Plum and Prune
XII Symposium
Zlatibor, Serbia

XII International Symposium on Plum and Prune Genetics, Breeding and Pomology

PROGRAMME AND BOOK OF ABSTRACTS

September 14−17, 2021

Zlatibor, Serbia

PROGRAMME AND BOOK OF ABSTRACTS OF XII INTERNATIONAL SYMPOSIUM ON PLUM AND PRUNE GENETICS, BREEDING AND POMOLOGY

Zlatibor, Republic of Serbia
September 14–17, 2021

XII International Symposium on Plum and Prune Genetics, Breeding and Pomology

Programme and Book of Abstracts

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PROGRAMME

TUESDAY, September 14th

8^{00}–10^{00}	Registration and poster placement
10^{00}–11^{00}	**Opening ceremony and co-organizer and guests greetings**
11^{00}–11^{30}	Welcome cocktail
11^{30}–13^{00}	**Plenary lecture of Session I – Genetics and Breeding** ***Chairpersons: Nebojša Milošević, Michael Neumüller and Darko Jevremović***
11^{30}–12^{15}	OI-01 RECENT ACHIEVEMENTS AND FUTURE CHALLENGES IN BREEDING FOR EUROPEAN PLUM CULTIVARS: FINDING THE SUITABLE GENETIC RESOURCES FOR IMPORTANT TRAITS *Michael Neumüller, Felicitas Dittrich and Christine Holzapfel*
12^{15}–13^{00}	DISCUSSION ON PLENARY LECTURE
13^{00}–14^{00}	Lunch break
14^{00}–16^{50}	**Oral presentations – Session I** ***Chairpersons: Nebojša Milošević, Michael Neumüller and David Ruiz***
14^{00}–14^{20}	OI-02 AN OVERVIEW OF PLUM BREEDING AT FRUIT RESEARCH INSTITUTE, ČAČAK *N. Milošević, I.S. Glišić, M. Đorđević, S. Radičević and D. Jevremović*
14^{20}–14^{40}	OI-03 PERFORMANCE OF 'LANA', A NEW PLUM CULTIVAR DEVELOPED AT FRUIT RESEARCH INSTITUTE, ČAČAK *S.A. Paunović, I.S. Glišić, Ž. Karaklajić-Stajić, N. Milošević and D. Jevremović*
14^{40}–15^{00}	OI-04 DEVELOPING NEW PRUNE CULTIVARS FOR THE CALIFORNIA DRIED PRUNE INDUSTRY *S. Castro and T.M. DeJong*
15^{00}–15^{20}	OI-05 ADVANCES IN PLUM BREEDING FOR RESISTANCE TO *Xylella fastidiosa* IN BRAZIL *M.A. Dalbó, A.C. Menezes-Netto, E.D. Bruna, H. Thomazi-Kleina and L.L. May-de-Mio*
15^{20}–15^{50}	Coffee break
15^{50}–16^{10}	OI-06 NEW PROMISING JAPANESE PLUM CULTIVARS FOR WARM AREAS FROM CEBAS-CSIC/IMIDA BREEDING PROGRAMME

D. Ruiz, J. Cos, M. Nicolás-Almansa, J. Egea, F. García, A. Carrillo, M. Rubio, D. López, J.A. Salazar and A. Guevara

16^{10}–16^{30} OI-07

INHERITANCE AND CORRELATION OF MAIN PHENOLOGICAL AND POMOLOGICAL TRAITS IN JAPANESE PLUM (*Prunus salicina* Lindl.)

M. Nicolás-Almansa, J.A. Salazar, M. Rubio, A. Guevara, A. Carrillo, F. García, J. Cos, P. Martínez-Gómez and D. Ruiz

16^{30}–16^{50} OI-08

SSR MARKER-BASED PATERNITY TESTS TO DETERMINE SUITABLE POLLENISERS FOR THE JAPANESE PLUM CULTIVAR 'SWEET PEKEETAH'

P. Jiménez-Muñoz, P. Zapata, J.A. Salazar, C. Kusch, R. Infante and I. Pacheco

16^{50}–18^{30} Poster Session I

WEDNESDAY, September 15th

9^{00}–18^{00} Excursion

THURSDAY, September 16th

8^{00}–8^{30} Registration and poster placement

8^{30}–10^{05} Oral presentations of Session II – Genetic Resources and Cultivar Testing

Chairpersons: Ivana S. Glišić, Ferenc Nádosy and Dragan Milatović

8^{30}–8^{50} OII-01

THE SLOVENIAN TRADITIONAL PLUM GERMPLASM AND ITS DIVERSITY COMPARED TO THE FRENCH NATIONAL PLUM COLLECTION

T. Ternjak, T. Barreneche, A. Šušek, M. Šisko, A. Ivančič and J. Quero-García

8^{50}–9^{10} OII-02

HEALTH STATUS ASSESSMENT OF THE SERBIAN AUTOCHTHONOUS PLUM CULTIVARS FOR CRYOPRESERVATION PURPOSES

D. Jevremović, T. Vujović, N. Milošević and S.A. Paunović

9^{10}–9^{30} OII-03

GROWTH AND PRODUCTIVITY OF EARLY AND MEDIUM LATE MATURING PLUM CULTIVARS IN THE BELGRADE AREA

D. Milatović, G. Zec, D. Đurović and Đ. Boškov

9^{30}–9^{50} OII-04

INVESTIGATON IN PLUM ORCHARD OF NARIC FRUIT AND ORNAMENTAL RESEARCH INSTITUTE IN CEGLÉD

F. Nádosy, T. Demku, Z. Treutz and E. Peti

9^{50}–10^{05} Coffee break

10^{05}–10^{45} Poster Session II

10^{45}–12^{25} **Oral presentations of Session III – Rootstocks**

Chairpersons: Ivan P. Glišić, Ted DeJong and Radek Vávra

10^{45}–11^{05} OIII-01

TREE GROWTH, PRODUCTIVITY AND FRUIT SIZE OF 'ČAČANSKA LEPOTICA' AND 'ČAČANSKA NAJBOLJA' PLUMS AS INFLUENCED BY ROOTSTOCK

I.P. Glišić, T. Milošević, R. Ilić, G. Paunović and M. Mitrović

11^{05}–11^{25} OIII-02

VARIATION IN PRODUCTIVITY AND FRUIT QUALITY OF THE PLUM DEPENDING ON ROOTSTOCK

J. Tomić, I.P. Glišić, R. Ilić, M. Pešaković, Ž. Karaklajić-Stajić and S.M. Paunović

11^{25}–11^{45} OIII-03

FIELD EVALUATION OF ROOTSTOCKS FOR 'IMPROVED FRENCH' PRUNE PRODUCTION IN CALIFORNIA GROWER TRIALS

L. Milliron, F. Niederholzer, R. Buchner, J. Connell, A. Fulton, R. Rosecrance, M. Gilles, T.M. DeJong, S. Castro, C. Gilles, C. DeBuse, C. Fleck and D. Wolter

11^{45}–12^{05} OIII-04

FIELD EVALUATION OF *Prunus* ROOTSTOCKS FOR USE IN DRIED PRUNE PRODUCTION

K. Jarvis-Shean, R. Buchner, F. Niederholzer, T.M. DeJong, S. Castro and C. DeBuse

12^{05}–12^{25} OIII-05

GROWTH REDUCTION EFFECT AND FRUIT QUALITY OF PLUM CULTIVARS ON ROOTSTOCKS 'KRYMSK®1' AND 'KRYMSK®2' AFTER FIVE YEARS OF CULTIVATION

M. Jonáš, V. Kadlecová and R. Vávra

12^{25}–13^{00} **Poster Session III**

13^{00}–14^{00} Lunch break

14^{00}–15^{40} **Oral presentations of Session IV – Physiology and Orchard Management**

Chairpersons: Tomo Milošević, Larisa Ufimtseva and Miljan Cvetković

14^{00}–14^{20} OIV-01

BIOTIC AND ABIOTIC FACTORS LIMITING THE PRODUCTIVITY OF *Prunus cerasifera* subsp. *macrocarpa* (Ehrh) Erem. Et Garcov.

A. Grigoriev, L. Lukicheva, V. Korzin and V. Gorina

14^{20}–14^{40} OIV-02

PLUM TRAINING SYSTEMS ON VIGOUR ROOTSTOCKS – EXPERIENCE FROM SERBIA AND BOSNIA AND HERZEGOVINA

M. Cvetković, I.P. Glišić and B. Pašalić

14^{40}–15^{00} OIV-03

IMPROVING THE TECHNOLOGY OF GROWING *Prunus salicina* Lindl. IN CONTAINER CULTURE

L.V. Ufimtseva and N.V. Glaz

15^{00}–15^{20} OIV-04

DESIGNING AND IMPLEMENTING INNOVATIVE AND SUSTAINABLE PRACTICES IN PLUM GROWING TECHNOLOGY

M. Pešaković, I.S. Glišić, J. Tomić, Ž. Karaklajić-Stajić, S. Milenković, R. Cerović and B. Rilak

15^{20}–15^{40} OIV-05

MECHANICAL PRUNING OF 'IMPROVED FRENCH' PRUNE TREES

R. Rosecrance, L. Milliron and F. Niederholzer

15^{40}–16^{15} Poster Session IV

16^{15}–16^{30} Coffee break

16^{30}–17^{45} Plenary lecture of Session V – Diseases and Pests

Chairpersons: Sylvie Dallot and Darko Jevremović

16^{30}–17^{15} OV-01

IMPROVED KNOWLEDGE ON KEY EPIDEMIOLOGICAL PARAMETERS TO OPTIMIZE SHARKA MANAGEMENT STRATEGIES

Sylvie Dallot and Gaël Thébaud

17^{15}–17^{45} DISCUSSION ON PLENARY LECTURE

17^{45}–18^{45} Oral presentations – Session V

Chairpersons: Sylvie Dallot, Bob Johnson and Darko Jevremović,

17^{45}–18^{05} OV-02

MORPHOLOGICAL AND PATHOGENIC CHARACTERISTICS OF *Alternaria alternata* ISOLATES FROM PLUM (*Prunus domestica* L.)

T. Vasić, D. Jevremović, S. Milenković, T. Vujović and A. Leposavić

18^{05}–18^{25} OV-03

IMPROVED UNDERSTANDING OF THE THREAT POSED BY *Phellinus* HEART-ROT IN CALIFORNIA PRUNE ORCHARDS

B. Johnson, F. Niederholzer, L. Milliron and D.M. Rizzo

18^{25}–18^{45} OV-04

ETIOLOGY OF PEACH AND SWEET CHERRY LEAF SPOT AND TWIG CANKER IN MONTENEGRO

T. Popović, J. Menković, A. Prokić and A. Obradović

18^{45}–19^{15} Poster Session V

20^{30} Gala dinner

FRIDAY, September 17th

8^{30}–9^{00} Registration and poster placement

9^{00}–10^{30}	**Plenary lecture of Session VI – Fruit Quality, Ripening and Postharvest; Session VII – Fruit Drying and Processing; Session VIII – Marketing and Economics** ***Chairpersons: Ninoslav Nikićević, Juan Salazar and Branko Popović***
9^{00}–9^{45}	OVI/VII/VIII-01 PRODUCTION OF SUPERIOR QUALITY PLUM BRANDY IN SMALL DOMESTIC DISTILLERIES IN SERBIA *Ninoslav Nikićević*
9^{45}–10^{15}	DISCUSSION ON PLENARY LECTURE
10^{15}–10^{30}	Coffee break
10^{30}–11^{50}	**Oral presentations – Sessions VI, VII and VIII** ***Chairpersons: Karen Mesa, Juan Salazar and Olga Mitrović***
10^{30}–10^{50}	OVI/VII/VIII-02 AN INTEGRATED TRANSCRIPTOMIC AND EPIGENETIC ANALYSIS DISCLOSE THE ROLE OF ETHYLENE-RELATED PHYTOHORMONES DURING SHELF LIFE IN JAPANESE PLUM (*Prunus salicina* L.) AND APRICOT (*Prunus armeniaca* L.) *J.A. Salazar, M. Nicolás-Almansa, D. Ruiz and P. Martínez-Gómez*
10^{50}–11^{10}	OVI/VII/VIII-03 THE EFFECT OF FOLIAR SPRAYS CONTAINING CALCIUM ON QUALITY AND STORABILITY OF 'STANLEY' PLUM FRUIT *A. Korićanac, I.S. Glišić, O. Mitrović, M. Milinković, B. Popović and M. Lukić*
11^{10}–11^{30}	OVI/VII/VIII-04 FREEZING AS A PRE-TREATMENT IN AIR DRYING OF PLUMS *O. Mitrović, B. Popović, A. Korićanac, N. Miletić and A. Leposavić*
11^{30}–11^{50}	OVI/VII/VIII-05 SUITABILITY OF NEW PLUM GENOTYPES DEVELOPED IN ČAČAK FOR PROCESSING INTO PLUM SPIRIT *B. Popović, O. Mitrović, I.S. Glišić, N. Milošević, N. Nikićević, V. Tešević and I. Urošević*
11^{50}–12^{30}	**Poster Sessions VI, VII and VIII**
12^{30}	**Symposium Closure**

POSTER PRESENTATIONS

SESSION I: GENETICS AND BREEDING

PI-01 'SIRMA' AND 'PAGANE' – NEW BULGARIAN PLUM CULTIVARS

M. Nesheva and V. Bozhkova

PI-02 EUROPEAN PLUMS USED AS PARENTS FOR CULTIVARS BRED IN ROMANIA

M. Butac and M. Botu

PI-03 SUCCESS RATE OF INDIVIDUAL POLLINIZERS TO EUROPEAN PLUMS

M. Meland, R. Cerović, M. Đorđević and M. Fotirić-Akšić

PI-04 'LUCIA MYRTEA' AND 'VICTORIA MYRTEA', TWO NEW LOW CHILLING REQUIREMENTS, EARLY RIPENING AND HIGH QUALITY FRUIT JAPANESE PLUM CULTIVARS FROM THE CEBAS-CSIC/IMIDA BREEDING PROGRAMME

A. Guevara, M. Nicolás-Almansa, J. Cos, J. Egea, F. García, A. Carrillo, J.A. Salazar, D. López and D. Ruiz

PI-05 ASSESSMENT OF WINTER HARDINESS OF VARIOUS FORMS AND CULTIVARS OF PLUM IN THE CONDITIONS OF THE SOUTH URALS OF RUSSIA

N. Glaz, F. Gasymov and L.V. Ufimtseva

PI-06 DETERMINATION OF THE SELF-COMPATIBILITY AND SUITABLE POLLENIZERS FOR THE PLUM CULTIVAR 'NADA'

Đ. Boškov, D. Milatović, D. Nikolić, G. Zec and A. Radović

PI-07 BREEDING FOR *Prunus* ROOTSTOCK TOLERANCE TO REPLANT DISEASES

K. Gašić, S. Miller, G. Barać, C. Saski, G. Schnabel and G. Reighard

PI-08 ASYMMETRY OF FRUITS IS ASSOCIATED WITH THE OVULE ABORTION IN JAPANESE PLUM (*P. salicina* Lindl.) AND RELATED *Prunus* SPECIES

P. Martínez-Gómez, J.A. Salazar and M. Nicolás-Almansa

PI-09 GENETIC MAPPING FOR PROCYANIDIN COMPOSITION IN JAPANESE PLUM FRUITS

I. Pacheco, B. Battistoni, D. Valderrama, A. Sepúlveda, W. Vega, I. Cho, J.A. Salazar, A. Peña and R. Infante

PI-10 ASSESSMENT OF SELF-(IN)COMPATIBILITY IN NEW PLUM (*Prunus domestica* L.) CULTIVARS DEVELOPED AT FRUIT RESEARCH INSTITUTE, ČAČAK

I.S. Glišić, N. Milošević, M. Đorđević, S. Radičević, S. Marić and R. Cerović

PI-11 REPRODUCTIVE ABILITY OF PLUM (*Prunus domestica* L.) POLLEN STORED AT LOW TEMPERATURES

M. Đorđević, T. Vujović, R. Cerović, I.S. Glišić, N. Milošević, S. Marić and S. Radičević

PI-12 DEVELOPMENT OF MARKER-ASSISTED SELECTION STRATEGIES FOR FRUIT QUALITY AND POSTHARVEST TRAITS IN JAPANESE PLUM (*P. salicina* Lindl.): AN INTEGRATED GENOMIC, TRANSCRIPTOMIC AND EPIGENETIC PERSPECTIVE

J.A. Salazar, M. Nicolás-Almansa, I. Pacheco, P. Zapata, D. Ruiz, R. Infante and P. Martinez-Gomez

PI-13 FUNCTIONALITY OF EMBRYO SAC AND FRUIT SET IN PLUM CULTIVAR 'ČAČANSKA RANA'

R. Cerović, M. Fotirić-Akšić, M. Đorđević and M. Meland

PI-14 DEVELOPING NEW GENOMIC RESOURCES FOR GENETIC MAPPING AND QTL IDENTIFICATION IN JAPANESE PLUM (*Prunus salicina* Lindl.)
M. Nikolás Almansa, J.A. Salazar, M. Rubio, A. Guevara, P. Martinez-Gomez, D. Ruiz, P.J. Brown and P.J.M. García

PI-15 AGRONOMIC AND FRUIT QUALITY CHARACTERISTICS OF THE BULGARIAN PLUM CULTIVAR 'PAGANE'
N. Neshev, M. Nesheva and V. Akova

SESSION II: GENETIC RESOURCES AND CULTIVAR TESTING

PII-01 EVALUATION OF NON-TRADITIONAL PLUM CULTIVARS FOR GROWING IN CZECH CONDITIONS
T. Nečas, E. Rampáčková, M. Göttingerová, T. Kiss and I. Ondrášek

PII-02 EVALUATION OF SOME NEWLY INTRODUCED PLUM CULTIVARS IN BULGARIA
D. Sotirov, S. Dimitrova and M. Kolev

PII-03 RESPONSE OF SOME PLUM CULTIVARS TO ABIOTIC STRESS
S. Dimitrova, S. Krumov, D. Sotirov and *M. Kolev*

PII-04 FATTY ACID COMPOSITION OF OIL EXTRACTED FROM EUROPEAN PLUM KERNELS
M. Fotirić-Akšić, K. Lazarević, R. Cerović and M. Meland

PII-05 FRUIT CHARACTERISTICS OF NEW PLUM CULTIVARS BRED IN CZECH REPUBLIC
I. Novotná, V. Danková, G. Pravcová and R. Vávra

PII-06 BEHAVIOUR OF SERBIAN PLUM CULTIVARS UNDER ROMANIAN ECOLOGICAL CONDITIONS
M. Butac, C. Plopa, M. Chivu and E. Mareşi

SESSION III: ROOTSTOCKS

PIII-01 STUDY OF THE INFLUENCE OF FIVE ROOTSTOCKS ON THE GROWTH AND PRODUCTIVITY OF THREE PLUM CULTIVARS GROWN IN BULGARIA
S.*G. Tabakov, A.I. Yordanov and M.N. Petrov*

PIII-02 STUDY OF THE INFLUENCE OF ROOTSTOCKS ON FRUIT FLESH QUALITY OF THREE PLUM CULTIVARS
S.G. Tabakov, A.I. Yordanov, P.N. Denev and D.G. Teneva

PIII-03 PERFORMANCE OF FOUR ROMANIAN PRUNE CULTIVARS GRAFTED ON TWO ROOTSTOCKS UNDER THE TRIDENT CANOPY
F. Stanica, L.M. Iliescu and C.A. Mihai

PIII-04 INFLUENCE OF 'MYROBALAN 29C' AND 'ISHTARA' ROOTSTOCKS ON SOME AGRONOMIC AND SENSORY CHARACTERISTICS OF SOME ROMANIAN PLUM CULTIVARS
L.M. Iliescu, F. Stanica and C.A. Mihai

SESSION IV: PHYSIOLOGY AND ORCHARD MANAGEMENT

PIV-01 IN VITRO CULTURE ESTABLISHMENT AND SHOOT MULTIPLICATION OF EIGHT AUTOCHTHONOUS PLUM GENOTYPES
T. Vujović, D. Jevremović, I.S. Glišić, N. Milošević and T. Anđelić

PIV-02 'KRYMSK 86' STONE FRUIT ROOTSTOCK: HIGH IN VITRO ROOTING POTENTIAL EVEN IN ABSENCE OF AUXINS
A. Tsafouros and P. Roussos

PIV-03 WATER REQUIREMENTS IN TRADITIONAL PLUM PRODUCING REGIONS OF SERBIA
M. Ćosić, A. Lipovac, M. Vujadinović-Mandić, A. Vuković-Vimić, D. Đurović and D. Nikolić

PIV-04 HEAT REQUIREMENTS FOR FLOWERING OF EUROPEAN AND JAPANESE PLUM CULTIVARS IN THE BELGRADE REGION
M. Ruml, D. Milatović, M. Đurđević and Đ. Boškov

PIV-05 INTENSIVE TYPE PLUM PLANTATIONS IN LATVIA
I.Grāvīte, D. Dēķena, E. Kaufmane and L. Ikase

PIV-06 INFLUENCE OF INTENSITY AND TIME OF POMOTECHNICAL TREATMENTS ON THE CHARACTERISTICS OF PLUM SHOOTS
M. Bratić, B. Pašalić, A. Životić, T. Stojanović and M. Cvetković

PIV-07 HERBICIDAL WEED CONTROL IN PLUM ORCHARDS
N. Neshev, M. Yanev, A. Mitkov and M. Nesheva

PIV-08 POSSIBILITIES FOR WEED CONTROL IN PLUM ORCHARDS
M. Nesheva, A. Mitkov, M. Yanev, N. Neshev and T. Tonev

PIV-09 THE IMPLICATIONS OF WOOD DECAY FOR CLIMATE BENEFITS AND IMPACTS IN A PERENNIAL CROPPING LANDSCAPE: THE CASE OF CALIFORNIA PRUNE PRODUCTION
E. Marvinney and B. Johnson

SESSION V: DISEASES AND PESTS

PV-01 THE RESPONSE OF NEWLY INTRODUCED PLUM CULTIVARS TO NATURAL INFECTION WITH PLUM POX VIRUS
A. Borisova and D. Sotirov

PV-02 MANAGEMENT AND BIOCONTROL OF *Phellinus* HEART-ROT IN CALIFORNIA PRUNES
D.A. Hernandez, B. Johnson and D.M. Rizzo

PV-03 *Xylella fastidiosa* – POTENTIAL THREAT TO STONE FRUIT PRODUCTION IN SERBIA
A. Obradović, J. Menković, A. Prokić and M. Ivanović

PV-04 PLUM RESISTANCE TO *Clasterosporium carpophilum* IN CONNECTION WITH THE MORPHOLOGICAL AND BIOCHEMICAL PECULIARITIES OF LEAVES
J. Burmenko, S. Motyleva, G. Upadysheva, T. Tumaeva and V. Simonov

SESSION VI: FRUIT QUALITY, RIPENING AND POSTHARVEST

PVI-01 TEXTURE EVOLUTION OF AN ASIAN PLUM PHENOTYPE
L. Contador, G. Szendy and R. Infante

PVI-02 SUGAR ANALYSIS AND POLYPHENOL PROFILES OF SIX PLUM CULTIVARS GROWN IN INTEGRATED AND ORGANICAL PRODUCTION SYSTEM IN A NORDIC CLIMATE
M. Fotirić-Akšić, T. Tosti, U. Gašić, Ž. Tešić and M. Meland

PVI-03 EVALUATION OF CONSUMERS' PERCEPTION REGARDING SOME LOCAL AND FOREIGN PLUM CULTIVARS
L.M. Iliescu, F. Stanica and C.A. Mihai

PVI-04 DOES A HIGH PHENOLIC CONTENT IMPLY A HIGHER EFFECT ON CONSUMERS' HEALTH? DETERMINING BIOACCESIBILITY AND INTRACELLULLAR REDOX EFFECT OF PHENOLIC COMPOUNDS PRESENT IN JAPANESE PLUM FRUITS
A. Sepúlveda, M. Hidalgo, R. Infante, O. Porras and I. Pacheco

PVI-05 PRELIMINARY RESULTS OF THE DETERMINATION OF HARVEST INDEXES FOR THE FRESH CONSUMPTION OF 'D'AGEN' PLUM IN CHILE
K. Mesa, C. Guerrero, L. Contador, D. Manríquez and G. Reginato

SESSION VII: FRUIT DRYING AND PROCESSING

PVII-01 DETERMINATION OF VOLATILE FATTY ACID ETHYL ESTERS IN RAW SPIRITS OBTAINED FROM AUTOCHTHONOUS PLUM CULTIVARS USING SOLID PHASE MICROEXTRACTION AND GAS CHROMATOGRAPHY-MASS SPECTROMETRY
V. Mitrović, M. Nikolić and M. Gojković

SESSION VIII: MARKETING AND ECONOMICS

PVIII-01 QUANTIFYING ENVIRONMENTAL PERFORMANCE AND POTENTIAL TRADE-OFFS IN CALIFORNIA PRUNE PRODUCTION USING THE SPARCS-LCA MODEL FRAMEWORK
E. Marvinney, A. Kendall and S. Ave

ABSTRACTS

OI-01

RECENT ACHIEVEMENTS AND FUTURE CHALLENGES IN BREEDING FOR EUROPEAN PLUM CULTIVARS: FINDING THE SUITABLE GENETIC RESOURCES FOR IMPORTANT TRAITS

Michael Neumüller, Felicitas Dittrich, Christine Holzapfel

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Due to changing biotic and abiotic factors affecting the plants, certain traits become more important in European plum (*Prunus domestica* L.). These include resistance to winter and late frosts, the tendency to develop heat damage on the fruits, to stone cracking and to form double fruits. Resistance to the plum pox virus is available in the form of hypersensitivity resistance and will retain its important role in cultivar breeding, as will breeding for excellent fruit quality. However, it is a breeding challenge to combine the newly relevant traits in new cultivars in the best possible way. This requires precise knowledge of the degree to which the traits in question are genetically determined. It is shown that the phenotypic characterisation of collections of genetic resources can make a valuable contribution to breeding.

Keywords: *Prunus domestica*, climate change, frost resistance, heat damage, plum pox virus resistance, stone cracking, fruit caverns.

OI-02

AN OVERVIEW OF PLUM BREEDING AT FRUIT RESEARCH INSTITUTE, ČAČAK

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Plum breeding work at Fruit Research Institute, Čačak, which has been implemented since founding of the Institute in 1946, has led to the development of very important European plum (*Prunus domestica* L.) cultivars. Namely, cultivars such as 'Čačanska Lepotica', 'Čačanska Rodna', 'Čačanska Najbolja' and 'Čačanska Rana' are well known worldwide and have been grown in comercial orchards, as well as used as parents in different plum breeding programmes. Planned hybridization was used as the most important method in breeding. During the programme realization, the main breeding objectives were fruit quality, high productivity, early and late ripening time, tolerance to ecological conditions as well as diseases, especially sharka virus. In previous period, 14 cultivars were developed. Thereafter, four cultivars were released in the last eight years: 'Nada' in 2012, 'Divna' and 'Petra' in 2018 and 'Lana' in 2020. Along with planned hybridization, clonal selection of the most important autochthonous cultivars has been carried out. Clones with larger fruit, better fruit quality and tolerant to stress factors and diseases are singled out and will be used in further breeding work or will be introduced into production, especially as a raw material for the brandy production. Therewith, research is also focused on plum floral biology which includes pollen quality and pollen tubes growth in the pistil observations, as well as cytoembryology with the aim of determining the degree of self-(in)compatibility and the most suitable pollenisers for self-incompatible cultivars.

Keywords: *Prunus domestica* L., released cultivar, planned hybridization, clonal selection, floral biology.

OI-03

PERFORMANCE OF 'LANA', A NEW PLUM CULTIVAR DEVELOPED AT FRUIT RESEARCH INSTITUTE, ČAČAK

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'Lana' was recognized as a new plum cultivar developed at Fruit Research Institute, Čačak in 2020. It is the eighteenth plum cultivar created at the Institute. 'Lana' was developed by planned hybridization of 'California Blue' × 'Ruth Gershtetter' and aimed selection of obtained plum hybrids of early fruit ripening time, good fruit quality, positive pomological properties, regular and optimal yield, and resistance or tolerance to the main plum pathogens. The new cultivar is characterized by a moderately vigorous to vigorous tree, a rare canopy with narrow-pyramidal shape. The branches are well garnished with fruiting wood. Flowering time is medium early similar to standard plum cultivar 'Čačanska Rana' with which it was evaluated in parallel. It is a self-incompatible cultivar. The ripening season is early, occurring in the second decade of July, about 4–10 days after 'Čačanska Rana'. It crops regularly and moderately. In field conditions, under natural pathogen infections pressure, 'Lana' shows no susceptibility to the *Polistigma rubrum* (Pers.) DC, *Puccinia pruni-spinosae* (Pers.: Pers.) and *Taphrina pruni* (Fuck.) Tul, while sporadic symptoms of brown rot can be observed pointing at moderate susceptibility to *Monilinia laxa* (Aderhold & Ruhland) Honey. 'Lana' is tolerant to Sharka, it could exhibit sporadic symptoms on individual leaves but not on the fruits. The fruit is large, with average weight of 86.34 g, roundish, with very pronounced suture line. The skin is purple-blue with mildly expressed bloom. The flesh is yellow-greenish, moderately firm, juicy and aromatic with sweet-subacidic flavor, having 97.08% of share in the fruit weight. It contains an average of 14.5% soluble solids, 9.95% total sugar and 1.34% total acids. The stone is large and partially separated from the flesh. 'Lana' is a plum cultivar intended primarily for fresh consumption. It is recommended for growing in suitable agro-ecological conditions of vineyard areas.

Keywords: European plum, new cultivar, flowering and ripening season, fruit quality, field tolerance.

OI-04

DEVELOPING NEW PRUNE CULTIVARS FOR THE CALIFORNIA DRIED PRUNE INDUSTRY

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California is a world leader in dried prune production but is almost entirely dependent on the use of a single cultivar, the 'Improved French' prune. This monoclonal situation lends itself to vulnerability to widespread disease, pest outbreaks and annual, statewide variations in yield caused by variable weather conditions that can negatively or positively affect fruit set and/or fruit retention. In addition to the risks of a monoculture system, the entire industry harvests and dehydrates the crop within a few weeks, since the entire crop has a similar developmental pattern. In highly competitive markets, the industry would benefit from the development of new prune cultivars that have cost saving characteristics such as improved tree structure that would require less pruning, improved fruit dry matter content that would decrease drying costs and expanded windows for bloom and harvest. The California prune breeding programme at UC Davis has enlarged its germplasm and bred new generations of progeny through traditional horticultural breeding methods since its beginnings in 1985. In addition to expanding periods of bloom that will mitigate against risks of periods of inclement weather during bloom and selecting genotypes that can expand the harvest window, in recent years the programme has identified selections with enhanced fruit quality characteristics that increase efficiency and quality of drying and processing. This report will focus on the characteristics of six of the latest selections that are currently being evaluated in advanced grower trials to determine suitability for the commercial California dried prune industry.

Keywords: plum breeding, fruit quality, bloom timing, harvest timing, fruit firmness.

OI-05

ADVANCES IN PLUM BREEDING FOR RESISTANCE TO *Xylella fastidiosa* IN BRAZIL

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Xylella fastidiosa, the causal agent of plum leaf scald, was introduced in Brazil in the 1960s, leading to death most of plum orchards. Lately, with the identification of medium resistance cultivars, such as 'Laetitia' and 'Fortune', plum cultivation resumed its importance. However, infected orchards are generally short-lived, which increases production costs. This bacterium is widespread in the main producing regions due to the presence of insect vectors (leafhoppers) and native hosts. A plum breeding programme has been developed since 1990 in Santa Catarina State, Brazil, focusing on leaf scald resistance. Initially, resistant materials from Argentina and Florida were used as sources of resistance. These materials are infected with the bacterium but the symptoms are mild or not visible. After generations of crosses made to combine leaf scald resistance and fruit quality some genotypes showed resistance levels even higher than the resistant parentals. Some plum selections are not infected in the field but transmission occurs when grafted over infected plants. Apparently, there is a mechanism that interferes in the transmission by insect vectors (leafhoppers). One example is the cultivar 'Zafira', recently released. It was observed that the leafhopper *Sibovia sagata* has a clear preference for feeding on 'Laetitia' than on 'Zafira'. In the field, the number of vector insects captured in yellow adhesive traps placed within the canopy of 'Zafira' is much lower than in 'Fortune', suggesting the presence of repellent compounds. More recently, plum genotypes apparently immunes have been identified. They are negative for *Xylella* by PCR tests even when grafted over infected trees. These materials will be used in future crosses for more durable resistance and possibly immunity to the disease.

Keywords: *Prunus salicina*, disease resistance, plum leaf scald.

OI-06

NEW PROMISING JAPANESE PLUM CULTIVARS FOR WARM AREAS FROM CEBAS-CSIC/IMIDA BREEDING PROGRAMME

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A Japanese plum breeding programme coordinated between CEBAS-CSIC and IMIDA is being developed since 2011 in Murcia (Spain). One of the main objectives is to release new cultivars characterized by low chilling requirements that allow their adaptation to warm areas, particularly important in the current context of global warming. In addition, the other priority objectives considered in the breeding programme are: i) early ripening time as far as possible (May-June), which would lead to a competitive advantage in the market; ii) self-compatibility; iii) high quality fruit in terms of flavour, skin appealing and flesh colour, especially focused on releasing new cultivars of red flesh, high firmness and good postharvest behaviour; iv) resistance to sharka disease (plum pox virus, PPV) including interspecific crosses between resistant apricot cultivars and Japanese plums. As a result of the more than 80 crosses carried out and around 6,000 seedlings evaluated, a set of 11 advanced selections have been obtained which combine most of the good aforementioned features, two of which ('Lucia Myrtea®' and 'Victoria Myrtea®') have been recently registered as new Japanese plum cultivars. This set of new cultivars is characterized by very low chilling requirements, which ensures its good adaptation in warm areas; they cover a range of ripening dates from May 15th to July 15th; all of them are characterized by high quality fruit, most of them with red flesh; and some of the new cultivars are self-compatible, which is an important milestone in the breeding of the Japanese plum species. This work shows the main lines of research developed in our breeding programme and the characteristics of the released advanced selections.

Keywords: *Prunus salicina*, low chilling requirements, early ripening, fruit quality, self-compatibility.

OI-07

INHERITANCE AND CORRELATION OF MAIN PHENOLOGICAL AND POMOLOGICAL TRAITS IN JAPANESE PLUM (*Prunus salicina* Lindl.)

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The inheritance of 15 important agronomic traits including main phenological [beginning of flowering (F_5), full flowering time (F_{50}), flowering intensity, ripening time] and pomological [productivity, fruit weight, fruit diameter, fruit shape, skin color, flesh color, fruit firmness, soluble solids content and acidity] traits and theirs relationships were studied for two years in three segregating Japanese plum (*Prunus salicina* Lindl.) progenies: 'Black Splendor' × 'Pioneer'; 'Red Beauty' × 'Black Splendor' and 'Red Beauty' × 'Santa Rosa Precoz' with 121, 103 and 103 seedlings, respectively. The progenies showed a wide range of variability in the traits studied and high segregation in the progenies, especially in the 'Black Splendor' × 'Pioneer' family. Skin and flesh color showed non-parametric distributions which indicates its oligogenic character, while the rest of traits tended to a normal distribution indicative of its polygenic nature and quantitative inheritance. In addition, the observed transgressive values, out of the parent range, of some descendants evidenced the influence of the genetic background in the evaluated progenies. Significant correlations between several traits were also identified. The knowledge of the transmission and correlation of these traits will be of great use to improve the efficiency of Japanese plum breeding programmes. These results are also of great interest providing suitable segregating progenies for QTL identification after their molecular characterization to develop efficient marker assisted selection strategies.

Keywords: Japanese plum, *Prunus*, breeding, transmission, flowering, ripening, fruit quality.

OI-08

SSR MARKER-BASED PATERNITY TESTS TO DETERMINE SUITABLE POLLENISERS FOR THE JAPANESE PLUM CULTIVAR 'SWEET PEKEETAH'

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Chile is the second largest exporter of fresh plums in the Americas and the sixth largest in the world, and also has important breeding programmes in the *Prunus* genus, including the programme of the University of Chile which has recently released 'Sweet Pekeetah' (SPK), a Japanese plum (*Prunus salicina* L.) with high fruit quality and long storage potential. To guarantee high fruit set and yield, the choice of an adequate polleniser is mandatory. With the aim to identify the best polleniser for SPK, we ran paternity tests based on SSR markers in seedlings obtained from open pollination variant of SPK plants in three geographically separated orchards. We identified 10 potential pollenisers with overlapping blooming time with SPK. Sixty-four *Prunus* simple sequence repeat (SSR) markers were amplified to check for polymorphism and allele diversity. In total 286 alleles of sizes between 82 bp and 600 bp were determined in agarose gels. A set of four markers with the highest polymorphism (CPSCT018, CPSCT030, BPPCT007 and CPSCT039, with a total of 34 alleles) were chose to genotype a total of 352 seedlings through capillary electrophoresis. This analysis yielded a 60.5% of effectiveness on the assignment of the male parent from the 10 analyzed pollenisers. In addition, our results pointed that SPK showed high compatibility with most of the 10 pollenisers. Furthermore, these results could be helpful in identifying of full-sibs from the whole half-sib population (352 seedlings), allowing to perform more targeted and precise studies for fruit quality trait genetic dissection.

Keywords: *Prunus*, genetics, electrophoresis, postharvest, fruit, quality.

OII-01

THE SLOVENIAN TRADITIONAL PLUM GERMPLASM AND ITS DIVERSITY COMPARED TO THE FRENCH NATIONAL PLUM COLLECTION

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Slovenia, due to its close historical, geographical and economic links with the Balkan Peninsula, has a long tradition of plum cultivation and utilisation. During the last decades, the loss of valuable indigenous genotypes due to plum pox virus significantly narrowed the genetic base of the existing plum germplasm. In order to preserve genetic diversity and reduce its erosion, systematic collecting and careful conservation management are crucial. Considering fast changing climate, agricultural intensification and appearance of new pests and diseases, it is vital to implement efficient and sustainable breeding approaches that utilize highly improved (i.e. modern cultivars), traditional (i.e. old, traditionally grown cultivars) and primitive germplasm (i.e. primitive and wild genotypes). The present research was set up to investigate the genetic relationship and variability among 125 accessions belonging to three *Prunus* species (*P. domestica, P. cerasifera* and *P. spinosa*) representing the Slovenian plum gene pool, including some modern cultivars from other countries (e.g. Germany, Romania, Serbia, UK and USA). The most frequently present traditional plum genotypes found in Slovenia probably belong to the species *P. domestica* and its subspecies. Hence, our study focused on *P. domestica* genotypes maintained in an ex situ collection of the Slovene Plant Gene Bank (26) and was compared with several accessions from the French Plum National Collection (14). The two collections were studied with 11 SSR markers: UDP96-005, BPPCT034, EMPAS12, UCD-CH17, EMPAS06, EMPAS11, EMPAS14, BPPCT014, BPPCT025, CPSCT026 and CPPCT006. For both collections, a relatively high and valuable diversity was determined. Several accessions clustered in accordance with the widely accepted pomological groups, such as traditional prunes, greengages and mirabelle plums.

Keywords: *Prunus* spp., plum, genetic resources, genetic diversity, SSR.

OII-02

HEALTH STATUS ASSESSMENT OF THE SERBIAN AUTOCHTHONOUS PLUM CULTIVARS FOR CRYOPRESERVATION PURPOSES

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The conservation of genetic diversity and its sustainable use are essential to meet a number of challenges facing humanity. European plum (*Prunus domestica* L.), as the leading fruit species in Serbian agriculture, is facing with climate changes and long-term inoculum pressure of numerous pathogens. In order to identify the trees as a source for cryopreservation using vitrification-based techniques (V and D cryo-plate), we collected samples from nine autochthonous cultivars. A total of 140 samples of plums 'Belošljiva', 'Crvena Ranka', 'Crnošljiva', 'Cerovački Piskavac', 'Dragačevka', 'Moravka', 'Požegača', 'Sitnica' and 'Trnovača' were collected from various geographical locations in Serbia that are considered as their origin. Samples were collected from the symptomless trees showing typical pomological characteristics of the cultivars (true-to-type). All samples were tested for the presence of plum pox virus (PPV), prune dwarf virus (PDV), prunus necrotic ringspot virus (PNRSV), apple chlorotic leaf spot virus (ACLSV), apple mosaic virus (ApMV), plum bark necrosis stem pitting-associated virus (PBNSPaV), myrobalan latent ringspot virus (MLRSV) and '*Candidatus* Phytoplasma prunorum'. The analysis for the virus presence was performed by ELISA and RT-PCR test. Samples were additionally tested for PPV presence by Real-time PCR, whereas '*Candidatus* Phytoplasma prunorum' was detected by nested-PCR. Of all analyzed pathogens, only PPV was detected in six samples. The presented results showed that, even in the high virus inoculum pressure, it is possible to select virus-free trees from the existing old orchards. After analysis, selected healthy trees were used as a source of explants for the establishment of aseptic culture of each genotype for the conservation purpose.

Keywords: *Prunus*, autochthonous, viruses, detection, conservation.

OII-03

GROWTH AND PRODUCTIVITY OF EARLY AND MEDIUM LATE MATURING PLUM CULTIVARS IN THE BELGRADE AREA

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Characteristics of growth and cropping (trunk cross-sectional area, yield per tree, yield efficiency and biennial bearing index), as well as fruit weight were studied in 26 plum cultivars of early and medium late maturity time in the Belgrade area during the eight-year period (2012–2019). The cultivar 'Čačanska Lepotica' was used as a control for comparison. The period of study was divided to initial bearing (age of trees four and five years) and full bearing (age of trees from six to eleven years). Significant differences in yield among cultivars were found in both initial and full bearing periods. Average yield per tree in the period of initial bearing ranged from 1.0 kg in 'Vengerka Yubileynaya' to 8.2 kg in 'Valerija', and in the period of full bearing from 9.1 kg in 'Venera' to 28.1 kg in 'Delikatnaya'. Compared with the control cultivar, significantly lower yield in the full bearing was obtained in 17 cultivars. Trunk cross-sectional area was significantly higher in five cultivars, and lower only in one cultivar ('Valerija'). Cumulative yield efficiency varied from 0.36 kg cm^{-2} in 'Venera' to 1.96 kg cm^{-2} in 'Valerija'. Biennial bearing index was the lowest (0.14–0.16) in cultivars 'Čačanska Najbolja' and 'Čačanska Rana', and the highest (0.63–0.66) in cultivars 'Delikatnaya' and 'Green Gage'. Fruit weight ranged from 22.9 g in 'Katinka' to 67.7 g in 'Reeves'. Compared with control, fruit weight was significantly higher in seven cultivars, and significantly lower also in seven cultivars. On the basis of high yield and large fruit size, cultivars 'Valor', 'Reeves', 'Čačanska Najbolja' and 'Valerija' are distinguished.

Keywords: *Prunus domestica*, cropping, trunk cross-sectional area, yield efficiency, biennial bearing index, fruit weight.

OII-04

INVESTIGATON IN PLUM ORCHARD OF NARIC FRUIT AND ORNAMENTAL RESEARCH INSTITUTE IN CEGLÉD

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Plum and apricot genebank collections of Hungarian University of Agriculture and Life Sciences, Institute of Horticultural Science, Research Centre for Fruit Growing in Cegléd (Hungary) were established in 1960's. Plum collection contains 385 accessions. 'Purpurovaja', 'Ruth Gerstetter' and 'W.35 Myr. 368-2A' are the earliest ripening cultivars harvested at the beginning of June. Cultivar collection is not virus free, but some cultivars ('Albatros 2', 'Brassai' and 'Pacifiq') remained virus free for a period of 15 years. Processed fruits of plums 'Opál', 'Čačanska Najbolja' and 'Čačanska Rodna' seemed most suitable for compote, while 'Zimmers Frühzwetche' and 'Valjevka' for juice. Plums 'Centenar', 'Gabrovska' and 'Gras Ameliorat' were found most appropriate for jam. Aim of our rootstock experiment is the investigation of effects of the commonly used 'Myrobalan C.162.' rootstock for plum cultivars compared to eight, different rootstocks from abroad. Longterm results will be useful for nurseries and producers too in terms of extension of rootstock supplies. We planted 'Čačanska Lepotica', 'Haroma' and 'Toptaste® Kulinaria(S)' plum cultivars on 'Myrobalan C.162', 'GF 677', 'Marianna', 'Ishtara®' ('Ferciana'), 'Myrobalan 29C', 'Pumiselect®', 'Wangenheim', 'St. Julien A', 'Wavit®' and 'Penta®' rootstocks. Every combination was tested in twenty replications. First year results showed that every parameter of 'GF 677' was significantly higher than 'Myrobalan C.162' applied as control.

Key words: plum, rootstock, cultivar, vigour, gene bank, ripening time, processing.

OIII-01

TREE GROWTH, PRODUCTIVITY AND FRUIT SIZE OF 'ČAČANSKA LEPOTICA' AND 'ČAČANSKA NAJBOLJA' PLUMS AS INFLUENCED BY ROOTSTOCK

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From the first to the tenth year after planting the impact of four rootstocks ['Pixy', 'St. Julian A', 'Fereley' and Myrobalan seedling (*Prunus cerasifera* Ehrh.)] on tree vigour (assesed as trunk cros sectional area), yield per tree and unit area, cumulative yield, yield efficiency, biennial bearing index and fruit weight of plum cultivars 'Čačanska Lepotica' and 'Čačanska Najbolja' under Čačak conditions (Serbia) was investigated. Trees were grown under high density planting system and spaced at 4.0×1.8 m (1,380 trees ha^{-1}). Results showed that Myrobalan seedling induced the highest tree vigour of both evaluated cultivars, whereas cultivars had the smalest trees on 'Pixy'. Cultivars grafted on 'St. Julian A' and 'Fereley' had medium tree vigour. Individually, the most vigorous trees had 'Čačanska Najbolja' grafted on Myrobalan seedling (106.40 cm^2), while 'Čačanska Lepotica' grafted on 'Pixy' rootstock was the vigourless (24.43 cm^2). 'Čačanska Najbolja' on 'Fereley' had the highest, while 'Čačanska Lepotica' on 'Pixy' had the lowest cumulative yield. Biennial bearing index was significantly smaller in 'Čačanska Lepotica' than in 'Čačanska Najbolja' (0.27 and 0.37, respectively). Regarding rootstocks, values of biennial bearing index varied from 0.31 ('St. Julian A' and 'Fereley') to 0.37 ('Pixy'). Fruit weight of 'Čačanska Najbolja' was significantly higher than 'Čačanska Lepotica'. Both cultivars on 'Pixy' gave smaller fruits in comparison with Myrobalan seedling, 'St. Julian A' and 'Fereley' with no significant differences among them.

Key words: cumulative yield, fruit weight, *Prunus domestica* L., tree vigour.

OIII-02

VARIATION IN PRODUCTIVITY AND FRUIT QUALITY OF THE PLUM DEPENDING ON ROOTSTOCK

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Despite Serbia being among the world's largest producers of plums with about 5% of world production, seedlings of Myrobalan (*Prunus cerasifera* Ehrh.), characterized by a number of disadvantages, represent the most commonly used plum rootstock. Considering the intensification of plum production in the orchards of the Serbia and other European countries, this study was aimed to assess the productivity and fruit quality of two plum cultivars ('Čačanska Lepotica' and 'Čačanska Najbolja') grafted on four different rootstocks (Myrobalan seedling, 'Fereley', 'St. Julien A' and 'Pixy') for two consecutive years (2017–2018). Cultivars 'Čačanska Lepotica' and 'Čačanska Najbolja' produced similar average yield per tree (10.9 and 10.8 kg tree^{-1}, respectively), while fruit weight, content of total phenols and antioxidant activity were significantly higher in 'Čačanska Najbolja' samples compared to 'Čačanska Lepotica', regardless rootstock. Yield per tree in plum grafted on Myrobalan seedling was higher compared to other rootstocks in both years, except in cultivar 'Čačanska Najbolja' in 2017, when the yield per tree was low in all studied rootstocks. Dwarf rootstock 'Pixy' showed the lowest yield per tree and induced high total phenols and antioxidant activity in fruit of cultivar 'Čačanska Lepotica' in both year of testing. However, in cultivar 'Čačanska Najbolja' there was no general trend in yield and fruit quality depending on rootstock. The medium vigor rootstocks 'Fereley' and 'St. Julien A' induced high values of yield per tree and content of total phenols in cultivar 'Čačanska Lepotica', although not significant differences were found with Myrobalan seedling as a rootstock. Owing to the high amounts of beneficial phytochemicals cultivar, 'Čačanska Najbolja' can be recommended for expansion in plum growing regions. Using semi-dwarf rootstocks 'Fereley' and 'St. Julien A', planting density can be increased, as well as yield and fruit quality, and facilitate application agricultural practices, such as pruning and harvesting.

Keywords: *Prunus domestica* L., cultivar, rootstock, yield, phenols, antioxidant activity.

OIII-03

FIELD EVALUATION OF ROOTSTOCKS FOR 'IMPROVED FRENCH' PRUNE PRODUCTION IN CALIFORNIA GROWER TRIALS

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Historically, the California prune industry uses four rootstocks, Myrobalan seedling, 'Myrobalan 29C', 'Marianna 2624' and 'Lovell' peaching seedling. Newer potential rootstocks for prune have been identified but not tested under California conditions since the last California prune rootstock experiments were planted in the 1980s. Two rootstock trials were planted in 2011 to evaluate the potential of 14 rootstocks for use in California prune production, with 'Improved French' as the scion. Evaluating survival, trunk size (trunk cross sectional area in cm^2), survival, yield (dry kg $tree^{-1}$), dry ratio, and dry fruit size (% A and B screen). Butte and Yuba County experiments planted on commercial farms used randomized complete block designs with 14 rootstock treatments and five replicates with six trees per plot. Rootstocks include the four standards, as well as 'Marianna 30', 'Marianna 40', 'Marianna 58', 'HBOK 50', 'Krymsk 1', 'Krymsk 86', 'Citation', 'Rootpac-R', 'Viking', 'Atlas' and 'Empyrean 2'. Limitations include 'Rootpac-R' and 'Empyrean 2' only being planted at one site each, and no yield data being collected from one of the two sites in 2019. 'Viking', 'Atlas' and 'Krymsk 86' which except for the mediocre survival of 'Krymsk 86' at one site, had high survival and have also consistently been among the highest yielding rootstocks at both sites. At both sites 'Myrobalan 29C', 'Atlas', 'Viking' and 'Lovell' had amongst the largest trunk cross sectional areas while trees on 'Marianna 58' and 'Krymsk 1' were amongst the smallest. Additional years of evaluation will more clearly define survival and yield of the rootstocks.

Keywords: *Prunus*, vigor, yield, fruit quality, survival.

OIII-04

FIELD EVALUATION OF *Prunus* ROOTSTOCKS FOR USE IN DRIED PRUNE PRODUCTION

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The California prune industry has historically utilized five rootstocks, Myrobalan seedling, 'Myro 29C', 'Marianna 2624', 'Lovell' and 'Marianna 40'. The last statewide organized prune rootstock effort was planted in 1987. Since the conclusion of that experiment many more potential rootstocks for prune have been identified. In 2011, a non-replicated screening trial was planted to test 15 experimental rootstocks and three standard rootstocks nursery budded to 'Improved French'. This experiment provides an initial evaluation of possible rootstocks that have previously not been tried with prune or have had very little field testing. Our results show a number of rootstocks, including some with moderate size controlling capabilities, hold promise as potential rootstocks for prune production in the future.

Keywords: prune, dried plums, *Prunus domestica*, rootstock, size controlling.

OIII-05

GROWTH REDUCTION EFFECT AND FRUIT QUALITY OF PLUM CULTIVARS ON ROOTSTOCKS 'KRYMSK®1' AND 'KRYMSK®2' AFTER FIVE YEARS OF CULTIVATION

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The influence of rootstocks 'Krymsk®1' (*Prunus tomentosa* × *Prunus cerasifera*) and 'Krymsk®2' (*Prunus incana* × *Prunus tomentosa*) on growth (trunk cross-sectional area – TCSA, tree canopy volume) and fruit quality parameters (fruit weight, height, firmness and soluble solids content – SSC) was compared with rootstock 'Mr.S. 2/5' (*Prunus cerasifera* × *Prunus spinosa*). Tree vigour and fruit quality of four plum cultivars ('Čačanska Lepotica', 'Elena', 'Hanita' and 'Tophit') were evaluated in Holovousy (Czech Republic) in the experimental plum orchard after five growing seasons. Statistical analyses were carried out by Statistica software (version 12, Stat Soft). The growth (TCSA and tree crown volume) was significantly lower on 'Krymsk®1' and 'Krymsk®2' in comparison with 'Mr.S. 2/5'. No significant differences in fruit weight were recorded ('Krymsk®1' – 26.5 g, 'Krymsk®2' – 24.8 g and 'Mr.S. 2/5' – 25.2 g). Fruit firmness was significantly higher on rootstock 'Mr.S. 2/5' (index 73.7) in comparison with 'Krymsk®1' (index 70.0) and 'Krymsk®2' (index 71.0). SSC was the highest in 'Krymsk®2' (19.8°Brix) and lower in 'Krymsk®1' and 'MRS 2/5' (19.3°Brix). Some differences were recorded between the cultivars. Tree size-controlling rootstocks for plums provide a great boost in production efficiency suitable for growing conditions in Central Europe.

Keywords: TCSA, plums, dwarfing rootstocks, fruit size, tree vigour.

OIV-01

BIOTIC AND ABIOTIC FACTORS LIMITING THE PRODUCTIVITY OF *Prunus cerasifera* SUBSP. *macrocarpa* (EHRH.) EREM. ET GARCOV.

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To increase the economic efficiency of the horticultural industry, it is necessary to introduce high-yielding cultivars and considering scientific grounds for their placement in specific soil and climatic conditions. The aim of the presented research was to identify biotic and abiotic environmental factors that significantly affect the productivity of large-fruited cherry plum trees (*Prunus cerasifera* subsp. *macrocarpa* (Ehrh.) Erem. et Garcov.) of the Crimea. The studies were carried out according to generally accepted methods. The results of the long-term research of weather and climate factors on the plants productivity of the cultivars 'Obilnaya' and 'Rumyanaya Zorka' in the steppe Crimea are presented. It was determined that the main factors limiting productivity in the both cultivars are: flowering intensity and minimum air temperature during flowering. The most significant dependence of productivity from these factors were found for cherry plum 'Obilnaya'. Moreover, this cultivar has a closer dependence (r = 0.53, r = 0.64, respectively) than the 'Rumyanaya Zorka' cultivar. The most adapted to the conditions of the Crimean steppe zone was cultivar 'Rumyanaya Zorka'. A significant factor limiting large-fruited cherry plum cultivation is spring frosts. Thus, we studied the frost resistance of generative buds of 45 promising breeding forms in the field and by freezing in a climatic chamber. Among the promising breeding forms, five are distinguished by high frost resistance of generative buds: '91-151', '6/65a', '90-213', '8/27' and '90-249'. According to the complex of adaptive traits, two promising breeding forms were selected: '15-85' and '17/28'. They are the sources of this character and can be used in further breeding and production testing.

Keywords: large-fruited cherry plum, cultivars, forms, limiting factors, steppe Crimea.

OIV-02

PLUM TRAINING SYSTEMS ON VIGOUR ROOTSTOCKS – EXPERIENCE FROM SERBIA AND BOSNIA AND HERZEGOVINA

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An efficient system of plum production implies the application of all measures that will enable the timely achievement of the optimal tree size with the achievement of the initial yield, which is especially important for the vigour control. The reasons for the intensification of training systems in plum orchards are of a universal character, as for other fruit species: earlier return of invested funds, economically viable use of labor and production of high yields with good fruit quality. Regardless of the finding of vegetative rootstocks for plum during the previous years, in the area of the Western Balkans, the dominant rootstock is still the seedling of Myrobalan (*Prunus cerasifera* Ehrh.). The vigour of this rootstock requires a specific approach in intensive training systems. For more efficient plum production, it is necessary, in addition to the training system, to change the concept of pruning. The paper presents the characteristics of the most important current plum training systems on vigorous rootstock based on the experience of production in Serbia and Bosnia and Herzegovina. The most significant challenges of modern plum training systems that impose the need for efficient plum growing are also presented. The most important training systems in regular plum production in Serbia and Bosnia and Herzegovina are the combined pyramid, vase and plum spindle. Training systems that enable mechanization of certain work operations, primarily harvest and pruning, as well as redistribution of vigour, can be of special importance for further intensification of plum production.

Keywords: *Prunus domestica* L., pruning, training.

OIV-03

IMPROVING THE TECHNOLOGY OF GROWING *Prunus salicina* Lindl. IN CONTAINER CULTURE

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The relevance of container culture in the cultivation of fruit plants in the northern horticultural zone is undeniable. Modeling of a substrate with desired properties and the quality of irrigation water are the most important factors that ensure high technology efficiency. The studies were conducted at the experimental base in the conditions of the South Urals of Russia and aimed at increasing the efficiency of growing *Prunus salicina* Lindl. in a container culture. The effect of the components of the substrate and the chemical composition of irrigation water on the biometric indicators and the intensity of the photosynthetic process of grafted plum plants was studied. According to the results of the experiment, quantitative criteria for the chemical composition of the suitability of water for irrigation of plum plants were determined. A significant relationship was established between the composition of the substrate and the quality of the plants when grown in container culture. A model of the substrate "loose structure + good water-holding ability + complex of macro- and microelements" is proposed. Systems based on soil and peat, as well as systems based on peat, have been studied. The complex of macro- and micronutrients was introduced into the substrate due to fertilizer of controlled release Basacote with a prolongation period of six months. It is recommended to apply Basacote 2.5–5.0 g L^{-1} of the substrate in preparation for planting, depending on the rootstock and plum cultivar. The use of Basacote provided the number of quality seedlings twice as much as in comparison with the control. As a result of research, the fundamental role of substrate and irrigation water at the development of *Prunus salicina* Lindl. plants in container culture were confirmed.

Keywords: irrigation water, salinity, substrate, controlled release fertilizer, peat, chlorophyll, Basacote.

OIV-04

DESIGNING AND IMPLEMENTING INNOVATIVE AND SUSTAINABLE PRACTICES IN PLUM GROWING TECHNOLOGY

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In recent years, due to the growing interest of population for healthy food consumption and environment protection, fruit growers are faced with many challenges related to creation of fruit production systems, which should meet the quality criteria of chemical-free fruits with increased nutritional value. One of the possible solutions which has become increasingly important and represents a high powered chance to meet aforementioned challenges may be found in development of new biotechnological procedures and use of natural biopotentials (biofertilizers, beneficial microorganisms etc.). Accordingly, this study is based on examination of influences of an innovative liquid product based on vermicompost enriched with selected strains of beneficial microorganisms (*VCMo*), developed at Fruit Research Institute, Čačak (FRI), on morphometric characteristics (fruit weight, length and width), internal quality traits (soluble solids content and firmness) and chemical properties (total anthocyanins content, total phenolic content and antioxidant activity) of 'Čačanska Lepotica' and 'Stanley' plum cultivars during two consecutive seasons. Findings of the study indicate that implementation of this eco-friendly technology (*VCMo*), led to larger and firmer fruits in both cultivars and in both investigated years. The same trend has been observed in terms of soluble solids content. Higher values of the total anthocyanins, total phenols and total antioxidative activity were determined in *VCMo* treatment also. The study identifies liquid vermicompost enriched with selected strains of beneficial microorganisms as a suitable product that could create the sustainable plum production and indicates the importance of adopting the stated growing technology as a powerful tool in orchard management.

Keywords: plum cultivars, vermicompost extracts, beneficial microorganisms, fertilisation strategy, sustainability.

OIV-05

MECHANICAL PRUNING OF 'IMPROVED FRENCH' PRUNE TREES

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The California prune industry relies on hand pruning to thin fruitwood, improve fruit size, reduce alternate bearing, and control tree size and shape. Both the high cost and limited availability of labor have increased the interest in mechanical pruning. An experiment was established to evaluate timing and severity of mechanical hedging compared to a hand pruned control. The severe mechanical pruning treatment consisted of hedging four sides of the canopy and topping (boxing) every year and the moderate treatment was hedged two sides of the canopy every year. These treatments were conducted either in early spring (May) or postharvest (October). Over two years of the study, no significant yield differences were found among the treatments compared to the hand pruned control. Early spring or fall are equally effective, indicating a wide seasonal window in which to mechanically prune 'Improved French' trees. Hedging and boxing provided $1071 and $894 savings per hectare, respectively, compared to costs of hand pruning. Significantly more wood (larger branches) was removed in the hand vs. the mechanical pruning treatments. Pruning weight of the hedged and boxed trees were about 70% and 50% lower than the hand prune trees, respectively. Canopy volumes were also significantly larger in the hand pruned trees. Mechanical pruning resulted in a compact tree which may affect spur longevity. The long-term effects of mechanical pruning on disease incidence and orchard longevity still need to be investigated.

Keywords: *Prunus*, mechanical pruning, hedging, topping, yield, canopy growth.

OV-01

IMPROVED KNOWLEDGE ON KEY EPIDEMIOLOGICAL PARAMETERS TO OPTIMIZE SHARKA MANAGEMENT STRATEGIES

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Sharka is a major viral disease of stone fruits (*Prunus*) worldwide, reducing both fruit quality and yield. Caused by plum pox virus (PPV, family *Potyviridae*, genus *Potyvirus*), the disease is spread over long distances by the propagation and transport of infected plant material and locally by aphids in a nonpersistent manner. Apart from strategies to breed resistant, hypersensitive or tolerant cultivars that are not yet available for all *Prunus* species, prophylaxis, surveillance and the removal of symptomatic trees remain the only options to mitigate the impact of sharka and to prevent the spread of new PPV variants. The design of sustainable management strategies, especially in the context of the recent European deregulation of PPV, requires a good understanding of the factors driving virus evolution and disease dynamics, from the tree to the landscape scales. To gain insights into the processes and parameters underlying epidemic dynamics, we use complementary approaches including experiments under controlled conditions, field surveys, and parameter estimations from disease surveillance databases. We work on key epidemiological parameters acting at the scale of the tree (e.g. interactions between PPV strains and *Prunus* species, duration of the latent period, aphid transmission rates) or at the landscape scale (aphid dispersal function). These parameters are integrated in a modeling framework to simulate epidemics in different types of landscapes and to identify the most effective sharka management strategies.

Keywords: *Plum pox virus*, surveillance, epidemiology, simulation, optimization.

OV-02

MORPHOLOGICAL AND PATHOGENIC CHARACTERISTICS OF *Alternaria alternata* ISOLATES FROM PLUM (*Prunus domestica* L.)

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During June and July 2020, numerous 'Stanley' plants were observed with small, brown spots on leaves in the plum orchard in locality Bačka Topola. Later on, leaf lesions became dark brown and irregular, resulting in necrosis that was followed by defoliation. Collected samples were analyzed using standard mycological procedures. Ten fungal isolates from leaves and branches were obtained from infected plums. Two isolates originating from branches (ŠG) and leaves (ŠL), were selected for further studies. The pathogenicity test was performed on five plum cultivars: 'Stenley', 'Čačanska Lepotica', 'Čačanska Rodna', 'Čačanska Najbolja' and 'Požegača'. Morphological characteristics of two selected isolates were studied on three nutrient media: cornmeal agar (CMA), carnation leaf agar (CLA) and potato dextrose agar (PDA). Both tested isolates formed airy, dark olive-green colonies on PDA medium. The colonies were light olive-green in all tested isolates on CMA. On CLA, all studied isolates formed olive-green substrate mycelium. Conidia size for tested isolate ŠG on PDA medium ranged from 19.20−46.24 × 7.95−12.88 µm (mean 25.85 × 10.42 µm), and for isolate ŠL from 18.17−36.16 × 8.09−12.59 µm, (mean 24.98 × 11.10 µm). Both studied isolates on all tested plant organs (leaf, branch and fruit) in all plum cultivars caused symptoms typical for fungi of the genus *Alternaria*, the appearance of dark brown necrotic lesions on leaves, branches and fruits. Based on preliminary research of morphological characteristics and pathogenic tests, analyzed isolates were identified as belonging to the species *Alternaria alternata*.

Keywords: plum, *Alternaria alternata*, morphology, pathogenicity.

OV-03

IMPROVED UNDERSTANDING OF THE THREAT POSED BY *Phellinus* HEART-ROT IN CALIFORNIA PRUNE ORCHARDS

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Prunes have been commercially grown in California for more than a century and prune production and processing are important to local economies, especially in the Sacramento Valley. In recent decades, wood decay has emerged as a significant threat to the industry by reducing orchard longevity. However, little information is available about the incidence and severity of wood decay. Consequently, effective management and control strategies are lacking. Over the course of three years, we conducted systematic surveys of wood-decay fungi in prune orchards throughout the Sacramento Valley. We determined disease severity in individual trees and the incidence of infection within orchard blocks across multiple age classes and created a model of disease progress. We found the near ubiquitous presence of *Phellinus tuberculosus* heart-rot throughout Sacramento Valley prune orchards, resulting in substantial limb breakage. Infections were associated with pruning wounds and began to appear in orchards as young as seven-years, with 50% or more trees infected by age 15. This study shows that control and management strategies must focus on prevention rather than eradication.

Keywords: wood-decay fungi, disease management.

OV-04

ETIOLOGY OF PEACH AND SWEET CHERRY LEAF SPOT AND TWIG CANKER IN MONTENEGRO

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During the surveys of stone fruit orchards in 2017 and 2018, yellow, convex and mucoid bacterial colonies were isolated from peach and sweet cherry samples showing leaf and fruit spot and twig necrosis. We selected 37 gram negative, HR positive strains. They were strictly aerobic, oxidase negative and catalase positive, hydrolyzed esculin and didn't grow at 37°C. PCR analysis with primers XapY17-F and XapY17-R produced a single band of 943 bp. Based on the BOX-PCR profile, ten strains were selected for amplification and sequencing of the *gyrB* gene using Parkinson et al. primers (2007). Obtained partial DNA sequences showed that eight strains share 98.97% to 99.71% of *gyrB* sequence identity with *Xanthomonas arboricola* pv. *pruni* (Xap) pathotype strain ICMP51. The remaining two strains showed 100% identity to *gyrB* gene of Xap peach and apricot strains from Hungary and peach in Italy. Pathogenicity was tested by spraying shoots, and by infiltration of leaves and fruits of peach cultivar 'Royal Time' and sweet cherry 'Stella' with the suspension (10^7 CFU mL^{-1} in SDW) of the strains, in three replicates. Lesions appeared on all inoculated plant material within four to eleven days after inoculation. The strains isolated from peach and sweet cherry in Montenegro were identified as *Xanthomonas arboricola* pv. *pruni*.

Keywords: *Xanthomonas arboricola* pv. *pruni,* stone fruits, symptoms, identification, *gyrB*.

OVI/VII/VIII-01

PRODUCTION OF SUPERIOR QUALITY PLUM BRANDY IN SMALL DOMESTIC DISTILLERIES IN SERBIA

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Making of plum brandy in the Balkans dates back to the 7th century AD. It is considered the national fruit brandy of Serbia and is technologically, along with French cognac and Scotch malt whiskey, the most perfect spirits in the world. Initially, production was primitive, of a craft type, to evolve for centuries to become modern and based on modern scientific and technological principles. The main stages of the technological process in obtaining top quality plum distillate from smaller individual producers in Serbia are: selection of plum fruits, primary processing and preparation of plum fruits for alcoholic fermentation, proper management of alcoholic fermentation, distillation of fermented plum mash and obtaining raw soft plum brandy, redistillation of raw soft plum brandy and obtaining the final colorless plum distillate, and finally for those distillates that will mature (age) for a certain period of time, placing them in oak vessels (casks or barrels). Primary processing is done exclusively with healthy, technologically ripe and undamaged plum fruits. Alcoholic fermentation is carried out in pure stainless-steel tanks or plastic container vessels, at a temperature of 16–20°C, with lowering of the pH of the mash, addition of suitable enzymes and selected yeast strains. Distillation and rectification are carried out on modern Charente type copper apparatus or column type apparatus. Maturing (aging) of plum distillates is carried out in oak casks and barrels for a minimum of four to five years. After harmonization and final processing of the distillate, they are placed in a glass unit pack of modern design.

Keywords: Serbian plum brandy, small distilleries, technological process.

OVI/VII/VIII-02

AN INTEGRATED TRANSCRIPTOMIC AND EPIGENETIC ANALYSIS DISCLOSE THE ROLE OF ETHYLENE-RELATED PHYTOHORMONES DURING SHELF LIFE IN JAPANESE PLUM (*Prunus salicina* L.) AND APRICOT (*Prunus armeniaca* L.)

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Nowadays the global fruit market is offering more diversity and novel *Prunus* cultivars of increased fruit quality. Most of these cultivars are characterized by a short shelf life due to its climacteric character. In this context, the current Japanese plum and apricot breeding programmes are mainly focused on fruit quality and a long shelf life. In the last few years, the mechanisms involved in the fruit ripening process and shelf life extension have been studied at transcriptomic, proteomic or metabolomic level. In Japanese plum and apricot, the role of epigenetics in the fruit ripening has not been studied in depth. Therefore, the main goal of this work was to study the postharvest behaviour of plum ('Santa Rosa') and apricot ('Goldrich') cultivars upon application an ethylene inhibitor (1-MCP) and ethylene stimulator (Ethrel®), in order to analyse the differentially expressed genes by using RNA-Seq as well as differential DNA methylation regions in relation to the main pathways involved in fruit ripening and shelf life extension. Transcriptomic analysis showed that plant hormone signal transduction and photosynthesis were the most significative pathways for any treatment comparison in both species, while the most over expressed genes were related to pentose and glucuronate interconversions, including pectinesterase [EC: 3.1.1.11] and polygalacturonase [EC: 3.2.1.15] in apricot and only pectinesterase in plum after Ethrel treatment. At methylation level, CG context showed the highest rate of methylated regions at 100%. A total of 12,628 and 9,249 genes showed differentially methylated regions between treatments in 'Goldrich' and 'Santa Rosa' respectively, including several genes involved in the most important pathways linked to fruit ripening such as starch and sucrose or pentose and glucuronate interconversions metabolism. These findings showed that 1-MCP and Ethrel influence the fruit ripening process inducing a differential gene expression, with a differential methylation, also evidencing that epigenetics could play an important role.

Keywords: plum, apricot, breeding, ripening, fruit quality, RNA-Seq, DNA methylation.

OVI/VII/VIII-03

THE EFFECT OF FOLIAR SPRAYS CONTAINING CALCIUM ON QUALITY AND STORABILITY OF 'STANLEY' PLUM FRUIT

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Loss of firmness is one of the major restraints for postharvest handling and adequate storage of plum fruits. In order to improve the fruit quality various pre- and postharvest treatments could be applied. The aim of this research was to evaluate the effect of foliar sprays containing calcium on postharvest quality of 'Stanley' fruits during two consecutive years. Three commercial sprays containing calcium were used in the experiment. The first spray contained calcium and boron, the second one calcium and phosphorus, whilst the third one contained calcium. The treatments involved four foliar applications, ten days after petal fall at twenty-day intervals. Unsprayed trees represented the control. All treatments significantly increased fruit firmness at harvest. However, no such effect was observed after four weeks of cold storage although fruits from treated trees had higher content of calcium. At harvest, fruits from the trees sprayed with calcium and phosphorus had significantly higher content of soluble solids, total acids and protopectin in comparison with two other treatments and control fruits. Neither fruit weight nor dimensions were affected by any of preharvest foliar treatments. The lowest weight loss after storage was recorded in fruits treated with the spray containing only calcium. The content of total acids, potassium and soluble solids depended on treatment, year and their interaction, both at harvest and after storage. There was a significant positive correlation between the fruit firmness at harvest and content of potassium and protopectin. However, firmness of fruits after storage was significantly positively correlated not only with the content of potassium, but also with the content of calcium.

Keywords: *Prunus domestica* L., postharvest quality, cold storage, fruit firmness, pectin.

OVI/VII/VIII-04

FREEZING AS A PRE-TREATMENT IN AIR DRYING OF PLUMS

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According to its composition, primarily for its high phenolic content and high antioxidant capacity, prune is among highly valuable nutritional foods. Because of using whole fresh fruit, drying of plums is considered a slow and time-consuming process. Thus, various pre-treatments are applied in order to reduce drying time with no effect on declining nutritional value. The most simple and commonly used pre-treatment is dipping – immersing fruit into boiling water before drying. Since drying plum season is timely restricted, we had come up with the idea to extend it by previously freezing the fruit intended for drying and then, after a few months of storage at -20°C, use them for drying. Considering the physical changes of fruit during freezing that could affect drying speed, freezing can be regarded as pre-treatment in the production of prune. Drying of fruit was carried out in an experimental dryer at an air temperature 90°C until reaching 75% of the total dry matter. Plum cultivars created at the Fruit Research Institute recommended for drying were used ('Nada', 'Čačanska Rodna' and 'Valjevka') and 'Stanley', which is the most frequently used for drying in Serbia. The aim of this work was to study the effect of pre-treatment (dipping and freezing) on quality of prune in comparison with non-treated dried fruit. The following quality parameters of prune: contents of sugars, acids, sugar/acid ratio, total phenols and antioxidant capacity as well as organoleptic properties (appearance, taste, aroma, consistence), were tested. Contents of total phenols, antioxidant capacity as well as total organoleptic evaluations in dried fruit obtained by pre-treatments (dipping and freezing) do not differ compared to non-treated fruit (control) in all tested cultivars.

Keywords: prune, cultivar, chemical composition, phenolic content, antioxidant capacity.

OVI/VII/VIII-05

SUITABILITY OF NEW PLUM GENOTYPES DEVELOPED IN ČAČAK FOR PROCESSING INTO PLUM SPIRIT

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Considering the presence of numerous autochthonous cultivars in plum assortment providing high-quality plum spirit, breeding work in Serbia has not included developing cultivars for plum spirit production. With regard to the utilization of fruit, the goals of plum breeding at Fruit Research Institute, Čačak are developing cultivars suitable for fresh consumption, drying and other processing methods. Some of the developed cultivars have also proven to be a very suitable raw material for production of plum spirit, which is particularly important in the years when there is no big demand for plums intended for other ways of processing. The aim of this work was, based on the two-year examinations, to assess suitability of some newly released plum cultivars ('Mildora' and 'Nada') and hybrid ('22/17/87') for processing into plum spirit, in comparison with standard cultivars ('Čačanska Rodna' and 'Valjevka'). Yields, major volatile components (methanol, 6 higher alcohols, ethyl acetate, acetaldehyde, benzaldehyde) and sensory characteristics of traditionally produced plum spirits from the examined genotypes were shown. The highest plum spirit yields were obtained from cultivar 'Mildora' and hybrid '22/17/87', whereas the lowest yields from cultivars 'Nada' and 'Valjevka'. The lowest contents of methanol were found in plum spirits obtained from hybrid '22/17/87'. In both years, high sensory grades (> 18.01 points, gold medals) had plum spirits of cultivar 'Valjevka' (18.33 and 18.15) and hybrid '22/17/87' (18.04 and 18.17). Harvest year significantly influenced whether the grade of produced plum spirit would be higher or lower than 18.01 (gold medal ≥ 18.01 > silver medal) in cultivars 'Mildora' (17.92 and 18.29) and 'Čačanska Rodna' (17.83 and 18.11). Plum spirit obtained from cultivar 'Nada', in both years, was graded lower than 18.01 points (17.90 and 17.81, silver medals).

Keywords: *Prunus domestica*, monovarietal distillates, yield of plum spirit, volatile components, sensory characteristics.

PI-01

'SIRMA' AND 'PAGANE' – NEW BULGARIAN PLUM CULTIVARS

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Plum is a traditional fruit crop grown in Bulgaria. Fruit Growing Institute has launched its plum breeding programme in 1987 in order to improve the range of available plum cultivars for this region. In 2019 two new plum cultivars – 'Sirma' and 'Pagane' were registered. Their main tree and fruit characteristics observed from 2014 to 2018 are presented in this study. The cultivar 'Stanley' was used as a standard for comparison. The flower development of all three cultivars starts in the third decade of March. 'Sirma' had a moderately early flowering period which starts 2–3 days before 'Stanley'. 'Sirma' outperforms the standard cultivar in yield – 170.30 kg per tree and average fruit weight of 44.70 g. Compared to 'Stanley', 'Pagane' had lower yield (78 kg tree^{-1}) and much larger fruits with an average weight of 63.68 g. After sensory evaluation, both cultivars had higher marks than 'Stanley' and their taste qualities were rated as very good. Plum cultivar 'Sirma' had a smaller tree size. No significant differences for tree dimensions between 'Stanley' and 'Pagane' were observed. The new cultivars are tolerant to Sharka, like 'Stanley'.

Keywords: *Prunus domestica*, new cultivars, plum, breeding.

PI-02

EUROPEAN PLUM USED AS PARENTS FOR CULTIVARS BRED IN ROMANIA

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There are about three thousand cultivars belonging to *Prunus domestica* available at present worldwide that can be used like genitors in the future plum breeding activity. An analysis of the pedigrees of plum cultivars developed in Romanian breeding programme shows that the most are descended from 'Tuleu Gras', 'Renclod Althan', 'Anna Späth' and 'Stanley', called "ancestors". That means they have at least one of these plums in their family tree, as a parent or grandparent. For those 40 plum cultivars registered in Romania in the 60 years of breeding an increased number of crosses with these ancestors has led to what can only called "inbreeding". According to the data presented in this paper, 'Tuleu Gras' cultivar was the most frequently used parent in the cross combinations, giving origin to 23 cultivars. Among the other frequently used genitors, the list include: 'RenclodAlthan' (seven cultivars), 'Anna Späth' (three cultivars) and 'Stanley' (one cultivar). Regarding other ancestors in origin of the cultivars, we can see that a significant share has the following cultivars: 'Early Rivers', 'd'Agen', 'Wilhelmina Spath' and 'Renclod Violet'. Many of the cultivars – 32 altogether (80%) originated from hybridization, whereas four originated from open pollination, three others from mutagenesis and one were found as selection in a plum population. In conclusion, plum breeders have worked with populations of greatly reduced genetic diversity and this strategy becomes a problem because it leads to genetic impoverishment, and, also, the loss of the genetic resistance to different diseases.

Keywords: breeding, inbreeding, ancestors.

PI-03

SUCCESS RATE OF INDIVIDUAL POLLINIZERS TO EUROPEAN PLUMS

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Fruit set and yield optimization in orchards depend on the success of pollination and fertilization. There is a wide variation in the self-fertility among European plum genotypes from self-fertile to completely self-incompatible requiring compatible pollinizers with overlapping flowering times. Thus, for the successful cultivation it is necessary to determine the best pollinizers in order to obtain high yields. The aim of this investigation was to find the most suitable pollinizers for the cultivars 'Edda', 'Mallard', 'Reeves' and 'Jubileum', which are well adapted to the production in the Nordic climate, and in order to recommend to the producers which cultivars should be planted within the same orchard to provide large and stable, annual yields. The phenology of flowering of these plum cultivars was monitored during the springs 2018 and 2019 at different plum growing regions. Pollen viability, cross pollination with different pollinizers included open- and self-pollination, pollen tube growth and pollen–pistil incompatibility reactions were investigated. The dynamics of pollen tube growth (third, sixth and ninth day after anthesis) in the style (upper, middle and lower third) and parts of ovary in different crossing combination were observed by fluorescent microscopy over the same two years in relation to fruit set. Overview and preliminary results from the different experiments will be presented.

Keywords: *Prunus domestica* L., phenology, cross pollination, pollen germination, pollen tube growth, fruit set.

PI-04

'LUCIA MYRTEA' AND 'VICTORIA MYRTEA', TWO NEW LOW CHILLING REQUIREMENTS, EARLY RIPENING AND HIGH QUALITY FRUIT JAPANESE PLUM CULTIVARS FROM THE CEBAS-CSIC/IMIDA BREEDING PROGRAMME

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As a result of the Japanese plum breeding programme developed by CEBAS-CSIC and IMIDA (Murcia, Spain), two new cultivars, 'Lucia Myrtea' and 'Victoria Myrtea', have been recently released and registered for commercialization. These new Japanese plum cultivars combine the main desired characteristics that are the aim of our breeding programme. Both cultivars are characterized by very low chilling requirements, which make it possible to adapt to warm areas, as well as an early flowering time (second week of February) and early ripening date (i.e. 'Lucia Myrtea' in the first week of June and 'Victoria Myrtea' in mid-June). They stand out for their high quality fruit, with very remarkable organoleptic qualities, around 16–17°Brix, high firmness and good postharvest behaviour. In addition, these new cultivars are characterized by very attractive fruit whose dark purplish skin with lenticels together with a very striking intense red flesh colour make them very attractive to the market. 'Lucia Myrtea' and 'Victoria Myrtea' initiate the creation of a series of Japanese plum cultivars of similar typology with high taste qualities. These new cultivars, together with the advanced selections from the CEBAS-CSIC/IMIDA breeding programme that will be registered in the future, are intended to cover the early-mid harvest period. They offer farmers cultivars adapted to warm climates with fruit of a similar typology and high organoleptic qualities for a long period of time.

Keywords: *Prunus salicina*, warm areas, high productivity, lenticels, self-compatibility, °Brix, new cultivars, red flesh.

PI-05

ASSESSMENT OF WINTER HARDINESS OF VARIOUS FORMS AND CULTIVARS OF PLUM IN THE CONDITIONS OF THE SOUTH URALS OF RUSSIA

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Winter hardiness, as an indicator of adaptability to the environment, is one of the most important signs of plum breeding in the Southern Urals of Russia. The object of research is breeding material and promising forms of plum. In the Ural region the plum assortment was created mainly with the participation of *Prunus salicina*, the most cold-resistant in the world. Trees can tolerate frosts down to minus 40°C. *Prunus nigra*, *Prunus cerasifera* and *Prunus spinosa* are also used in breeding. *Prunus nigra* is inferior in quality to the *Prunus salicina*, but the biological qualities of this plum (long deep peace, high frost resistance of the tree and flower buds) attract the attention of breeders. As a result of using *Prunus nigra* in breeding, promising forms were selected and a large-fruited 'Kuyashskaya' cultivar was obtained. *Prunus cerasifera* and *Prunus spinosa* are of interest for selection in the Urals due to their resistance to rotting. For further selection, several forms were selected from *Prunus cerasifera* var. *pissardii*. In the crosses of *Prunus salicina* with *Prunus cerasifera*, the following cultivars were obtained: 'Ural'skayazheltaya' ('Uvel'skaya' × 'Alycha Pissarda'), 'Ural'skiychernosliv' ('Alycha P-31' × 'Uvel'skaya'), 'ZhemchuzhinaUrala' ('Alycha P-31' × 'Uvel'skaya'). Work with the *Prunus spinosa* is carried out mainly with wild forms. In these forms, the fruits are usually small with a more pronounced astringency, they have good winter hardiness and productivity. Hybrids have high winter hardiness. A long-term study of the genetic fund of plum revealed a high winter hardiness of seedlings in hybrid groups 4-12-5 from free pollination ('Ural'skayazheltaya' × 'Uvel'skaya', 'Alycharannyaya' × 'Chebarkul'skaya'). The use of the selected form 'Pissard P-31' in plum breeding improves winter hardiness and the quality of the fruits of the obtained hybrids.

Keywords: plum, winter hardiness, adaptability, hybrid, rotting, selection.

PI-06

DETERMINATION OF THE SELF-COMPATIBILITY AND SUITABLE POLLENISERS FOR THE PLUM CULTIVAR 'NADA'

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The self-compatibility of the plum cultivar 'Nada' as well as suitability of five different pollenisers: 'Čačanska Lepotica', 'Čačanska Rodna', 'Čačanska Najbolja', 'Stanley' and 'Mildora' were studied over two years. The study included the evaluation of flowering phenology, pollen germination in vitro, pollen tubes growth in vivo and fruit set, in all crossing combinations. Pollen germination was determined on the medium with agar and 15% sucrose while fluorescence microscopy method was used for testing pollen growth in vivo. Regarding the flowering time, all pollenisers overlapped well with 'Nada'. Tested pollenisers showed different pollen germination rates, ranging from 28.87% to 46.76%. An average number of pollen tubes at the base of the style and in the ovary was significantly higher with crossing combination: 'Čačanska Rodna', 'Čačanska Lepotica', 'Mildora' and 'Stanley', compared with 'Čačanska Najbolja'. Selfed 'Nada' had very low fruit set (2.25%). The highest average fruit set in both years was obtained with 'Čačanska Rodna' (16.95%), 'Mildora' (14.70%) and 'Čačanska Lepotica' (13.50%) as pollenisers, while with 'Stanley' (9.45%) and 'Čačanska Najbolja' (8.65%) significantly lower fruit set was recorded. Based on these results, 'Čacanska Rodna' can be recommended as the best polleniser for 'Nada'. Satisfactory results were also obtained with 'Čačanska Lepotica' and 'Mildora' as pollenisers.

Keywords: *Prunus domestica,* flowering phenology, pollen germination, fruit set, pollination, fertilization, fluorescence microscopy.

PI-07

BREEDING FOR *Prunus* ROOTSTOCK TOLERANCE TO REPLANT DISEASES

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Southeastern USA peach production is facing a sustainability issue with replant diseases affecting the longevity and productivity of peach orchards. Two major replant problems that endanger peach production in the Southeast (SE) are Peach Tree Short Life (PTSL) and Armillaria Root Rot (ARR). PTSL is a complex syndrome that includes susceptibility of rootstocks to ring nematode (Mesocriconemaxenoplax) and scions to bacterial canker (*Pseudomonas syringae*) infection. ARR in the SE is caused by the soil-borne fungus *Desarmillaria tabescens* that infects the root(s) and colonizes at the soil-trunk interface, killing the tree by girdling. Trees on PTSL and ARR sensitive rootstocks often die prematurely on replant sites. South Carolina is ranked second in the U.S. for fresh market peach production, grossing ~$80 million annually on more than 17,000 acres. Annually, ~4% of orchard trees die from replant diseases, mainly attributed to ARR, thereby reducing growers' income and viability of peach production. PTSL is controlled with resistant rootstocks and almost all peach orchards in the SE are on the Guardian® rootstock that is tolerant to PTSL, but susceptible to ARR. Management strategies for ARR are limited, as the above ground root collar excavation system only extends the life of the trees a few years. Genetic resistance is the best long-term solution. Therefore, development of rootstocks with both PTSL and ARR tolerance/resistance is at the utmost importance for survival of the SE peach industry. There is only one commercially available rootstock, 'MP-29', that is resistant to both PTSL and ARR. However, its interspecific background presents propagation challenges in nursery production settings and its horticultural characteristics require adjustments in production from growers. The latest discoveries in understanding the genetics behind the tolerance to both PTSL and ARR, and prospects for future development of tolerant rootstocks for different *Prunus* species will be presented.

Keywords: nematode, Armillaria root rot, germplasm, disease resistance.

PI-08

ASYMMETRY OF FRUITS IS ASSOCIATED WITH THE OVULE ABORTION IN JAPANESE PLUM (*P. salicina* Lindl.) AND RELATED *Prunus* SPECIES

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Several Japanese plum (*Prunus salicina* Lindl.) cultivars possess a characteristic asymmetric site in the fruits which represents a negative trait from the commercial point of view. This situation is also present in related *Prunus* species such as apricot (*P. armeniaca* L.). In addition, abortion of one of the two ovules in the ovary is often in *Prunus* initiated at or shortly after bloom. This phenomenon has been described as critic in the early fruit development and could be the responsible of the mentioned asymmetry in the fruits. In this study the characterization of this asymmetry has been evaluated in two Japanese plum ('Golden Japan' and 'Santa Rosa') and apricot ('Bergeron' and 'Real Fino') cultivars. The position of this big (asymmetric) size in fruits was evaluated together with the position of the attached (not abortive). Results showed a perfect correlation between the location of the big site and the attached site in the case of single seed fruits in the three cultivars and locations assayed. The implications of these results for breeding have been also discussed.

Keywords: plum, apricot, *prunus*, fruit quality, ovule fertilization.

PI-09

GENETIC MAPPING FOR PROCYANIDIN COMPOSITION IN JAPANESE PLUM FRUITS

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Nutritional and health-promoting quality of fruits and vegetables are traits with an increasing interest among producers and breeders. Phenolic compounds, including phenolic acids and flavonoids, are an attractive target for content improvement through breeding since the widely-reported antioxidant and anti-inflammatory effects (among others) on the consumers' health status. Also, these compounds show significant variability in their content in diverse crop germplasm collections. In this work, we analyzed the content of 21 phenolic compounds in 90 F_1 seedlings from the cross '98-99' × 'Angeleno' (hereon 98ANG), using HPLC-DAD. The detected compounds include phenolic acids, anthocyanins, flavonols and flavan-3-ols. After the analysis, the 98ANG progeny showed a significant genetic variance component for the content of most of these compounds and compound families. In the specific case of flavan-3-ol composition, we could distinguish two separated groups of F_1 seedlings, which were contrasting for the content of catechin and epicatechin as revealed principal component analysis. We used a previously available genetic map and genotypic data for ~7000 SNP markers for 98ANG, to perform QTL mapping of phenolic compound composition. Among the significant QTLs found in this study, we detected a strong phenotype-genotype association in the distal part of chromosome 1. This QTL explains more than 80% of phenotypic variation in the catechin/epicatechin composition, suggesting the existence of a major gene controlling procyanidin fruit composition in Japanese plum. These results open the possibility to fine-map the genetic elements leading to variation in single-compound content and confirm the feasibility to improve phenolic compound content in fruit crops through molecular breeding.
This work has been funded by grants FONDECYT Inicio 11150662 and FONDECYT Regular 1191446.

Keywords: procyanidin, flavan-3-ol, catechin, epicatechin, QTL, mapping.

PI-10

ASSESSMENT OF SELF-(IN)COMPATIBILITY IN NEW PLUM (*Prunus domestica* L.) CULTIVARS DEVELOPED AT FRUIT RESEARCH INSTITUTE, ČAČAK

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Breeding work at Fruit Research Institute, Čačak is predominantly focused on developing new European plum (*Prunus domestica* L.) cultivars. Since its establishment until now, 18 plum cultivars have been named and released. Knowledge of self-(in)compatibility status of these cultivars is of great importance for growers to design orchards, and for breeders to choose parents in future breeding programmes. The objective of this study was to determine the degree of self-(in)compatibility of three new plum cultivars released in 2018 ('Petra' and 'Divna') and 2020 ('Lana'). The investigation was conducted during two years (2018/19), and included pollen performance in vitro (germination on agarose-sucrose medium) and in vivo (the number of pollen tubes in the upper third of the style, at the base of the style and in the ovary; the percentage of pistils with the pollen tube penetrating the nucellus 10 days after pollination), as well as examination of fruit set under self- and open pollination modes. In vitro pollen germination had high values, ranging between 61.57% ('Lana') and 62.73% ('Petra'). 'Divna' and 'Petra' were characterized by the high values of all parameters of pollen tube growth in vivo, as well as fruit set in both self-pollination (33.26 and 30.35%, resp.) and open pollination (53.18% and 48.74%, resp.) variants. In the pistils of 'Lana', pollen tubes growth inhibition was manifested in the upper parts of the style after self-pollination, so in the base of the style and in the ovary no tubes were noticed; fruit set was not observed as well. Somewhat lower values of all mentioned parameters (except the number of pollen tubes in the upper third of the style) were also found in 'Lana' under open pollination mode. Based on the obtained results, 'Lana' can be characterized as self-incompatible, while 'Petra' and 'Divna' are self-compatible cultivars.

Keywords: European plum, new cultivars, self-pollination, open-pollination, initial and final fruit set.

PI-11

REPRODUCTIVE ABILITY OF PLUM (*Prunus domestica* L.) POLLEN STORED AT LOW TEMPERATURES

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Breeding programmes often require the necessity for longer pollen storage, whether asynchronous flowering of parental pairs exists (especially if early-flowering genotypes are pollinated with late-flowering), or if there is a temporal, geographical or spatial distance. The objective of this study was to assessed pollen vitality in vitro and in vivo in three plum cultivars ('Čačanka Lepotica', 'Valjevka' and 'Valerija') after one year of storage at +4°C and sub-freezing temperatures (-20°C, -80°C and -196°C). Pollen viability in vitro was determined on germination medium and by staining with fluorescein-diacetate. For in vivo vitality assay, stored pollen was used for pollination of emasculated flowers of 'Čačanka Lepotica'. Parameters of pollen tubes growth was determined on 3th, 6th and 10th day after pollination. In all cultivars, the lowest rate of pollen viability was observed for that stored at +4°C. Pollen stored at sub-freezing temperatures showed relatively high viability that was reduced from 8.85 to 47.15% in comparison with fresh pollen. Generaly, in vitro germination test showed lower pollen viability compared to fluorescein-diacetate staining method. Pollen viability under in vivo conditions, corellated with the those obtained under in vitro conditions. The growth of pollen tubes, from pollen stored at +4°C, or was absent or it ended mainly in the upper parts of the style. For pollen stored at sub-freezing temperatures, pollen tubes penetrated into the nucelus on the 6th day after pollination in all cultivars. The best dynamic of pollen tube growth of 'Čačanska Lepotica' and 'Valerija' was observed with pollen stored at -80°C, while in 'Valjevka' with that stored at -196°C.

Keywords: *Prunus domestica* L., pollen storage, pollen gernination in vitro, pollen germination in vivo.

PI-12

DEVELOPMENT OF MARKER-ASSISTED SELECTION STRATEGIES FOR FRUIT QUALITY AND POSTHARVEST TRAITS IN JAPANESE PLUM (*P. salicina* Lindl): AN INTEGRATED GENOMIC, TRANSCRIPTOMIC AND EPIGENETIC PERSPECTIVE

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One of the main objectives in the Japanese plum breeding is the high fruit quality demanded by producers and consumers together with suitable self-life extension. Nowadays, the integration of Marker-Assisted selection in the breeding programmes is a powerful tool for the improvement of these traits and therefore is particularly useful in the development of new Japanese plum cultivars. In order to elucidate the molecular bases and to identify candidate genes associated with fruit quality traits and self-life extension in Japanese plum, a genomic and transcriptomic integrated approach is being developed at CEBAS-CSIC of Murcia (Spain) and Universidad de Chile of Santiago (Chile) Japanese plum breeding programmes. In a first stage, one segregating progeny (the selection '98-99' as the female progenitor and 'Angeleno' as pollen donor) was phenotyped for fruit quality and self-life extension traits and genotyped by using SNP and SSR molecular markers. This has allowed the construction of genetic linkage maps and the identification of quantitative trait loci associated to the most important postharvest and fruit quality traits. In a second stage, the shelf-life period of three plum genotypes ('Angeleno', 'Santa Rosa' and 'Black Splendor') were monitored after antagonistic phytohormones treatments (1-MCP and Ethrel) and the most contrasting cultivar was 'Santa Rosa' whose transcriptome was sequenced in the most contrasting day during fruit ripening. These RNA sequencing results allowed the identification of candidate genes involved in the main differential expressed pathways. In addition, monitoring the expression of those genes in reference Japanese plum cultivars will allow the establishment of a correlation between expression patterns and its specific phenotypes. With this integrated genomic and transcriptomic approach, we have identified several candidate genes responsible for most important fruit quality and self-life extension traits. Furthermore, new DNA methylation analyses are being incorporated to complete the genomic and transcriptomic approaches.

Keywords: plum, *Prunus*, breeding, fruit quality, postharvest, DNA, RNA.

PI-13

FUNCTIONALITY OF EMBRYO SAC AND FRUIT SET IN PLUM CULTIVAR 'ČAČANSKA RANA'

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'Čačanska Rana' is a dessert plum cultivar of excellent quality that can reach good price in the market. It is self-incompatible cultivar which has irregular yielding with year-to-year variation. For achieving good fruit set and high yields, it is necessary to conduct successful pollination and fertilization where many cyto-embryological processes must take place at the right time. In this study, functionality of embryo sac – their viability and fruit set, were used to evaluate fruit set in open pollination and emasculated unpollinated flowers as control (onset of full bloom on the third, sixth, tenth, fourteenth and twenty-first day after onset of full bloom) in 'Čačanska Rana' during the two years period (2015/2017). Considering the results of functionality of embryo sacs (8-, 5- and 4- nucleate stages), their viability was slightly longer in 2015 compared to 2017. In both years, fast degeneration of one out of two synergids and presence of 3- nucleate stage (with normal egg cell) up to fourteenth days of full flowering were observed. The embryo development recorded after fourteenth day after onset of full bloom. On the other hand, fruit set (24%) was higher in 2015, compared to fruit set (5.3%) in 2017. These results indicated that functionality of embryo sac as one of the factors that may be responsible for irregular yield of 'Čačanska Rana'.

Keywords: plum, 'Čačanska Rana', functionality of embryo sac, fruit set.

PI-14

DEVELOPING NEW GENOMIC RESOURCES FOR GENETIC MAPPING AND QTL IDENTIFICATION IN JAPANESE PLUM (*Prunus salicina* Lindl.)

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Application of next-generation sequencing (NGS), for de novo and reference-based SNP discovery is now feasible for numerous horticultural crop such as in Japanese plum (*Prunus salicina* Lindl). Four different Japanese plum cultivars ('Black Splendor', 'Pioneer', 'Red Beauty' and 'Santa Rosa Precoz') were crossed to obtain three different plum populations. The family 'Black Splendor' × 'Pioneer' is composed by 121 individuals, 'Red Beauty' × 'Black Splendor' and 'Red Beauty' × 'Santa Rosa Precoz' have 103 descendants each. These biparental populations were sequenced using a Genotyping-by-Sequencing (GBS). After a preprocessing of raw reads, TASSEL5 GBS pipeline was used to align the reads and to discover GBS-derived SNPs. In addition, a Whole Genome Sequencing (WGS) strategy was carried out to sequence each parent at 80X coverage and to assembly their genomes. GBS-derived SNPs will be used for linkage map construction, QTL identification and to improve the genome assembly of the parental cultivars. These results will be of great interest to develop efficient marker assisted selection strategies.

Keywords: plum, SNPs, Genotyping-By-Sequencing, Whole Genome Sequencing.

PI-15

AGRONOMIC AND FRUIT QUALITY CHARACTERISTICS OF THE BULGARIAN PLUM CULTIVAR 'PAGANE'

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Prunus domestica L. is one of the most widely spread and commonly grown fruit species in Bulgaria. The breeding programme of the Fruit Growing Institute for producing new plum cultivars has been active since 1987. 'Pagane' is the last registered cultivar, resulted from it. In this study, its main agronomic and fruit quality characteristics from 2017 to 2020 are described. The cultivar's frost vulnerability, phenological stages, fresh fruits biometry, chemical characteristics and fruit colour data are presented. 'Pagane' has high productivity and large (70.25 g), asymmetric fruits, with light violet skin ground colour and yellow fruit flesh. The average fruit ripening date is August 17th. Fully ripe fresh fruits are sweet with TSS content of about 17.5°Brix, 12.58 % total sugars and a very low percentage of acidity – 0.36%. Sensory analyses of fresh and processed fruits were performed. Jelly, fresh and canned fruits were highly evaluated and appreciated by the testing panel of consumers.

Keywords: chemical analyses, color, fruit quality, plum, sensory analyses.

PII-01

EVALUATION OF NON-TRADITIONAL PLUM CULTIVARS FOR GROWING IN THE CZECH CONDITIONS

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The current trend of climate change has led fruit growers to seek solutions stabilizing yields and ensuring profitable production. Furthermore, it is necessary to take into account the qualitative requirements of the market, such as the emphasis being placed on bio-sustainable cultivation and fruit production. This study deals with the possibility of growing cultivars from species not typical for fruit growing in the Czech Republic. These cultivars are derived from *Prunus salicina*, *Prunus cerasifera* and various hybrids. A total of 29 interesting cultivars and two control cultivars ('Stanley' and 'Čačanska Rana') were included in the experiment. Phenological data, pomological and qualitative characteristics were evaluated. The cultivar with the largest fruit was the Japanese plum 'Aphrodite®', with an average fruit weight of 53.6 g, followed by 'Fortune' with 48.5 g, and the interspecific hybrid 'Čornyj Princ' with 45.7 g. The highest refraction was recorded in the European plum 'Stanley' (22.7%) and some Asian plums such as 'Wan Hong' and 'Burbank' (22.3% and 21.6%, resp.). Surprisingly, the highest content of titratable acids was found in the cultivars 'Lavina' (40.19 g 100 g^{-1}) and 'Kleopatra' (36.98 g 100 g^{-1}) (both of a myrobalan origin) and the Asian plums 'Aphrodite' (34.18 g 100 g^{-1}) and 'Zurna' (33.62 g 100 g^{-1}) (both interspecific hybrids *P. salicina* × *P. cerasifera*). On the other hand, the lowest content of titratable acids was observed in 'Stanley' (7.69 g 100 g^{-1}) as the control cultivar. Vitamin C content is a very important parameter for human health. The results again show significant variability among the assessed cultivars, with the highest values of vitamin C measured in both interspecific hybrids from our breeding work 'SLE2014/1' and 'SLE2014/2' (447.1 and 328.9 mg 100 g^{-1}, resp.). Similarly high vitamin C contents were measured in other interspecific hybrids as well. On the contrary, European and Japanese plum cultivars had less vitamin C (on average 15.7 and 26.7 mg 100 g^{-1}, resp.). Another important parameter for consumers is the taste of the flesh. The results show that the European plum dessert cultivars had the best taste, followed by greengage cultivars, and cultivars derived from big fruit myrobalans and their hybrids. Surprisingly, the cultivars of Asian plums and interspecific hybrids had the lowest taste ratings.

Keywords: *P. salicina*, *P. cerasifera*, pluot, Asian plums, fruit quality.

PII-02

EVALUATION OF SOME NEWLY INTRODUCED PLUM CULTIVARS IN BULGARIA

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The aim of this study was to evaluate six newly introduced plum cultivars from Germany under the agroecological conditions of Kyustendil region, Bulgaria. The plum trees were grafted on *Prunus cerasifera* rootstock and planted in the spring of 2011 at distance 4×3 m. 'Stanley' was used as a standard cultivar. The trees were formed as free-growing crowns and grown without irrigation. The vegetative growth parameters (trunk cross-sectional area and crown dimensions), term of flowering and fruit ripening, yield per tree and some fruit biometric characteristics were recorded all years. The highest yield was recorded in the standard cultivar 'Stanley', followed by 'Topper' and 'Top 2000'. The highest values of yield efficiency had 'Topper' and 'Topking' and the lowest were recorded in 'Topfit'. The ripening time of 'Topfit' was the earliest (July 22nd–28th), while the latest was of 'Tophit Plus' (September 15th–October 5th). 'Topking' had the largest fruits (65.9 g) followed by 'Tophit' and 'Toptaste' while relatively smaller mass was recorded in 'Topper' and 'Top 2000'. According to these results, in could be concluded that all cultivars are suitable for this region and can be used as alternative cultivars in plum growing.

Keywords: *P. domestica*, time of flowering, time of ripening, tree vigour, fruit size.

PII-03

RESPONSE OF SOME PLUM CULTIVARS TO ABIOTIC STRESS

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Significant changes in climatic factors have been observed in recent years which necessitates the introduction of new cultivars into the production after their preliminary testing regarding their reaction to different climatic anomalies. During 2017–2020, the resistance to winter cold (in lab conditions at -15°C, -20°C and -25°C, lasting five hours), late spring frosts and summer drought of 10 new plum cultivars introduced in Bulgaria from Germany were evaluated. The trees were grafted on seedling rootstocks (*P. cerasifera*) and planted in an experimental plantation in the spring of of 2011. Cultivar 'Stanley' was used as a control. The results indicated significant differencies among evaluated cultivars. From the analysis of the results at the three freezing levels it can be concluded that 'Stanley', 'Top 2000', 'Topend Plus', 'Tophit' and 'Topper' have relatively higher resistance to low winter temperatures. 'Stanley', 'Topking', 'Tophit' and 'Top 2000' showed low damage to flower buds or pistils (between 14.3% and 38.5%), while 'Toptaste', 'Topgigant Plus' and 'Topper' proved to be very sensitive to spring frost (-3°C) – damages varied from 59.6% to 75.8%. The highest drought resistance, determined by leaf water potential (LWP) and visual observations, showed 'Topstar Plus' and 'Topper', and the most sensitive were 'Topfirst', 'Toptaste' and 'Topgigant Plus'.

Keywords: *P. domestica*, cold hardiness, late spring frost, damage.

PII-04

FATTY ACID COMPOSITION OF OIL EXTRACTED FROM EUROPEAN PLUM KERNELS

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Total oil content and fatty acid methyl ester profiles (FAME) in kernels of eight commercial plum cultivars ('Jubileum', 'Reeves', 'Čačanska Lepotica', 'Edda', 'Avalon', 'Valor', 'Opal' and 'Mallard') were determined in this study. Plum fruits were harvested when fully ripen during 2018 in Ullensvang, western Norway. The highest oil content was found in cultivar 'Reeves' (35.7%), and the lowest in 'Valor' (18.0%). In total, fifteen fatty acids were identified and quantified in plum oil extracts with significant cultivar dependence. Oleic acid, linoleic acid, palmitic acid and stearic acid, in decreasing order represent more than 99% of the total fatty acids content. Saturated fatty acids (SFA) were 6.7% ('Reeves') and up to 7.9% ('Jubileum') of total fatty acid content. The monounsaturated fatty acids (MUFA) were dominant and ranged between 47.8% ('Avalon') to 62.1% ('Mallard'), while polyunsaturated fatty acids (PUFA) ranged from 30.7% ('Mallard') to 44.9% ('Avalon'). Oleic/linoleic acid ratio (O/L rate), which is used for differentiation of cultivars and determining the quality of the kernel due to its preventive effect on lipid oxidation, varied from 1.06 ('Avalon') to 2.02 ('Mallard'). It can be concluded that oil obtained from plum kernels have both good oxidative stability, and significant nutritional value.

Keywords: *Prunus domestica*, FAME, SFA, MUFA, PUFA.

PII-05

FRUIT CHARACTERISTIC OF NEW PLUM CULTIVARS BRED IN CZECH REPUBLIC

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Six new plum cultivars 'Amátka', 'Dwarf', 'Kamir', 'Stáňa', 'Simona' and 'Samera' were released in the Research and Breeding Institute of Pomology Holovousy Ltd. 'Amátka' is early ripening cultivar with medium to high fruit size (34–46 g). 'Dwarf' is early ripening cultivar with very specific columnar shape of the tree growth. Fruit size is small to medium with 27–32 g. 'Kamir' is medium late to late ripening cultivar with high to very high fruits (45–67 g) and excellent acidulated fruit taste. 'Stáňa' is medium late ripening cultivar. Fruits are small to medium small (28–34 g) with sweet to acidulated taste. 'Simona' is medium early ripening cultivar, fruit size is small with 20–33 g and sweet to acidulated taste. 'Samera' is medium late ripening cultivar, has medium to high fruits (34–57 g), very juicy fruits with acidulated taste. All cultivars have good stone separation. Productivity is precocious, high and regular.

Keywords: *Prunus*, fruit size, fruit weight, productivity, fruit taste.

PII-06

BEHAVIOUR OF SERBIAN PLUM CULTIVARS UNDER ROMANIAN ECOLOGICAL CONDITIONS

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Plum is the most important fruit species in Romania and Republic of Serbia due to high productivity and favorable natural conditions for growing. Regarding Romanian plum assortment, there are local and other cultivars from Europe, such as 'Stanley', 'Anna Späth', 'Tuleu Gras', designated for processing and for fresh consumption widespread in orchards. Therefore, in our plum breeding programme we aimed to improve the assortment by creating new cultivars as well as to introduce new cultivars from other programmes. As a result of the collaboration with the Fruit Research Institute, Čačak, Serbia, the following cultivars: 'Čačanska Lepotica', 'Čačanska Rodna', 'Čačanska Najbolja', 'Boranka', 'Mildora', 'Valjevka', 'Valerija' and 'Timočanka' have been introduced at Research Institute for Fruit Growing, Pitesti, Romania. During 2018–2020, the following observations and measurements were carried out: flowering and ripening time, yield (kg tree^{-1}), vigour (expressed by trunk diameter in mm), fruits quality (weight – g, soluble solids content – °Brix) and susceptibility to plum pox virus (PPV). The average flowering time of studied cultivars was in the first half of April and the average ripening time ranged from beginning of July ('Boranka') to the end of August ('Mildora' and 'Čačanska Rodna'). The lowest vigour was recorded in 'Boranka' (57.60 mm) and the highest vigour had 'Timočanka' (68.61 mm). Regarding production, 'Čačanska Lepotica', 'Čačanska Najbolja', 'Mildora' and 'Valerija' were noted as large yielding cultivars (over 15 kg tree^{-1} in the 5th year after planting). The average fruit weight ranged from 31.30 g ('Mildora') to 63.21 g ('Timočanka'). 'Čačanska Rodna', 'Mildora' and 'Valjevka' had a high content of dry matter (over 18°Brix). Excepting 'Čačanska Lepotica' and 'Čačanska Rodna', the other cultivars were tolerant to PPV. Most of the introduced Serbian cultivars showed very good results in Romanian climatic conditions, but most spread is 'Čačanska Lepotica'. The cultivars 'Boranka', 'Timočanka' and 'Čačanska Najbolja' were used as parents in our breeding work.

Keywords: plum, cultivars, phenology, productivity, vigour, fruits quality.

PIII-01

STUDY OF THE INFLUENCE OF FIVE ROOTSTOCKS ON THE GROWTH AND PRODUCTIVITY OF THREE PLUM CULTIVARS GROWN IN BULGARIA

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The rootstocks 'G×N15' ('Garnem'), 'GF677', Mirobalan seedling, 'Ishtara' and 'Wavit®' were studied for their influence on the growth and productivity characteristics of three well-known plum cultivars ('Čačanska Lepotica', 'Stanley' and 'Jojo') in Bulgaria. The study was conducted during three years (2017–2019) in South Bulgaria near the town of Plovdiv on relatively low fertile soil with drip irrigation provided. In the autumn of 2015 one-year-old nursery trees were planted at the density of 500 trees per hectare (5×4 m). Trees were formed as free crown. In terms of growth characteristics, the peach-almond hybrid rootstocks 'G×N 15' and 'GF677' formed the biggest trunk-cross sectional area and crown volume in all three cultivars. During the first four vegetations the most commonly used rootstock in this region, Mirobalan seedling, induced the formation of trees with similar sizes as those on 'Ishtara' and 'Wavit®' rootstocks. The trees on 'GF677' produced the largest cumulative yield per tree. The rootstock 'Ishtara' induced the highest productivity per trunk-cross sectional area and crown volume of cultivars 'Čačanska Lepotica' and 'Stanley'. Mirobalan seedling and 'Wavit®' occupied an intermediate position while peach-almond hybrid rootstocks were often inferior in order mentioned parameter. The results concerning productivity of cultivar 'Jojo' budded on different rootstocks cannot be reliably commented due to frost during flowering period in 2019, which occurs significantly earlier in this cultivar than in the other two cultivars. At the end of the fourth vegetation 20% of the trees on 'Ishtara' rootstock were strongly inclined by winds and this combination definitely needs a support construction, while there is no such problem with other rootstocks.

Keywords: peach-almond hybrid rootstocks, *Prunus domestica*, growth, yield efficiency.

PIII-02

STUDY OF THE INFLUENCE OF ROOTSTOCKS ON FRUIT FLESH QUALITY OF THREE PLUM CULTIVARS

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The study of the various rootstocks of the fruit species is most often associated with their influence on the growth and reproductive characteristics of the grafted cultivars. Recently, with increasing production of fruits and their consumption as fresh or processed fruits, the requirements for the quality of fruit flesh have also increased. In this regard, we investigated the influence of the rootstocks 'G×N15' ('Garnem'), 'GF677', Myrobalan seedling, 'Ishtara' and 'Wavit' on the content of sugars, organic acids, polyphenols and anthocyanins in the fruit flesh of plum cultivars 'Čačanska Lepotica', 'Stanley' and 'Jojo'. The study was conducted in South Bulgaria near the town of Plovdiv. The obtained results indicated that rootstocks did not have a significant influence on the basic parameters that shape the quality of fruit flesh in plum cultivars. The cultivars included in the study have different values regarding the content of sugars, organic acids, polyphenols and anthocyanins due to their genotype.

Keywords: *Prunus domestica*, fruit quality, peach-almond hybrid rootstocks, sugars, polyphenols.

PIII-03

PERFORMANCE OF FOUR ROMANIAN PRUNE CULTIVARS GRAFTED ON TWO ROOTSTOCKS UNDER THE TRIDENT CANOPY

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Four local Romanian prune cultivars ('Gemenea', 'Brumării', 'Record' and 'Record Mutant') were grafted on 'Mirobolan 29C' and 'Ishtara' rootstocks and planted in early spring of 2013 at the Faculty of Horticulture in București. The trees planted at 4×2.5 m were trained as Trident canopy on four wire trellis fixed on pine poles. Typical winter and summer pruning, completed with axes leading on trellis wires have been used to form a parallel Trident canopy. The inter row was covered with a mixture of perennial grasses and mowed mechanically. Along the row, the soil was kept clean by mechanical cultivation. Drip irrigation was provided with self-compensating drippers and an integrated pest management was applied. Tree growth, expressed as height, trunk cross-sectional area and total length of annual shoots, average yield per tree and hectare, cumulative yield and the grafting compatibility between scions and rootstocks were recorded. Rootstocks influenced significantly the tree vigor and productivity of tested cultivars. The vegetative trait measurements showed that cultivars grafted on 'Myrobalan 29C' were the most vigorous. The highest cumulative yield was obtained from 'Record Mutant' grafted on 'Ishtara', while the lowest yield was harvested from 'Brumării' on 'Myrobalan 29C'. Some fruit physicochemical parameters as weight, fruit shape index, firmness and soluble solids content were studied annually (2014–2019) after ripening. The largest fruit weight was recorded on the cultivars grafted on 'Ishtara' rootstock, while the smallest one on 'Myrobalan 29C'. 'Gemenea' and 'Record' seems to be interesting for fresh consumption, while 'Brumării', due to its highest content of soluble solids, can be recommended for processing. By analysing tree growth parameters, fruit quality and production, Trident canopy showed to be suitable for medium density planting systems in prune orchards.

Keywords: vigour, yield, fruit characteristics, grafting compatibility, planting system.

PIII-04

INFLUENCE OF 'MYROBALAN 29C' AND 'ISHTARA' ROOTSTOCKS ON SOME AGRONOMIC AND SENSORY CHARACTERISTICS OF SOME ROMANIAN PLUM CULTIVARS

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The increasing consumers' demand for fruit quality is a relevant reason to present information about the relation between physico-chemical composition and the sensory characteristics of some plum rootstock/cultivar combination. The influence of 'Myrobalan 29C' and 'Ishtara' rootstocks on fruit quality of four local plum cultivars 'Gemenea', 'Brumării', 'Record' and 'Record Mutant' was analyzed. The study was performed during 2019 at the University of Agronomic Sciences and Veterinary Medicine of Bucharest (Romania) and the fruits were obtained in an integrated orchard management. Fruit colour, size, weight, firmness, soluble solids content, dry matter and acidity were measured for quality evaluation. Regarding consumers' expectations and perception, the aim of this study was to evaluate trough sensory analysis fresh plums size, colour, firmness, pulp juiciness, taste and flavour. The results showed that the consumer's preferences were influenced by the rootstocks used. 'Gemenea' and 'Brumării' grafted on 'Ishtara' rootstock, 'Record' and 'Record Mutant' grafted on 'Myrobalan 29C' rootstock, were more appreciated. In all studied cultivars largest fruits were noted when they were grafted on 'Ishtara' rootstock. The chemical characteristics, like soluble solids content, dry matter and acidity, were also influenced by cultivars and rootstocks.

Keywords: flesh firmness, soluble solids, dry matter, acidity, taste, flavour.

PIV-01

IN VITRO CULTURE ESTABLISHMENT AND SHOOT MULTIPLICATION OF EIGHT AUTOCHTHONOUS PLUM GENOTYPES

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Autochthonous plum genotypes have immeasurable genetic and cultural value in Serbia. The paper deals with initial steps for establishment of efficient protocol for micropropagation of selected eight autochthonous plum genotypes. The clonal selection has been carried out within cultivars 'Crvena Ranka' (six genotypes), 'Crnošljiva' (one genotype) and 'Metlaš' (one genotype) originated from heterogeneous local populations in West Serbia. Two surface-sterilizing procedures containing sodium hypochlorite or mercuric chloride as the main sterilizing agents, were tested for establishment of aseptic cultures. Single-node cuttings were cultured on Murashige and Skoog (MS) medium containing 2 mg L^{-1} BA, 0.5 mg L^{-1} IBA and 0.1 mg L^{-1} GA_3 for rosette initiation. After four weeks of culture, frequency of explants with and without developed leaf rosettes and as well as contaminated and necrotic explants after each sterilization procedure were recorded. Significantly better results for contamination control and rosette initiation were achieved when surface sterilization was done with mercuric chloride in comparison to sodium hypochlorite in all genotypes, except 'Metlaš'. All genotypes can be successfully multiplied for et least five subcultures on MS medium with 1 mg L^{-1} BA, 0.1 mg L^{-1} NAA and 0.1 mg L^{-1} GA_3. For most of the genotypes, constant increase in shoot formation capacity was observed over repeated subculturing. Further research is necessary to evaluate rooting and acclimatization stages in micropropagation protocol of selected genotypes.

Keywords: *Prunus domestica* L., aseptic culture, multiplication capacity in vitro, subculturing.

PIV-02

'KRYMSK 86' STONE FRUIT ROOTSTOCK: HIGH IN VITRO ROOTING POTENTIAL EVEN IN ABSENCE OF AUXINS

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'Krymsk 86' (*Prunus cerasifera* × *Prunus persica*) is a relatively new launched stone fruit rootstock suitable for plum, peach, apricot, and almond cultivars. It can be successfully propagated by softwood and semi-hardwood cuttings but its in vitro propagation is not well-established. In the present trial, the effect of two synthetic auxins [indole-butiric acid (IBA) and 1-naphthaleneacetic acid (1-NAA)] in four different concentrations (2.5 μM, 5 μM, 10 μM and 20 μM) on the rooting ability of 'Krymsk 86' explants was studied. Furthermore, the effect of basal medium strength (full and half strength DKW), supplemented with four different carbon sources (sucrose, fructose, glucose and sorbitol), in the absence of auxins, are also reported. In the first experiment, explants grown on medium supplemented with 20 μM IBA exhibited the highest rooting percentage (100%), whereas the inclusion of 5 μM IBA produced the lowest number of roots. The maximum root length was achieved with 2.5 μM IBA, and declined with increased IBA concentration. In the second experiment, microshoots cultivated on half strength DKW medium exhibited higher rooting rate (80%) and root length (3.92 cm) than those cultivated in full strength medium (24% and 0.95 cm, respectively), in the absence of auxins. Among the sugar treatments, explants cultivated in fructose-supplemented substrate exhibited higher rooting ability, whereas explants cultivated in glucose had longer roots.

Keywords: rooting potential, *Prunus* micropropagation, sugars, nutrient medium, auxins.

PIV-03

WATER REQUIREMENTS IN TRADITIONAL PLUM PRODUCING REGIONS OF SERBIA

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Plum water requirements are relatively large. European plum cultivars (*Prunus domestica* L.) produce best yields in regions with annual precipitation above 700 mm and vegetation seasonal rainfall above 350 mm. Increased climate variability, as a consequence of climate change, has brought interannual redistribution of precipitation, more frequents droughts and intensive precipitation. Main goal of this research was to analyse water requirements of plums in order to support producers in decision-making towards achieving high quality yields. Plum water requirements were analysed in nine administrative regions across western, southern and central Serbia, where more than 90% of its production is situated. Based on observed meteorological data for the period 2000–2019 were calculated mean seasonal evapotranspiration and water deficit for the plum orchards with and without grass cover. The smallest mean seasonal deficit is found in Zlatibor region (285.3 mm with, and 131 mm without grass cover) and the largest in Pomoravlje region (615.4 mm with, and 411.3 mm without grass cover). The largest monthly deficit in all studied regions is found in July, a month of peak water consumption in the Serbia's climate conditions. Although both evapotranspiration and water deficit are larger in case of orchards with grass cover, grassing in regions with sufficient precipitation creates favorable microclimatic conditions in orchards, which has positive effect on the quality of fruits, as well as protects the soil from erosion (degradation).

Keywords: plum water requirements, grass cover, water deficit, climate change.

PIV-04

HEAT REQUIREMENTS FOR FLOWERING OF EUROPEAN AND JAPANESE PLUM CULTIVARS IN THE BELGRADE REGION

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This study aims to estimate heat requirements for flowering in 35 European and 15 Japanese plum cultivars grown in the Belgrade region. Eight years of phenological and temperature observations (2011–2018) were used to perform the study. The heat requirements were quantified using the Growing Degree Days (GDD). The base temperature (Tb) and starting date of heat accumulation, necessary for GDD calculation, were determined by the CV method (the least coefficient of variation in GDD). For both European and Japanese plum, the least CV was obtained for the Tb of 0°C when taking January 1st and February 1st as starting dates. For European plum, a slightly smaller CV value was obtained for February 1st than for January 1st, while the opposite was true for Japanese plum. Cultivars of Japanese plum flowered earlier than cultivars of European plum (nine days on average) and required smaller temperature sums for flowering. The heat requirements for flowering calculated from January 1st for Tb of 0°C ranged from 462 to 548 GDD for cultivars of European plum (501 GDD on average), and from 381 to 428 GDD for cultivars of Japanese plum (401 GDD on average). The average temperature sum for Tb of 0°C accumulated from February 1st was 411 GDD for European plum, ranging from 372 to 458 GDD among cultivars, while for Japanese plum, it ranged between 291 and 338 GDD, with an average value of 311 GDD.

Keywords: *Prunus domestica* L., *Prunus salicina* Lindl., temperature sum for flowering, base temperature, Growing Degree Days, Serbia.

PIV-05

INTENSIVE TYPE PLUM PLANTATIONS IN LATVIA

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In the northern part of Europe, plum orchards are not found in large areas. In central Europe, they are used more for production of fresh fruits than for processing. Latvian consumers use plums both fresh consumption and for various processed products. Intensive plantings are required to obtain a high-quality harvest and a rapid increase in yield. In 2012, an experiment including five cultivars, with tree crown formation in the Hekaespalier and spindle crown support systems was planted at the Institute of Horticulture, which already gave significantly faster and higher quality yield in the first years of growth compared with the control of a flat combined type of crown. The trial included cultivars 'Jubileum' and 'Victoria' and new cultivars selected in Latvia – 'Ance', 'Adelyn' and 'Sonora'. *P. cerasifera* rootstock was used. The average yield was evaluated from the sixth to the ninth year of growth. Significantly higher yields were obtained from trees in the support systems. Cultivar 'Victoria' in the control had an average yield of 9.4 kg per tree and 10.6 kg in the Hekaespalier system. For the more productive cultivar 'Ance' the control had a yield of 13.2 kg and the Hekaespalier system – 16 kg. The results of this experiment gave an impulse to test the possibilities of testing these systems in different regions of Latvia. Since Latvia is close to the Baltic Sea, the climate is very different in its coastal and central parts. In order to provide consumers with high-quality fruit, it is important to create local plantations in the regions. In 2018, following the example of the Horticultural Institute, experimental plantations were established in three different places in Latvia with the aim to find out whether it is possible, using intensive crown formation technologies, obtain a high-quality crop with integrated and organic management methods.

Key words: *P. domestica* L., Heka espalier, spindle system, cultivars.

PIV-06

INFLUENCE OF INTENSITY AND TIME OF POMOTECHNICAL TREATMENTS ON THE CHARACTERISTICS OF PLUM SHOOTS

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The issue of economically viable plum production implies the design and establishment of high-intensity training systems, that can enable quick fruiting and achieve high yield with satisfactory fruit quality. Intensive plum cultivation is possible in the spindle system, even when vigorous generative rootstocks (*Prunus cerasifera* Ehrh.) are used. For successful cultivation, it is necessary to apply various pomotechnical measures during the vegetation. The aim of this paper was to examine effect of the intensity and time of new shoots heading treatment as part of regular summer pruning, on the shoot characteristics in the plum cultivars 'Stanley' and 'Čačanska Lepotica'. This treatment aims to reduce strong vigor of upright new shoots. The research was performed during 2018 and 2019, on the 'Stanley' and 'Čačanska Lepotica' cultivars in the 10-year-old orchard. Lorette procedure was done during summer pruning in three different time periods during the vegetation (during the June) and heading was done above third and sixth node. The effects of new shoot heading on the characteristics of shoots at the end of vegetation such as the percentage of activated buds, the total length of newly formed shoots as well as the percentage of formed fruiting spurs, fully justify its application in the tested cultivars. Intensity and moment of application should be adjusted to the desired goal (vegetative development or reproductive potential).

Keywords: cultivar, fruiting branch structure, yield potential.

PIV-07

HERBICIDAL WEED CONTROL IN PLUM ORCHARDS

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Effective weed control in orchards, including plum (*Prunus domestica* L.) is essential for obtaining high and stable yields. In 2018 a field trial with well-established, new and promising soil- and foliar herbicide products was conducted. Some of the herbicides object of evaluation were applied before, and others during the vegetation of the crop. The efficacy of the studied soil herbicide products was reported on 30th, 60th, 90th and 120th day after application, and the efficacy of the foliar herbicides on the 7th, 14th, 28th and 56th day after application was performed. The existing weeds on the field with the highest density were *Stellaria media* L., *Poa annua* L., *Veronica hederifolia* L., *Lamium amplexicaule* L., and the perennial species *Taraxacum officinale* L. Before the application of the foliar herbicides the weeds with the highest density were *Veronica hederifolia* L., *Stellaria media* L., *Poa annua* L., *Capsella bursa-pastoris* Medik., *Alopecurus myosuroides* Huds., *Conyza canadensis* L., *Portulaca oleracea* L., *Solanum nigrum* L., *Polygonum aviculare* L., *Amaranthus retroflexus* L., *Setaria viridis* L. *Taraxacum officinale* L. and *Convolvulus arvensis* L. It was found that at the present weed infestation the application of Stomp Aqua CS (455 g L^{-1} pendimethalin) had an excellent herbicide efficacy. The efficacy of the herbicide product Pledge 50 WG (flumioxazin 500 g kg^{-1}) (400 g ha^{-1}) is appropriate if the infestation is presented by more difficult-to-control weed species. It was also observed that the application of the total contact bio-herbicide with active substance eucalyptus oil had short efficacy after which a secondary weed infestation developed on the field. The application of the total systemic herbicide Roundup Energy (450 g L^{-1} glyphosate) was found to be highly effective mean for weed control in plum orchards.

Keywords: plum orchards, herbicides, weeds, efficacy.

PIV-08

POSSIBILITIES FOR WEED CONTROL IN PLUM ORCHARDS

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An effective solution to the problem of weed infestation in orchards, including plum (*Prunus domestica* L.) is essential for obtaining high and stable yields. In 2018 a field trial with well-established, new and promising soil and foliar herbicide products was conducted. Some of the herbicides object of evaluation were applied alone, and others as a system in different stages of the crop. The efficacy of the studied soil herbicide products was reported on 30th, 60th, 90th and 120th day after application, and the efficacy of the foliar herbicides on the 7th, 14th, 28th and 56th day after the application was performed. The existing weeds on the field with the highest density were *Stellaria media* L., *Poa annua* L., *Veronica hederifolia* L., *Lamium amplexicaule* L., and the perennial species *Taraxacum officinale* L. Before the application of the foliar herbicides the weeds with the highest density were *Veronica hederifolia* L., *Stellaria media* L., *Poa annua* L., *Capsella bursa-pastoris* Medik., *Alopecurus myosuroides* Huds., *Conyza canadensis* L., *Portulaca oleracea* L., *Solanum nigrum* L., *Polygonum aviculare* L., *Amaranthus retroflexus* L., *Setaria viridis* L., *Taraxacum officinale* L. and *Convolvulus arvensis* L. It was found that at the present weed infestation the application of Stomp Aqua CS (455 g L^{-1} pendimethalin) had an excellent herbicide efficacy. The efficacy of the herbicide product Pledge 50 WG (flumioxazin 500 g kg^{-1}) (400 g ha^{-1}) is appropriate if the infestation is presented by more difficult-to-control weed species. It was also observed that the application of the total contact bio-herbicide with active substance eucalyptus oil had short efficacy after which a secondary weed infestation developed on the field. The application of the total systemic herbicide Roundup Energy (450 g L^{-1} glyphosate) was found to be a highly effective mean for weed control in plum orchards.

Keywords: plum orchards, herbicides, weeds, efficacy.

PIV-09

THE IMPLICATIONS OF WOOD DECAY FOR CLIMATE BENEFITS AND IMPACTS IN A PERENNIAL CROPPING LANDSCAPE: THE CASE OF CALIFORNIA PRUNE PRODUCTION

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California's Central Valley growing region is a globally unique agro-industrial landscape, characterized by a favorable Mediterranean climate, extensive freshwater delivery infrastructure, and widespread perennial crop acreage of which prune is an economically and agro-ecologically important component. Accurate and robust assessment of the impacts and services provided by this landscape demands an accounting of industrial, physiological and ecological processes – especially those affecting carbon storage and greenhouse gas emission from orchard floor soils and standing biomass. *Phellinus tuberculosus* is a fungal pathogen that causes heart-rot wood decay in prune trees and is widespread if not ubiquitous in California prune orchards, spreading via wind-borne spores and infecting trees via pruning cut wounds. As white-rot fungi, *Phellinus* spp. primarily attack the structural compounds lignin and cellulose, reducing wood density and integrity as releasing stored carbon as carbon dioxide and the potent greenhouse gases methane and chloromethane. These factors significantly reduce the potential for greenhouse gas mitigation in the prune production land use system. We use a Scalable, Process-based, Agronomically Responsive Cropping System Life Cycle Assessment (SPARCS-LCA) model to quantify the temporary carbon storage potential and net greenhouse gas footprint of prune orchards within the Central Valley. The effects of *Phellinus* on carbon storage and orchard productive lifespan are implicit in the datasets on which these baseline environmental assessments are based. Using data on the input demands and efficacy of various cultural, chemical and biological pest control practices, we extrapolate the potential greenhouse gas benefits and tradeoffs of varying degrees of *Phellinus* mitigation via scenario and sensitivity analyses within the SPARCS-LCA framework. This analysis integrates crop epidemiological and agricultural life cycle assessment modeling to account for the effects of ecological processes of disease transmission and severity on tree crop physiological parameters driving orchard climate mitigation benefits. These findings have direct implications for growers and the prune industry in California, as they quantify greenhouse gas benefits directly related to novel management interventions – an important criteria for participation in California's greenhouse gas cap and trade programme. They may also provide a guiding framework for assessment of the climate benefits of interventions against various wood decay pathogens in prune and other tree crops, and in various global growing regions.

Keywords: prune, dried plum, life cycle assessment, wood decay, heart rot, *Phellinus*, climate mitigation, greenhouse gas footprint, white rot.

PV-01

THE RESPONSE OF NEWLY INTRODUCED PLUM CULTIVARS TO NATURAL INFECTION WITH PLUM POX VIRUS

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Plum (*Prunus domestica L.*) is one of the main fruit crops in Bulgaria. The biggest losses in plum production, as to the other tree species are due to diseases and pests. The aim was to study the response of 12 newly introduced plum cultivars regarding the most important virus disease of plum (Sharka) under conditions of natural infection in Kyustendil region of Bulgaria. The trees of the studied cultivars were planted in a collection plantation at the Institute of Agriculture – Kyustendil in the spring of 2011. Observations of symptom expression were made during vegetation period from 2015 to 2020 by repeated surveys. The disease index (DI) on leaves and fruits was calculated. Leaf samples from the cultivars were tested for the presence of plum pox virus (PPV), prunus necrotic ringspot virus (PNRSV), prune dwarf virus (PDV) and apple chlorotic leafspot virus (ACLSV) by ELISA assay. Under the biotic and abiotic environmental conditions in Kyustendil region on the basis of DI on the fruits, confirmed by ELISA tests the cultivars are divided in three groups: Tolerant – 'Black Diamond' and 'Topstar Plus'; Slightly susceptible – 'Topfirst', 'Tophit Plus', 'Topking', 'Topgigant Plus', 'Toptaste', 'Top 2000' and 'Stanley'; Moderately susceptible – 'Topper', 'Top' and 'Topend Plus'.

Keywords: plum, new cultivars, PPV, Disease index, evaluation.

PV-02

MANAGEMENT AND BIOCONTROL OF *Phellinus* HEART-ROT IN CALIFORNIA PRUNES

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California prunes occupy 18,000 hectares planted almost entirely of a single cultivar. In prune orchards, wood decay diseases have long been considered problems of older trees. However, prune growers throughout the California's Sacramento Valley report increased incidence, severity and earlier onset of decay-related limb failure and tree decline. *Phellinus tuberculosus* was identified as the primary cause of decay-related limb failure with infections associated with pruning wounds. More than 35 orchards were surveyed of which 86% had evidence of *Phellinus* infestation with symptoms emerging in some orchards as young as 7 years old. Early onset of this disease means that management strategies must focus on prevention rather than eradication. Preliminary testing has begun on several potential control methods. The sole reliance on 'French Improved' variety may have allowed for a degree of specialization by *P. tuberculosus* in California, necessitating introduction of more prune varieties. However, no trends were evident in *P. tuberculosus* decay rates among wood blocks of selected prune varieties and trials in living trees are ongoing. *Trichoderma* spp. were observed on *P. tuberculosus* fruiting bodies in orchards and are routinely isolated from decayed prune wood. *Trichoderma* is considered a mycoparasite and is considered an effective biocontrol of diseases in other crops. *Trichoderma* isolates collected from orchards reduced *P. tuberculosus* growth in culture, and several commercially available products reduced *P. tuberculosus* decay in wood blocks when applied prior to *P. tuberculosus* inoculation. Field testing of *Trichoderma* containing products as a pruning wound protectant are underway. Conventional maintenance pruning involves removal of interior limbs to maintain a vase-like structure, leading to *P. tuberculosus* infection and limb breakage near the crotch of the tree. Less incidence and severity of disease was observed in orchards that were mechanically hedged, suggesting alterations to pruning practices may lessen impacts of *P. tuberculosus* infection.

Keywords: wood decay fungi, heart-rot, *Phellinus*, biocontrol, *Trichoderma*, pruning.

PV-03

Xylella fastidiosa – POTENTIAL THREAT TO STONE FRUIT PRODUCTION IN SERBIA

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Introduction and establishment of *Xylella fastidiosa* (Xf) in some European countries caused a major concern of plant bacteriologists. So far, more than 550 plant species were listed by EFSA as potential hosts of this bacterium. Serbia is considered a *Xylella*-free country and the pathogen status has been checked continually by inspecting and sampling either planting material during the import or young orchards in the country already established by the imported material. However, major risks are coming from still unknown Xf host range, the latent nature of the bacterium, high number of agricultural and ornamental plant species imported, and potential spread of the bacterium by natural or accidental spread of the vectors. Considering the risks, there is a high probability of the pathogen introduction. Apart from the subtropical and tropical species, Xf is found in many plants distributed in the zone of continental climate, where Serbian flora belongs as well. There is a strong reason to believe that potential introduction could lead to the bacterium establishment in some major agricultural crops, but the role of some ornamentals and species in spontaneous flora should not be neglected. Stone fruit production in Serbia is not only a strong pillar of the fruit production contributing the farmers' and national economy wellbeing. It is a very important part of the national tradition, deeply rooted in peoples' culture. Therefore, losses due to Xf occurrence in Serbia would not be measured only by loss of the stone fruit production incomes. We often forget the nonmaterial losses, such as emotional suffering of the farmers and their families, reduction of employment, changes in the environment, etc. Raising awareness and learning from the experience in countries where Xf was already detected may be of great importance in reducing the threat that this bacterium poses to Serbian stone fruit production.

Keywords: *Xylella fastidiosa*, introduction, detection, hostrange, stone fruits.

PV-04

PLUM RESISTANCE TO *Clasterosporium carpophilum* IN CONNECTION WITH THE MORPHOLOGICAL AND BIOCHEMICAL PECULIARITIES OF LEAVES

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Lesion by the clasterosporium disease (*Clasterosporium carpophilum* (Lev.) Aderh.), causative agent is *Wilsonomyces carpophilus* (Lév.) Adask., J.M. Ogawa & E.E.Butler significantly reduces the productivity of stone fruit plantations. The use of plum cultivars, resistant to this disease is promising for commercial plantations. The complex application of classical (infection with a pure culture, observation during the years of epiphytotics) and biochemical methods allows a more efficient selection. The aim of the study was to search for bio-chemical substances that are markers of resistance to *W. carpophilus* in plants of the genus *Prunus* L. The objects of research were the leaves and epicuticular wax of plum leaves *P. domestica* L., *P. salicina* Lindl., *Prunus* × *rossica* Erem., *P. spinosa* L. and interspecific hybrids with different degree of damage by clasterosporium. The total antioxidant activity of aqueous and alcoholic extracts by the DPPH method and the content of chlorophylls a and b were determined on a Helios Ɣ spectrophotometer. The microsculpture of the wax was examined on a JEOL JSM-6010LA scanning electron microscope; its qualitative composition was examined by GCMS method on a JMS-Q1050GC mass spectrometer. Biochemical studies of the leaves of plum cultivars with different resistance to clasterosporium showed that in non-resistant cultivars ('Yaichnaya Sinyaya') the antioxidant activity of the water extract and the total chlorophyll content are significantly lower than in cultivars weakly affected by this disease ('Kubanskaya Kometa'). There was a tendency to an increase in the studied parameters in the combinations of cultivars with the rootstock Novinka, which is characterized by high resistance to leaf diseases and winter hardiness. It has been established that the waxy layer of leaves resistant to clasterosporium was uniform, electronically dense; in the non-resistant leaves the waxy layer was loose. The wax of samples with low immunity to clasterosporium ('Yaichnaya Sinyaya' and 'Fioletovaya') contains ribitol, which is absent in the wax of resistant cultivars ('Eurasia 21', 'Skoroplodnaya', 'Kubanskaya Kometa' and hybrid '6-24'). Ribitol is a potential marker for disease susceptibility. According to Almaghamsi at el. (2020) the synthesis of this substance in the leaves of tomato lines exposed to unfavorable abiotic conditions was a consequence of the effect of stress on the plant organism.

Keywords: plum, clasterosporium, leaves, epicuticular wax, microsculpture, bio-chemical marker.

PVI-01

TEXTURE EVOLUTION OF AN ASIAN PLUM PHENOTYPE

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The Asian plum (*Prunus salicina* Lindl.) is a fruit species extensively grown in Chile, which fruit is destined to foreign markets worldwide. For the Chilean industry it is extremely relevant to preserve the fruit quality for long periods in cold storage up to they arrive to the final consumers, which for some markets could last for 50 days after harvest. The first symptom of fruit decay is the rapid loss of freshness and breakdown of the flesh's texture. It is quite common the development of gummy and dry flesh, which is unacceptable for consumers. The University of Chile develops an Asian plum breeding programme focused in the development of cultivars with outstanding sensory attributes, being 'Crunchiness of the flesh' one of our main focus of breeding. In this sense, the new cultivar called 'Sweet Pekeetah' is a well representative of this special ideotype of new plums for fresh consumption. The aim of this research was to evaluate texture changes of 'Sweet Pekeetah' plum in response of different harvesting periods. The fruit was picked in four opportunities in the Experimental Station of the University of Chile located in Santiago, starting on February 13th and finishing on March 6th. Fruit ripeness was characterized by the maximum force of the flesh, the sugar content, the fruit size, and the chlorophyll absorption of the skin. The results showed that as the harvest time was delayed, all the maturation parameters changed, as was expected. In terms of texture, the flesh firmness (measured as the Maximum force) goes down as the time advances, however Crunchiness of the flesh keeps rather unchanged. This result suggest the independence of the attributes crunchiness and firmness in plum flesh.

Keywords: crunchiness, texture, postharvest, Japanese plum.

PVI-02

SUGAR ANALYSIS AND POLYPHENOL PROFILES OF SIX PLUM CULTIVARS GROWN IN INTEGRATED AND ORGANICAL PRODUCTION SYSTEM IN A NORDIC CLIMATE

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The objective of this study was to compare the sugar and phenolic profiles of fruits from six plum cultivars ('Excalibur', 'Opal', 'Mallard', 'Reeves', 'Edda' and 'Jubileum') grown in both organic (OP) and integrated production systems (IP) in Ullensvang, western Norway. Mature fruits for marketing from the different cultivars were pick at commercial harvest time in 2016. Sugar analysis was done using high-performance anion-exchange chromatography (HPAEC) with pulsed amperometric detection (PAD). Phenolic analysis was done while using ultra-high performance liquid chromatography coupled to a linear ion trap-Orbitrap hybrid mass analyzer. The results showed that the disaccharide sucrose was the most abundant sugar for all cultivars, followed by the monosaccharides glucose and fructose, and the sugar alcohol sorbitol. The most abundant polyphenolic compounds were rutine together with catechin and quercetin 3-O-glucoside. No clear pattern was found between the sugar components and the two production systems. Cultivar 'Jubileum' had all important sugars elevated when grown in the organic way and two folds higher sweetness index than IP fruits. Organic 'Edda' had the highest sweetness index due to the highest level of sucrose. 'Jubileum' and 'Opal' fruits from OP had higher level of all stress sugars (arabinose, ribose and galactitol), referring to higher sensitivity level of those two cultivars. Elevated levels of phenolics compounds were mostly found in IP fruits, except in 'Mallard' and 'Opal'. The cultivars 'Excalibur' and 'Reeves' had almost the same sugar and polyphenolic profiles in both IP and OP, and can be recommended for both production systems. OP grown 'Opal' and 'Mallard' had much higher level of the phenolic compounds and sorbitol, and much less sucrose and thus more healthy.

Keywords: chemical content, fruit quality, sweetness index, *Prunus domestica.*

PVI-03

EVALUATION OF CONSUMERS' PERCEPTION REGARDING SOME LOCAL AND FOREIGN PLUM CULTIVARS

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Evaluation of consumers' perception and physico-chemical aspects should be simultaneously considered in the breeding programmes, selection of new cultivars or large propagation. In order to recommend certain cultivars to the farmers, the fruits quality tested in the laboratory as well as the perception of the consumers must be considered. The aim of this study was to evaluate the consumers' expectations and perception regarding fresh plums of three Romanian ('Brumării de Voineşti', 'Record' and 'Record Mutant') and three foreign cultivars ('Elena', 'Presenta' and 'Top Hit'). Fruit size, colour, firmness, pulp juiciness, taste and flavour were analysed by consumers of different ages and gender. In parallel, some fruit physical and chemical analysis were made to characterize fruit samples – average fruit and stone weight, form index, firmness, soluble solids content, dry matter, acidity. Promising results were obtained for 'Record', 'Top Hit' and 'Elena' cultivars, thus concluding that the respondents are open to accept new or foreign cultivars as long as there is a beneficial sensorial advantage in the perceived quality of the product. The results also showed that the consumer's preferences are influenced by age and gender. Further consumer tests regarding these cultivars after different storage periods are needed to better understand their preferences.

Keywords: fruit size, firmness, pulp juiciness, taste, flavor, soluble solids content.

PVI-04

DOES A HIGH PHENOLIC CONTENT IMPLY A HIGHER EFFECT ON CONSUMERS' HEALTH? DETERMINING BIOACCESIBILITY AND INTRACELLULLAR REDOX EFFECT OF PHENOLIC COMPOUNDS PRESENT IN JAPANESE PLUM FRUITS

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Fruits have the potential to counteract the development of inflammatory processes related to the increase of oxidative stress since they contain secondary metabolites of phenolic nature with antioxidant activity. However, the mechanisms of action and interaction between these compounds and the organism are still unknown. The effect of the digestive process on the original food matrix must be considered to understand these mechanisms, being necessary to estimate the released fraction of phenolic compounds potentially is to estimate the bioaccessibility and redox intracellular impact of different families of phenolic compounds present in Japanese plum cultivars. We set up fruit digestions based on the standardized InfoGest digestion model, to estimate the bioaccessibility of phenolic compounds. With this protocol, we determined the phenolic compounds content in the pre- and post-digestion samples. In parallel, we developed an intestinal barrier model compatible with the digested fruit, which allows us to estimate the permeability of phenolic compounds through this barrier by incubating them in monolayers of Caco-2 cells. Finally, the effect of phenols in the redox tone was evaluated, by estimating the intracellular hydrogen peroxide (H_2O_2) using a biosensor expressed in Caco-2 cells (HyPer). Based on the bioaccessibility obtained for the contrasting cultivars 'Golden Kiss' and 'Larry Anne', we evaluated their redox impact with HyPer. With this tool, we could observe differential effects in the intracellular redox state among the cultivars. These results suggest that the bioaccessibility of phenolic compounds is cultivar-dependent. Also, they indicate that a higher content of phenolic compounds does not imply a higher bioaccessibility. Similarly, Caco-2 cells equipped with HyPer could discriminate between the cultivars evaluated, suggesting that their distinct phenolic content induces a differential cellular redox response. The followed procedure proves useful to test the effect of different plum cultivars in the intracellular redox machinery, with promissory applicability in phenotyping functional potential and thus breeding for healthier fruit cultivars.

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Keywords: plum, phenolic compound, gastro-intestinal digestion, bioaccesibility, redox homeostasis.

PVI-05

PRELIMINARY RESULTS OF THE DETERMINATION OF HARVEST INDEXES FOR THE FRESH CONSUMPTION OF 'D'AGEN' PLUM IN CHILE

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European plum (*Prunus domestica* L.) production has increased considerably in recent years in Chile. The O'Higgins region represents 67.5% of this crop at the national level, where 95% of the hectares correspond to the 'd'Agen' cultivar. In Chile has traditionally been used for processing into prunes. Recently, fresh consumption has left better orchard gate prices to the growers than the dehydrated destination. Nevertheless, insufficient knowledge exists about the harvest indexes for the production of fresh consumption, considering the export to distant markets. During the 2020–2021 season, a trial was conducted on the 'd'Agen' cultivar in three commercial orchards located in the O'Higgins region. The aim was to evaluate fruit maturity and growth parameters, relate and correlate among them, and define the best harvest index for the export of fresh consumption. In the field, from November 2020 until harvest, to determine fruit growth and maturity, biweekly were evaluated in 96 fruits the diameter and absorbance index of chlorophyll (I_{AD}). Simultaneously, to correlate these parameters with other destructive and non-destructive fruit quality parameters were characterized others 96 fruits in the laboratory. At harvest, was estimated the yield efficiency. Measurements in the orchard and laboratory did not show significant differences for the different evaluated dates. The I_{AD} during the growing season shows a behavior adjusted to segmented regression (two sections). In addition, this parameter obtained a good correlation with the main parameters of maturity, firmness, and CSS, approximately from seven o five weeks before harvest. Linear and negative regressions for the relationship between I_{AD} and fruit growth were evidenced. In the laboratory, the highest and most significant correlations were obtained between fruit weight and equatorial diameter (r = 0.96), Chroma and h (r = 0.81), and between fruit firmness measured destructively and non-destructively (r = 0.82). Different I_{AD} classes were established, where the most representative at harvest corresponded to values among 1.37–1.64, with a 59.40% of harvest fruits.

Keywords: chlorophyll absorbance index, I_{AD}, fruit quality parameters, yield efficiency, flesh firmness.

PVII-01

DETERMINATION OF VOLATILE FATTY ACID ETHYL ESTERS IN RAW SPIRITS OBTAINED FROM AUTOCHTHONOUS PLUM CULTIVARS USING SOLID PHASE MICROEXTRACTION AND GAS CHROMATOGRAPHY-MASS SPECTROMETRY

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The aromatic profiles of plum brandies were strongly influenced of desirable aromas of ethyl esters. Fatty acid esters contribute to the flavour of the destillates with a pleasant fruity and flowery smell, indicative of the quality of the spirit. An analytical method for the determination of fatty acid ethyl esters in raw spirits of different quality and produced from various autochthonous plum cultivars has been developed and optimized. A headspace solid phase microextraction (HS-SPME) as the extraction technique and gas chromatography coupled with mass spectrometry was utilized. The raw materials used for the production of distillates were mashes prepared from cultivars 'Crvena Ranka', 'Požegača' and 'Metlaš', respectively, and mixed combination of 'Metlaš' and 'Trnovača'. The aroma profile of the fractions obtained during the distillation was investigated as well as the aroma profile of fresh fruit and feremented broth. The most intensive aroma was detected in the first fractions (heads), however, there were undesirable components such as hydrocyanic acid and methanol, as well as, aliphatic aldehydes, acetals and higher alcohols (2-methyl-1-propanol, 1-pentanol, 1-hexanol). On the other side, the content of ethyl esters in middle fractions was lower than that in the first fractions. HS-SPME coupled with GC-MS showed high content of ethyl esters in analysed samples indicating a high quality of obtained distillates. The feasibility of the solid phase microextraction (SPME) for the analysis of fatty acid ethyl esters in raw spirits of different organoleptic quality was demonstrated. The SPME method showed high sensitivity and specificity, as well as the simple sample preparation which enable the use of this method for routine investigations in both industrial and research laboratories.

Keywords: aromas, gas chromatography, headspace solid phase microextraction, autochthonous plum cultivars.

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QUANTIFYING ENVIRONMENTAL PERFORMANCE AND POTENTIAL TRADE-OFFS IN CALIFORNIA PRUNE PRODUCTION USING THE SPARCS-LCA MODEL FRAMEWORK

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The Central Valley of California is a globally unique agricultural region, characterized by extensive, highly productive perennial cropping systems: an industrially managed agricultural forest of more than 1.3 million hectares. Central Valley orchard productivity is supported by favourable climate conditions and large-scale support infrastructure, including water storage in mountain snowpack, dry summers and wet winters, surface water conveyance, and biomass energy facilities. The complexity, regional variability, and extent of this cropping landscape – including material flows between cropping systems, changing environmental and infrastructural conditions over time, and interaction of management choices and agronomic responses – make characterization of environmental performance from a life cycle analytic perspective a challenging proposition. In response to this challenge, we have developed a Scalable, Process-based Agronomically Responsive Cropping System Life Cycle Assessment (SPARCS-LCA) model and parametrized it with data specific to the California prune industry. With this approach, we have produced a baseline impacts assessment including greenhouse gas (GHG), pollutant, water, and energy footprints on per-hectare and per-kilogram yield bases, with a scope including nursery production, postharvest operations, and shipping to regional, national, and international markets. The SPARCS-LCA framework has possible analysis of tradeoffs between possible orchard management alternatives in different impact dimensions – e.g. adoption of orchard recycling stands to reduce particulate matter and smog formation impacts, but at the cost of increased GHG emission. We have also quantified the GHG benefit of carbon storage in orchard floor soils and standing biomass using the Time Adjusted Warming Potential (TAWP) metric, accounting for variations in orchard lifespan, pruning and post-harvest practices, and the effects of wood decay and potential interventions for its management. Our initial findings indicate that the production of one kilogram of dried prunes (on a dry matter or 0% moisture basis) at post-harvest gate results in GWP100 emissions of 1.11 kg CO_2eq, TAWP100 emissions of 0.95 kg CO_2eq, 16.2 MJ energy use, and 1,167 L water use. This includes credits to the production system of 0.12 kg CO_2eq, 0.09 kg CO_2eq, 2.93 MJ, and 0.42 L respectively.

Keywords: LCA, GHG footprint, environmental impacts, carbon storage, wood decay.

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