof. Péter Szentiványi in 1997, and it contains around 100 different genotypes. The examined hybrids originated from the following combinations: 'Milotai 10' x 'Pedro', 'Pedro' x 'Alsószentiváni 117', 'Alsószentiváni 117 x Pedro'. During the examination period the most important characteristics of the genotypes were examined, such as leafing-out time, blooming time, ripening time and physical parameters of the walnut fruits.

Based on our results five genotypes had late leafing-out time, which are ideal for the Hungarian climate conditions. No significant difference was observed during the examination of blooming time and ripening time compared to the standard Hungarian varieties. Based on the results of the measurement of physical parameters all genotypes reached 32 mm fruit size in diameter, which is the requirement of the first grade fruits on the market. The fruit weight and fruit volume values of most hybrids exceeded the results of the control variety 'Alsószentiváni 117'. Only two genotypes reached 50% in kernel rate. Cracking rate determines the percentage of whole and half kernels, 11 hybrids reached the ideal 70% cracking ratio (ratio of halves and whole).

Based on the results of this study two genotypes (tree no. V/2/28-30 and tree no. V/3/30-31) were found which had excellent values as a result of all the examinations. Further studies are required to investigate this two promising walnut hybrids.

WALNUT CULTIVATION IN IRAN

Kourosh Vahdati

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Persian walnut *Juglans regia* originated from Persia (old Iran) and is the only species of walnut which is grown in Iran. There are a few trees of *J. nigra* and *J. hindsii*. Walnut planted area increased from about 10,000 ha in 1980th to more than 200,000 ha in 2010. Although walnut grafted orchard has been established in recent years but most of the orchards are seedling. Persian walnuts are cultivated in all parts of Iran with different elevations from -26 m to 2500 m above sea level although mostly scattered around Zagros mountain series in West and Alborz mountain series in North of Iran and around Lalezar and Barez mountains in South. Kerman, Lorestan and Hamedan have the largest area under walnut cultivation. The well-known populations situated in Toosierkan of Hamedan, Rabour of Kerman, Ziabad, Alamout of Qazvin and Shahmirzad of Semnan districts. According to the FAO, Iran ranked as the second largest walnut producer in 2014 but walnut export is quite low and the country ranks 27th and 32nd for export amount and export value, respectively. Number of walnut genotypes is estimated about 20 million seedling trees. Two new cultivars, ‘Jamal’ (Z63) and ‘Damavand’ (Z30) (as the pollinizer of ‘Jamal’), were released in 2010 as the first Iranian cultivars. Among the foreign cultivars, ‘Chandler’, ‘Fernor’, ‘Pedro’, ‘Howard’ and ‘Hartley’ are recommended and ‘Ronde de Montignac’ and ‘Franquette’ were selected as the pollinizer. Frost injury and drought stress are the main limiting factors in walnut orchards. Walnut harvest is also one of the difficulties in walnut growing areas, because the trees are very tall and could not be harvested by mechanized methods like shaking the trunk or limbs. These trees are usually harvested by long wooden sticks. Patch and shield budding under outdoor or greenhouse conditions and modified whip, saddle, bark and omega grafting of 2-3 years old seedlings are the most successful methods of walnut grafting in Iran. A modified bark grafting method was developed for topworking of mature trees in which the grafting point is wrapped using a plastic bag containing moist sawdust. Micropropagation of walnut initiated in 1990 in Iran and has been commercialized by some companies. Several micropropagated walnut orchards have been established in Iran during last decade. Department of Horticulture, University of Tehran, Aburaihan Campus, Pakdasht, Tehran was recognized as the Center of Excellence for Walnut Improvement and Technology in 2012.

Key words: *Juglans*, orchard, breeding, cultivar

POSSIBILITIES FOR HAZELNUT-TRUFFLE CO-CULTURE

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Hazelnuts are widely cultivated for their fruit with great success in numerous countries for centuries. In the last decades, however, a new, multi-purpose orchard type appeared, providing not only hazelnuts but also truffles from the same plant. Truffles are symbiotic fungi (so called mycorrhizal mushrooms) producing highly valued fruit bodies („truffles”) under the soil surface. Their host plants include oaks, pines, lindens and also hazels. Two species of truffles are the main objective of cultivation worldwide: Périgord truffle (*Tuber melanosporum*) and Burgundy truffle (*Tuber aestivum/uncinatum*), being sold for 800-1000 EUR/kg and 50-300 EUR/kg, respectively. The two fungi require different environmental circumstances, but both can be tailored to the need of hazels. Co-culture of hazelnuts and truffles means a compromise from both sides, however, considerable income can be realized from the multi-cropping. When establishing a plantation it is essential to decide primary and secondary purposes, however, probably less hazel and less truffle will be produced than a one-purpose plantation. On the other hand, mycorrhiza fungus helps seedling development and increases self-defence ability even under suboptimal circumstances, reducing fertilizer and pest control costs.

HAZELNUT AND ALMOND GENETIC RESOURCES CONSERVATION CHARACTERIZATION AND USE

**Loretta Bacchetta¹, Andrea Brunori¹, Chiara Santi¹,
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Francesca Mariani², Giulia Cappelli², Daniela Giovannini², Annalisa Basso²**

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Among nuts, hazelnut and almond have worldwide economic relevance. Italy is the second largest hazelnut producer in the world, placed just ahead of the USA and behind Turkey. Italy has also a long tradition of almond cultivation, although production has decidedly decreased in recent years, due to the reduction of EU agricultural support programs and the strong competition of the Californian almond production, traded at lower prices. As a consequence, these events have favoured the abandonment of plantations or a shifting towards more profitable crops. Regarding the internal nuts market, the per capita consumption of nuts in Greece is the highest in Europe - and one of the highest in the world - followed by Spain and Italy. Playing an important role in Mediterranean diet, almonds and hazelnuts are highly consumed within Southern Europe. Nuts are a great source of protein; they are rich in fibres, phytonutrients, antioxidants such as Vitamin E and are rich in polyunsaturated fats. In the past two decades, several biochemical and clinical studies have provided consistent evidence of the healthy properties of nuts. The EU domestic production supplies less than 40% of the local demand and the rest is imported from Turkey and USA. The main Italian cultivars (Tonda Gentile delle Langhe, Tonda Gentile Romana and Giffoni) receive large appreciation by industry and market. Additionally, also several traditional cultivars are available which have been selected over many centuries from local wild populations, thus underlining the social value and the role of nuts in sustainable agricultural systems. Moreover, as stated in the Commission Staff working paper, Analysis of the Nut Sector (2002): “*nut production plays a fundamental part in protecting and maintaining the environmental, social and rural balance in many regions*”. These aspects are key factors in favouring sustainability in rural areas according to a multifunctional concept of agriculture widely promoted by the EU.

Within research activity on hazelnut, ENEA studies focused on the propagation of this species by means of in vitro techniques (Bacchetta et al, 2008). The large scale production of tissues and plant cells in bioreactors is considered a promising technology for mass propagation, and preservation of crop plants (Paek et al., 2005). In recent years particular effort has been dedicated to the production of secondary metabolites from adventitious root cultures seemingly more stable and easier to handle compared to cell cultures. At ENEA, experiments have been carried out to study the production and accumulation of the antioxidant alpha-tocopherol in the adventitious roots of *C. avellana* (Sivakumar et al., 2005; Sivakumar and Bacchetta, 2006; Bacchetta et al., 2011). ENEA was also involved, as coordinator, in 068 Agri Gen Res SAFENUT project (11 Partners from 6 European Countries), providing an important contribute to the recovery, characterization and conservation of hazelnut and almond germplasm in the main European areas of cultivation. The main achievements and the SAFENUT Database will be discussed, highlighting critical aspects and perspectives.

On this background, a recent study was carried out in order to broaden the knowledge about hazelnuts human beneficial health effects. A group of healthy voluntaries were selected in order to verify the effect of an enriched hazelnut diet (40 gr/day for 6 week). The results confirmed a positive effect on blood lipid profiles without any body weight increment. However the beneficial effects appeared to be reversible after 6 weeks on a hazelnut free diet.

Analysis of the immune-modulating effects of *Corylus avellana* extract on human Monocyte-Derived-Macrophages (MDMs) primary cultures were carried out in collaboration with the Institute of Cell Biology and Neurobiology of the National Research Council.

A hydro-alcoholic extract of *C. avellana*, characterized by ENEA with liquid chromatography coupled to Q-Exactive (Thermo Scientific) high resolution mass spectrometry, was administered on a primary MDM culture infected with *Staphylococcus aureus*, both wild type and *Methicillin* resistant (MRSA), to ascertain its possible bactericidal effect. From preliminary results, the extract displayed significant bactericidal power in all the three healthy donors tested, as compared with untreated MDMs. Meantime MDMs gene expression for inflammatory mediators, as cytokines, chemokines, transcription factors is under investigation.

A possible future research activity is suggested by the availability of a new empirical system for climate seasonal forecast recently developed at ENEA (Copernicus-LRF). The system, thanks to its uniqueness and the flexible approach, provides seasonal outlooks with a potential for practical use. Considering the strong influence of climate seasonal trends on hazelnut yield and kernel quality, the system could be tested as a part of a research program, in order to provide an useful early yield estimation for growers according to the climatic conditions expected.

PISTACHIO CULTIVATION IN IRAN

Amanollah Javanshah

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Pistachio trees can be found in regions of Iran, Syria, Lebanon, Turkey, Greece, Xinjiang (China), Tunisia, Kyrgyzstan, Tajikistan, Turkmenistan, India, Egypt, Italy (Sicily), Uzbekistan, Afghanistan (especially in the provinces of Samangan and Badghis), Australia and the United States. First position on production and cultivation area is belonged to Iran. Iran's pistachio faced with salinity in water and soil, drought and global warming effects. Orchard management in saline and drought area is specials and completely different. Studies on pistachio plant as one of the resistance plants in desert area with salinity and drought showed complex responses of pistachio trees. The data showed amazing resistance on saline conditions. Global warming also affected some cultivars and new method to overcoming on this natural effect studied.

NUT PRODUCTION IN SERBIA

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Walnut is the most important nut species in Serbia. The average production of walnuts in shell in Serbia is around 22,000 t. The area under the walnut trees is 14,000 ha, and the average yield per hectare is 1.6 t. In the last decade the production has a tendency of a slight decrease.

Walnut seedlings dominate in the production, while a number of grafted trees (cultivars) is much smaller. The most represented foreign cultivars are ‘Sheinovo’ from Bulgaria, German selections from Geisenheim: ‘G-139’, ‘G-251’ and ‘G-286’, and Slovenian cultivar ‘Elit’. Among domestic varieties most cultivated are: ‘Šampion’, ‘Srem’, ‘Bačka’, and ‘Rasna’. Serbian walnut cultivars were created by selection from natural populations. The leading institution in walnut selection is the Faculty of Agriculture in Novi Sad, where five new cultivars (‘Šampion’, ‘Srem’, ‘Tisa’, ‘Bačka’ and ‘Mire’) and several selections (‘Novosadski kasni’, ‘Rasna’, ‘Kasni rodni’) were created. In the Fruit Research Institute in Čačak several walnut selections were also selected (‘Ibar’, ‘Vujan’, ‘Ovčar’, ‘Medveđa’).

Walnut trees are usually planted in the form of individual trees in the yards, at the edge of fields or along roadsides. If plantations are established, they are generally smaller in size, typically 1-2 ha. There are only a few large plantations, with an area of 10 ha or more. The most common spacing between trees is 8-10 m. Since the walnut trees slowly reach full bearing, to obtain a higher profitability, combined plantings with other fruit trees, such as apricots, plums, or hazelnuts are often established. They are planted between the rows of walnut trees and pulled out after 12 to 15 years.

Hazelnut. In Serbia, hazel production is not recorded statistically. The production is estimated to 1,500 t, which does not meet the domestic needs. Because of that 1,000-1,500 t of hazel are imported annually, mostly from Turkey and Italy. Larger plantations were raised near Gornji Milanovac and in Vojvodina. Most cultivated varieties of hazelnut are ‘Istrian Long’, ‘Tonda Gentile Romana’ and ‘Tonda Gentile della Lange’, and as pollenizers ‘Hall’s Giant’ (‘Hallesche Riesen’) and ‘Römische Zellernuss’. Two growing systems are used: a bush and a tree. If the hazelnut is grown as a bush as planting material are used rooted suckers. The advantages of this growing system are cheaper nursery trees, early coming into bearing and higher yields, especially in the period of initial cropping. If the hazelnut is grown as a tree for planting are used nursery trees produced by grafting on Turkish hazel (*C. colurna*) seedlings. The advantage of this system of cultivation is that it does not form suckers, and it is easier to perform orchard floor management, plant protection and harvesting. Tree spacing ranged from 5 × 2.5 m to 6 × 4 m.

Almond. Almond production in Serbia is very small and is not statistically recorded (it is estimated to 100 t). The main growing area is Vojvodina, especially the area of Fruška Gora mountain. Cultivars with a hard shell (eg. ‘Tuono’, ‘Ferragnes’, ‘Texas’), dominate in production because they bloom later and less suffer from late spring frosts. As rootstocks are mainly used vineyard peach seedlings, and less almond seedlings or clonal rootstock GF677.

Sweet chestnut (*Castanea sativa* Mill.) grow in Serbia mainly as wild species, in forests. It is widespread in Metohija (Dečani), Drina valley, Sandžak, Fruška Gora, around Čačak, Prokuplje, Vranje, and Vršac. To a lesser extent it is grown as an ornamental plant or as a fruit in the form of individual trees in the yards. Chestnut seedlings dominate in the production, while grafted trees are less represented.

BACTERIAL BARK CANKER DISEASE ON WALNUT IN HUNGARY

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During August 2012, vertical oozing cankers have been observed on trunks and branches of walnut trees (*Juglans regia* L.) in the city of Zánka, near Lake Balaton and other parts of Hungary. Cankers were observed on trunks and branches where brown-to-black exudates staining the bark appeared mainly in the summer. Isolations were performed primarily from exudates but also from infected tissues by using King's medium B. Colonies are similar in appearance to *Brenneria nigrifluens* (syn.: *Erwinia nigrifluens*) were purified and characterized. The bacterium, first reported in California, was also recorded in Iran, Spain, France and several Italian locations, from walnut trees. The bacterial strain isolated from walnut trees was gram negative and did not induce a hypersensitive reaction in tobacco (*Nicotiana tabacum* L. 'White Burley') leaves. Isolated bacteria grew at 26°C. Colonies on KB were white and non-fluorescent as other bacterial species. The results of substrate utilization profiling using the API 20E kit (Biomérieux, Marcy l'Etoile, France). The isolate showed positive reaction for citrate utilization, H₂S and acetoin production and also in urease, glucose, inositol, saccharose and arabinose reactions. Pathogenicity was tested by injecting five young healthy walnut branches with bacterial suspension of 10⁷ CFU/ml. Controls were injected with sterile distilled water. Branches were enclosed in plastic bags and returned to the greenhouse under 80% shade at 26°C day and 17°C night temperatures. Three months after inoculation, necrotic lesions were observed in the inner bark and dark lines were observed in internal wood, but no external cankers were observed on inoculated branches. The water control appeared normal. *B. nigrifluens* was reisolated from lesions on inoculated branches and identified with the above method, thus Koch's postulates were fulfilled. For molecular identification of the pathogen the 16S rDNA amplification was performed from strain Bn-WalnutZa-Hun1 with a universal bacterial primer (63f and 1389r). The sequence was deposited in NCBI GenBank (Accession No. HF936707) and showed 99 % sequence identity with a number of *B. nigrifluens* strains, including type strains Z96095, AJ233415, JX484740, JX484739, JX484738, FJ611884. On the basis of the symptoms, colony morphology, biochemical test and 16S rDNA sequence identity, the pathogen was identified as *Brenneria nigrifluens*. To our knowledge, this is the first report of a natural outbreak of bacterial bark canker on walnut in Hungary and presence of the pathogen may seriously influence in local orchards and garden production in the future. This appearance may have serious consequences for future Walnut production in Hungary.

CURRENT STATE OF CHESTNUT (*CASTANEA SATIVA* MILL.) CULTIVATION AND OCCURRENCE IN THE MODRÝ KAMEŇ AREA (SLOVAKIA)

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Castanea sativa Mill. has grown in the Modrý Kameň area as an important fruit tree in orchards, but it has also successfully expanded into forests as an ameliorative and melliferous tree species. Modrý Kameň area is located in the south part of central Slovakia. This area represents the unique chestnut region in Slovakia connected with the old tradition of cultivation this multipurpose species. The total amount of chestnut trees in this area have considered for more than 1500. Chestnut trees which grow in old orchards are generally of seed origin. It is supposed that chestnut was introduced first time to this area during Ottoman invasions between 16th and 17th century. Nowadays, chestnuts grow at few different localities mainly on slopes of the hills. During last years chestnut production markedly declined in the Modrý Kameň area as a result of huge dying out of chestnuts caused by chestnut blight. Variability itself which is so characteristic for this species has acquired during long-term cultivation and as well as different microclimatic conditions even greater variability in this area. It is necessary to take measures to preserve chestnut variability in the Modrý Kameň area for future generations.

NUT TREE CROPS RESEARCH AT IRTA (SPAIN)

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Work on nut tree crops at IRTA, including several R+D+i lines, started in 1973 when extensive surveys on hazelnut and almond genetic resources were carried out. Both species were and are important in Catalonia. Lately, with the aim of diversification and finding new alternatives to these traditional crops, works on other nut tree species was started. In 1976, work began in walnut and in 1982 in pistachio. In 1985 research on carob tree started and in 2007 work on two agroforestry species: stone pine and chestnut included. Regarding crop stock, wide germplasm of five species is maintained. Hazelnut, walnut and carob collections are the Spanish national gene-banks and are funded by Spanish government. An important almond cultivar collection is also conserved. On stone pine, clonal selections are maintained. Genetic diversity studies of most of the species using molecular markers have being made.

Work in each species is planned considering sector demands and efforts are devoted accordingly to crop relevance and funding availability (public and private), mainly in almonds and hazelnuts. Usually, the whole supply chain is covered, including plant stock, orchard management, harvest and postharvest management, industrial processing and product quality. Activities on almond include an active and large breeding programme aiming to obtain self-fertile, late blooming, easy training and productive varieties. Recently, tolerance to some fungal diseases and high kernel quality goals were highlighted. Several cultivars have been released and are widely planted by growers. In addition, several trials on cultivars, rootstocks, high density orchards and mechanical harvesting are carried out. Industrial aptitude of new almond selections is physically and chemically analyzed and also mathematical models developed to predict their industrial aptitude.

Traditional hazelnut orchards are been renewed by applying new technologies developed by IRTA. Virus-free cultivars are grafted onto non-suckering rootstocks in order to increase tree vigour, early bearing precocity, productivity and reduce cultural costs, allowing labour mechanization. Complementary R+D lines consider the study of particular pest and diseases responsible to prevent crop to be spoilt.

On chestnut, selection of local cultivars in two areas of Catalonia has being made. On stone pine work on grafting rootstocks has been developed both to reduce juvenility and better adaptation to chalky solis. Harvest management and postharvest technology was studied, in order to minimize quality loses in the orchard.

Currently, IRTA is part of the BIOFOS European project developing one analytical device, based on biosensors, microfluidics and photonics, to detect mycotoxins in any kind of nuts.

Key words: almond, carob, chestnut, hazelnut, stone pine, walnut, breeding, trialling, scion and rootstocks, crop and postharvest technology, product quality, research lines.

GERMPLASM EVALUATION, CONSERVATION AND BREEDING OF NUT CROPS IN ROMANIA

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Walnut, hazelnut, sweet chestnut and almond are nut crops that are commercially grown in Romania.

Out of these crops, walnut is by far the most important one, walnut trees being spread almost on the entire territory of Romania where favorable ecological conditions are present from Danube Delta, plains, hills and up to 800 m elevation. Almost 5 million walnut trees were reported, most of them being not grafted. Only a few organized orchards established with grafted material are present. Taking into account that most walnut trees are of seedling origin, selection activities have been carried out *in situ* starting with 1958. Research activities concerning walnut were carried out at Fruit Growing Research & Extension Stations (SCDP) of Geoagiu, Tg. Jiu, Iași, Fruit Growing Research Institute (ICDP) Pitești – Mărăcineni and University of Craiova - SCDP Vâlcea. Cultivar and rootstocks breeding were taken into account, till now 32 cultivars and 3 rootstocks were named. Only a few of them have been propagated and spread into culture.

Research activities concerning hazelnut were started in the 1970s at SCDP Vâlcea. At that time an active collection was set up with introduced material. Intensive breeding program through crossing was launched and 7 cultivars have been named till now. Identification and evaluation of wild hazelnut genetic resources was not performed. Old Turkish hazel trees (*Corylus colurna*) are present in several remote locations in the SW of Romania.

Sweet chestnut is a minor crop spread mainly in the North and South West of Romania. SCDP Baia Mare and SCDP Tg. Jiu research stations were involved in activities related with growing, selection and breeding sweet chestnut. Seven cultivars were obtained and spread in the orchards in the 1980s. Later, in the 1990s, selection and breeding activities were continued by UCv-SCDP Vâlcea. Two cultivars were named till now. In the last years, chestnut blight destroyed the orchards, but also seriously affected the chestnut groves. Inoculation with transmissible hypo virulent strains of *Cryphonectria parasitica* carried out by ICAS Brasov started to produce positive effects in several locations.

Almond is also very little distributed in Romania due to its demands regarding favourability of ecological conditions. Most of the almond orchards and isolated trees were located in the West, South West and South East of Romania. The almond breeding from SCDP Bihor has issued 7 cultivars released from 1991 till 2006.

Germplasm collections have been established using local genetic resources but also introduced biological material. Nowadays, national germplasm collections are located at ICDP Pitești, SCDP Geoagiu, SCDP Iași and UCv-SCDP Vâlcea for walnut, at SCDP Constanta for almond and UCv-SCDP Vâlcea for hazelnut and sweet chestnut. Accessions are evaluated using IPGRI, UPOV and FAO descriptors. Characterization of nut crops accessions using molecular markers was very little used.

NUT CROPS IN SLOVENIA: CURRENT STATE, RESEARCH AND PERSPECTIVE

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Walnut, hazelnut and chestnut belong to traditional fruit species, cultivated in Slovenia. Seedling populations of walnut and hazelnut are naturally widespread almost all over the country, whilst commercial growing of vegetatively propagated plant material is mainly located in the Central and the Eastern part of the country from the North towards the South. App. 500 hectares of walnut and 100 hectares of hazelnut orchards represent 12 and 2 % of Slovene intensive fruit growing area, respectively. Walnut year-production (seedlings and grafts) varies from 3.000 to 4.000 tons, and about 200 tons in-shell hazelnuts are produced in the orchards. European chestnut tree is naturally spread in forest areas in Central, Eastern and Western parts of the country. Together with some other acidophilic broadleaf trees, it covers app. 250.000 hectares, and is important for both nut and timber production, as well as for the tannin industry and in the social-cultural context. Due to spring frosts that frequently occur in the continental parts of the country, late leafing walnut cultivars, such as Franquette and Elit, currently Fernor and Fernette are the first choice for the orchards. Among mid-late cultivars, Lara, Chandler and G-139 are recommended for warmer locations. Istrska dolgoplodna leska, which is characterized by very high crop, predominates in older hazelnut plantations, while an interest for planting some foreign cultivars, such as Tonda di Giffoni, Daria, Ennis, etc. is increasing among new hazelnut growers. In chestnut, large fruits are favoured and collected from the seedling trees in the forests, compared to small orchards, which are made of marrone-type cultivars, such as Marsol, Bouche de Betizac, Precoce Migoule, Maraval and Marigoule. In the past time, planting material was mainly obtained from domestic nurseries, organized by Biotechnical faculty. Owing to increasing demands, additional material should currently be imported. The orchards include 100 – 208 walnut trees/ha, 333-500 hazelnuts/ha and 100 – 125 chestnut trees/ha. Walnuts and chestnuts are trained as goblet or central axis, while in hazelnut a multistem bush is still the main training system. App. one third of walnut orchards and a half of hazelnut ones are grown under integrated fruit production. 10-20 % of the orchards are ecological. The nuts are sold at local markets at good prices. The main producers offer them under trade-marks 'Slovenski oreh' and 'Slovenski lešnik', respectively. Due to good economical result and many health beneficial effects, an interest for both planting and consuming of walnuts, hazelnuts and chestnut is increasing. It is supported by research, mainly carried out by Biotechnical faculty. It is focused on testing foreign varieties; investigation of domestic genetic material and creating new varieties; study of tree architecture, propagation methods, some phases of orchard management and plant protection; biochemical characterization of the nuts and their by-products; linkage between secondary metabolites and different stress factors. The knowledge is regularly transferred to the growers. Most of them are members of the Association of Nut Growers of Slovenia, who cares about knowledge transfer organizing different forms of education.

NUTS IN BOSNIA-HERZEGOVINA – CROPS ON THE MARGINS OF FRUIT PRODUCTION

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Nut crops in Bosnia-Herzegovina have no economic significance. Specific pollination and fertilization conditions, environmental and pedoclimatic conditions and inappropriate production systems have contributed to the sporadic occurrence of walnut and hazelnut trees, while plantations are almost non-existent. Although chestnut (*Castanea sativa* Mill.) occurring in natural populations as a component of forest stands in northwestern Bosnia-Herzegovina exhibits high levels of genotypic diversity and richness, it is still generally used as a wood raw material, rather than as a fruit crop.

According to official data on nut crop production in Bosnia-Herzegovina in 2014, a total of 560,000 walnut trees were registered, with a total production of just above 2,000 t of fruits. Walnut production is characterized by dominant seedling production, an outdated range of cultivars and inappropriate growing technologies. Any attempt at hazelnut plantation production in Bosnia-Herzegovina in the last 50 years has failed. Namely, hazelnut plantations grown on over 250 ha of land during the period have been abandoned and cleared after a long period of poor productivity. Nowadays, hazelnut production in B-H is extremely low, regardless of growers' tendency to establish new plantations. Under Bosnian-Herzegovinian conditions, introduced cultivars of hazelnut bear fruit irregularly, and their fruiting is dependent on a number of factors primarily associated with a disturbance in reproductive organ development.

Project activities conducted at the University of Banja Luka (Faculty of Agriculture and Genetic Resources Institute) up to the present have involved research on hazelnut and chestnut. Study on the genotype specificity of hazelnut pollen during its formation and pollen functional ability during pollination in 14 hazelnut genotypes under the production conditions of the Banja Luka region has served as the basis for defining cultivar composition relevant to the realization of the fruit bearing potential in hazelnut plantings. Research on cytogenetic aspects of microsporogenesis and microgametogenesis in 22 chestnut genotypes in the Potkozarje region to single out high yielding trees that have a relatively high rate of pollen production and germination has been conducted for potential changes in the reproductive potential of hazelnut within a population i. e. to create a realistic basis for intervention involving the introduction of good pollinators to certain positions in natural chestnut populations.

Preliminary research on these fruit species confirms the necessity for further investigation as a prerequisite to the improvement of their cultivation in both the Republika Srpska and Bosnia-Herzegovina.

Key words: hazelnut, walnut, chestnut, fruit-bearing potential

THE TRENDS OF NUT CROPS VARIETY REGISTRATION AND PROTECTION

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The plant breeder's achievements are realized into new varieties for fruit growers. This is a cost and time-consuming process, especially in the case of nut sector. Additionally the orchards of different nut species are long-lasting culture generally with lower density. These conditions require significant investments from both sides of the breeder-grower partnership. Moreover the participants of nut sector have to face with new challenges within Europe in the changing economical and ecological environment. The nut production expects to meet the new requirements by new varieties among others. This way the plant variety registration and protection are good indicators to analyze the trends of nut crops.

Considering the number of officially registered varieties, almond (*Prunus dulcis* (Mill.) D. A. Webb), walnut (*Juglans regia* L.) and hazelnut (*Corylus avellana* L.) seem to be the dominating species of the nut sector. These three crops cover the 90% of common knowledge varieties within nuts. However this is too much a general number, which hides the trends of the recent years. The number of applications for variety registration compared with the number of plant variety protection and plant patent made during the last decade reflects effectively the developments. The number of new variety application for registration shows the same like the above mentioned situation comparing species and years. Almond takes almost the 40% of it. However there is a dramatic change in the number of candidates for variety protection. Although new almond varieties reach the 40% here also, the other 60% are almost equally shared by macadamia (*Macadamia* F. Muell.), pistachio (*Pistacia vera* L.) and interspecific hybrids, walnut and hazelnut. Additionally, the pecan nut (*Carya illinoensis* (Wangenh.) C. Koch) and chestnuts (*Castanea* sp.) have even more significant ratio as well. Observing the recent trends in nut production, it use even broader genetic basis. The upcoming trend crops and interspecific hybrids are meaning an even extended position of nut growers in fruit production of the close future.

RESEARCH ACTIVITIES ON NUT TREE CROPS AT DISAFA- UNIVERSITY OF TORINO

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The Department of Agricultural, Forest and Food Sciences has been working on nut tree species (hazelnut, chestnut, walnut and almond) for over 50 years. The main research lines include:

- germplasm search, rescue, characterization and conservation
- breeding and evaluation of cultivars
- studies on fructification biology
- nut quality and post-harvest management
- orchard management techniques
- development of propagation methods
- DNA typing by molecular markers
- control of pest and diseases

Current ongoing projects were designed on the specific issues concerning hazelnut, chestnut and walnut. Some of them are presented to follow.

Hazelnut. Research activity carried out is focused on the development of a genetic map from a F1 progeny 'Tonda Gentile delle Langhe' X 'Hall's Giant' aimed to map QTL regions for traits of interest.

A first QTL map was constructed using 152 SSR loci studied in 163 individuals. The map shows QTL regions for vigor, suckering aptitude and time of budburst. Further work is ongoing to develop a second, saturated, map using SNP markers obtained by genotyping by sequencing, detecting QTL regions for phenological and nut quality traits.

Chestnut. A segregating progeny was recently obtained to study the resistance trait to *Dryocosmus kuriphilus* Yasumatsu (Hymenoptera: Cynipidae) found in the Euro-Japanese hybrid 'Bouche de Bétizac' (BB). Studies carried out showed a hypersensitive response to the insect leading to larvae death in BB. The mapping of the traits, that appears to be inherited in a Mendelian way, is in progress. Transcriptomic analysis has been carried out by RNA-Seq to study the response of the plant to the insect in resistant and susceptible genotypes yielding the first chestnut reference unigene catalogue likely including genes involved in plant-insect interaction.

Walnut. The growing interest for the planting of orchards in Italy has increased the activities on this species. Crossings between Californian cultivars were carried out in the '80 at DISAFA and a group of individuals from these progenies are currently under advanced observations with major international cultivars in order to select new high yielding cultivars suitable for the North Italian climate.

STRUCTURE OF NUTS PRODUCTION IN MACEDONIA

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Despite the favorable environmental conditions and potentials for growing numerous fruit species in R. Macedonia, fruit growing production has not taken its rightful place and is not largely represented. In the last ten years, in the Republic of Macedonia, the areas under orchards cover 13 to 16 thousand hectares or 2.21-2.94% of the total arable land.

The production of nuts as a separate pomological group which includes walnut, almond, hazelnut, chestnut and pistachio is deficient and does not meet domestic needs. From this group only the walnuts are produced in somewhat larger quantities, but production is mainly from individual trees and small plantations. The total walnut production in Macedonia for 2014 was 5769 tons produced from 183160 trees. There has been a slight tendency increase in the cultivation of this fruit crop in the recent years. Mainly, walnut plantations can be found in the slightly hilly areas of all territory of the state. This production is mainly from orchards established by selected seedlings. Only small part of production is from grafted planting material and from specific varieties. Main varieties uses in the production are Bulgarian varieties: Sejnovo, Drenovo, Silistrenski and Izvor 10; Serbian varieties: Novosadski kasni, Srem, Sampion and Tisa. In the last years, there's an interest for the well known international varieties. Until now, only one selection K1 has been selected from the rich population of *Juglans regia* in Macedonia.

The existing almond plantations are mostly abandoned, but there have been recently established around 150 ha of new plantings.

In the recent years, the interest of hazelnut growing began to raise intensively. For the period 2010-2014, around 500 ha of new plantings hazelnut are established. These orchards still haven't reached their full fruiting.

Chestnut orchards are rare. The chestnut fruits are picked in large amounts out of wild fruits which are present in some regions with higher altitude. The majority of the fruit is exported. In average, the period 2010-2014 has a positive balance of export and import of chestnuts in quantities of about 325 t, worth about 230 thousand €.

Pistachio production is absent although in some regions there are suitable conditions for production of this fruit species. The deficit of production from this fruit species is satisfied mainly by imports. The average deficit in the import-export of this crop for period 2010-2014 is 417.8 t, with a value of 2,02 million €.

Imports mainly originates from Turkey, Greece, Iran and other countries in smaller quantities.

Key words: walnut, almond, hazelnut, chestnut, fruit production

CORRELATION AND MULTIPLE REGRESSION AMONG SOME TRAITS FOR ESTIMATING NON-DISTRACTIVE LEAF DRY WEIGHT IN WALNUT

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In abiotic stress experiments leaf dry weight measurement is one of the key traits. The objective of this study was to use statistical methods of phenotypic correlation, multiple stepwise regressions and path analysis to evaluate the relationship among leaf dry weight and related traits for estimation of nondestructive leaf dry weight of walnut using 200 walnut (*Juglans regia*) seedling genotypes. Leaf traits such as leaf length, leaf width, leaf area, petiole length, leaflet number of leaf and leaf dry weight were main selected measurements for the data analysis. Phenotypic correlation indicated that leaf dry weight had highly positive correlation with leaf length ($r=0.78^{**}$), leaf width ($r=0.76^{**}$) and leaf area ($r=0.80^{**}$). Stepwise multiple linear regression interpretation also indicated that 70% of variation in leaf dry weight attributed to variation which arose from leaf area, leaf width, and main leaf length. The results of path analysis strongly suggested that leaf area and leaf width contain positive direct roll on leaf dry weight. Therefore, it could be concluded that leaf area, leaf width and leaf length are putative morphological markers which can be considered as the desirable tools for estimating of leaf dry weight in walnut genotypes under the field conditions.

Key words: leaf dry weight, phenotypic correlation, stepwise multiple regression, walnut

ALMOND BREEDING PROGRAM OF CEBAS-CSIC IN MURCIA, SPAIN

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The almond breeding program of CEBAS-CSIC began in 1971. Since then, thousands of seedlings have been obtained and the late flowering self-compatible cultivars Antoñeta and Marta released. Both cultivars are being cultivated with success in Spain and abroad. Due to the expansion of this culture towards very cold inland areas in Europe where frost risk is very high, we included the extra-late flowering time among our objectives of breeding. After some years of work, the extra-late flowering self-compatible cultivars Penta and Tardona were released. Penta flowers 15-20 days after Ferragnès, it is self-compatible, very productive, and early ripening. Due to these characteristics, it is a cultivar very interesting for these areas with a high risk of frost. Tardona is less productive, but it is the latest flowering cultivar ever obtained in the world (20-30 days after Ferragnès), and it could be cultivated in the areas where even Penta flowering could be damaged by frost. Several promising new extra-late flowering self-compatible selections are under evaluation in commercial orchards in Spain.

Keywords: Almond, *Prunus dulcis*, breeding, self-compatibility, late flowering, new cultivars

SALINITY TOLERANCE OF PISTACHIO SEEDLINGS WAS IMPROVED BY EXOGENOUS APPLICATION OF SALICYLIC ACID

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Salicylic acid (SA) is a phenolic compound that is responsible for inducing tolerance to a number of biotic and abiotic stresses such as salinity stress. This stress is a serious threat to many pistachio growing regions in Iran. Effects of exogenous application of SA on improving salinity tolerance of a pistachio variety were evaluated under controlled conditions. Four-month seedling plants of *Pistacia vera* L. 'Badami-Zarand', foliar applied by SA in three concentrations including 0, 0.5 and 1 mM, and plants was irrigated with saline water including 0, 50 and 100 mM NaCl during the growing season. Growth parameters of the plants including height, stem diameter, shoot and root dry weight, number of leaves and leaf area were the traits measured at the end of the experiment. Also, chlorophyll concentration, relative water content (RWC) of the leaves, leaf prolin, total soluble sugars, MDA and H₂O₂ concentration were the other traits evaluated in this study. The results of this experiment indicated that SA plays an important role in reducing the adverse effects of salinity stress. Salinity decreased shoots and roots growth, number of leaves, plant biomass, and chlorophyll content in control plants. Foliar application of SA was led to improved growth characteristics of the plants under salinity stress. Also, it was decreased lipid proxidation index and increased the amount of hydrogen peroxide generated in the treated plants. In aggregate, plants irrigated with water containing 100 mM NaCl, suffered the greatest damage and foliar application of SA at 1 mM had the most alleviation on this salinity level.

Keywords: Pistachio, Salt stress, Salicylic acid, Salinity tolerance.

FRENCH NUT DEVELOPMENT: PRODUCTION AND RESEARCH

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Except from the Almond (which starts to rise, driven by the global excitement about it) the nut production (walnut, hazelnut and chestnut) has continued to grow the last years in France including positioning the walnut orchard in second in terms of area (21,000 ha). Indeed, the strong demand causing an attractive price and low subject to fluctuations and relative "simplicity" of the culture of these nuts has led producers to invest. This invest is mainly reflected by a dynamic of strong planting. It was also attended by a significant progress in terms of R & D. Indeed, based INRA scientists, Ctifl, different experimental stations or professional organizations, all contributed to the development of cultures. These advanced touched all areas of the culture of these species: (1) growing techniques with the introduction of high density orchards and an almost total mechanization, an irrigation management using the latest technology (sensor, image and hyperspectrale analysis), fertilization adapted to each culture, or even each variety, (2) the development of knowledge and alternative means to fight the various biological pests (mass trapping for walnut fly, the development of Puffer against codling moth, net against Eurytoma for almond,...) or yet (3) the plant material with the release of new varieties (Chestnut: Bellefer, Walnut: Ferbel, Ferouette, Feradam and Fertignac) and rootstocks from the latest innovation programs made of collections that are among the largest in Europe. Currently new innovation programs using biotechnology are in the pipeline including the walnut.

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4. Kórház köz
Lengyeltóti
8693
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The biggest homogeneous nut-tree grove of Hungary and the neighbour countries. Lies on the Southern side of Lake Balaton, on the hills between Fonyód and Balatonboglár. The company builds its activity upon the rich experiences in nut cultivation.

Gyugy village -which is next to Lengyeltóti- has an archaism name which evocates the word „nut” referring to the fact that nut has been also grown for half a century on the area. And there have been colonies enclosed by nut gardens in the surroundings for five hundred years.

The species form Alsószentiván, Milota and Tizacsécse have excellent external and internal value. As a result of a calculated more than 50 years long selection in the nut garden, now this species can be found as a homogeneous thirty years old stock.

We acquired the proficiency and modern knowledge in nut growing. Studying the national and foreign professional material and using the researchers and research institutes rich store of learning. About 15.000 walnut-trees are grown by integrated plant protection technology where the main aim is the quality nut from pruning to the harvest.

The large quantity of fruit is made. Exportable, good saleable product in the markets of the European Union by modern gathering, dehydration and preparation activity.

Is original, tasty, riched in vitamins and minerals. The light coloured walnut-meat, which has a good market in the national processing industry, confectionary and among consumers. Our aim is the high-quality small and large unit packing and the tasteful look of the nut on the foreign and national markets besides the Hungarian „TÓTI NUT” should remain a popular product on the markets in Munich, Stuttgart, Vienna and in England.

**Hungarian
Horticultural Propagation Material
Non-profit Ltd.**

306. Nagytétényi Street

Budapest

1225.

Tel: +36-1-207-8111



The Hungarian Horticultural Propagation Material Non-profit Ltd. was founded in 1949, which was transformed on 7th January 2015. from the Research and Extension Centre for Fruit Growing. It is a 100% state owned, strong public company in the field of production and distribution of the horticultural propagation material with a nationwide coverage. (Tax number: 14822951-2-43, Registration number: 01-09-201774)

The most important tasks:

- ❖ to place great volume and high quality domestic breeding material on the Hungarian and international market (fruit, grape, forest species)
- ❖ to implement and develop new methods in nursery production
- ❖ to convey the market feedbacks (demands, opportunities) to the researchers and breeders
- ❖ high-level advisory activity, solving technological problems and challenges (our professional background is the National Agricultural Research and Innovation Centre)
- ❖ cooperation with the National Agricultural Research and Innovation Centre in order to achieve the goals of the research and ensure the practical operational background

We elaborate and execute practical and high level R + D and innovation programs which improve the competitiveness and sustainable development of the Hungarian agriculture. The variety innovation and national variety management is priority among the Ltd. activities.

Great micro-propagation capacity and experience in the field of forestry and fruit tree species. 350.000 slips, 450.000 nursery sapling, 350.000 small fruit plants are sold each year. Eastern Europe's largest producer of walnut slips.

The kind of production is based in a conventional and biotechnological methods, expanding the business into some of the less cultivated and known fruits. The Company plays an important role in the biological basic of small fruits and woody fruits research, and supply of home nursery with virus-free propagation. A part of our products is prepared in micro-propagation laboratories, another part of our products is prepared by cuttings and field planting.

Within the framework of the Ltd. we make more than 19 species and 290 varieties of propagation production. To meet the changing market needs the propagation material production can be expanded within broad framework.

The Hungarian Horticultural Propagation Material Non-profit Ltd. currently has six locations, which are as follows:

- ❖ Újfehértó
- ❖ Érd-Elvira-Major
- ❖ Fertőd
- ❖ Cegléd
- ❖ Budapest, Park street
- ❖ Kecskemét-Katonatelep

The Ltd.'s all locations maintain consultancy points, where producers receive full help in all aspects of fruit production, for example the selection of the production site, the tenders, the first harvest, during entire period of the plantation in one-stop system.

The Ltd. in the year 2015 is starting the cooperation with the vineyards and forest research institutes as well. In the primary plans the Badacsony and Pécs Research and Extension Centre is included.

Useful informations

Wireless LAN access

Network Name: gyumolcsintezet

Password: 2217221722

Important telephone numbers:

NARIC-FRI Secretariat: +36-1-362-1596

Emergency numbers in Hungary:

Ambulance: 104

Fire: 105

Police: 107

General emergency: 112

Public transport websites:

Budapest Public Transport: www.bkk.hu

Hungarian State Railways: www.mavcsopot.hu

Airport of Budapest: www.bud.hu

Airport shuttle: www.airportshuttle.hu/en (ph: +36 1 269 8555)

Taxi companies:

6x6 Taxi : +36-1-666-6666

Taxi2000: +36-1-200-0000

FőTaxi: +36-1-222-2222

Budapest Public Transport (BKK) tickets:

- Single ticket (350 HUF): Valid for a single uninterrupted trip
- Budapest 24-hour travelcard (1650 HUF): Valid for 24 hours for an unlimited number of trips

For more information visit: <http://www.bkk.hu/en/tickets-and-passes/prices/>

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