

**Faculty of Agriculture
Goce Delcev University - Stip**



**3rd INTERNATIONAL MEETING
AGRISCIENCE & PRACTICE
(ASP 2023)**

BOOK OF ABSTRACTS

19-20th April 2023

Stip, Republic of North Macedonia

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**3rd INTERNATIONAL MEETING AGRISCIENCE & PRACTICE
ASP 2023**

Organized by

**FACULTY OF AGRICULTURE
GOCE DELCEV UNIVERSITY - STIP, REPUBLIC OF NORTH MACEDONIA
19-20 April 2023, Stip, Republic of North Macedonia**

Faculty of Agriculture organizes the 3rd International Meeting Agriscience & Practice (ASP 2023), giving an opportunity to the participants for presentation and discussion of original scientific and practical results in different fields of agriculture.

The 3rd International Meeting Agriscience & Practice (ASP 2023) is organized with an intention to bring together all agricultural stakeholders for sharing their knowledge, experience and obstacles. One of the main aims is to link research and field work in agricultural sector in the country and broader, giving it an international dimension.

The main goal of the Meeting was to connect and promote scientific achievements and practical knowledge presented in different thematic areas.

The scientific and applicative presentations are conducted in sections: 1. Agricultural economics, 2. Plant biotechnology, 3. Plant production, 4. Plant protection, 5. Quality control and food safety, 6. Soil science and hydrology 7. Viticulture, enology and fruit production, with a possibility for oral or poster presentation. Nevertheless, the needs of the agricultural sector entail organization of panel discussions, where invited speakers and panelists have a possibility to share their experience with the Meeting participants.

Dear colleagues, let's again gather together in one place with one joint idea - to combine agricultural science and practice with a purpose to share information, knowledge, experiences and solutions to exceed the problems. The main objective of this Meeting is successful establishment of continuous and valid communication and collaboration among scientific, research and practical activities in agriculture sector in our country, neighboring countries and broader international level. We will achieve the main goal of the Meeting as well as our common objective only by virtue of synergic connections on which we have been working intensively in the past years.

Every science has its significance and value in the given social context, but agricultural production has a special place of vital significance.

“Only one who knows the way of food movement, from field to table, really respects it”.

With great joyfulness we thank you for active participation in the Meeting!

Prof. d-r Emilija Arsov

**Dean of Faculty of Agriculture
&
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PLENARY PRESENTATIONS

**BOOK OF ABSTRACTS
PLENARY PRESENTATIONS**

CONSTRUCTIVE ALIGNMENT BETWEEN OBJECTIVES, TEACHING AND LEARNING ACTIVITIES, STUDENT COMPETENCIES AND ASSESSMENT METHODS IN HIGHER EDUCATION Slavča Hristov^{1*}, Dimitar Nakov², Jelena Miočinović¹

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Abstract

A high-quality learning process in higher education properly and constructively aligns essential elements: student workload, study programs and course objectives, learning outcomes, content, teaching and learning activities, assessment methods and acquisition of student competencies, which is known in the literature as constructive alignment (CA). In essence, CA is bringing into alignment the predetermined competencies, the learning and teaching activities, and the assessment types. Furthermore, CA is an outcomes-based approach to teaching in which the learning outcomes that students are intended to achieve are defined before teaching takes place. The success of students at all levels of study primarily depends on constructive alignment as one of the most significant and influential principles in higher education. Detailed knowledge of this principle and consistent application is the basic obligation of teaching staff in higher education. To develop a "constructively aligned" course unit, a teacher should start from the intended course-specific competencies, after which they should choose the most appropriate learning, instructive and teaching activities, and assessment methods for these specific competencies. The paper explains in more detail the essence of CA between student workload expressed through ECTS, study programs, course and unit objectives, learning outcomes, theoretical and practical contents, teaching and learning methodology, formative and summative assessment methods and effective acquisition of student generic and course-specific competencies.

Key words: *student workload, learning outcomes, learning and teaching activities, assessment, competencies.*

PLENARY PRESENTATIONS WITHOUT ABSTRACT

CURRENT SITUATION WITH GRAIN CROPS PRODUCTION IN REPUBLIC OF NORTH MACEDONIA Ognen Orovčanec^{1*}

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VARIABILITY OF AGROECOLOGICAL SYSTEMS AND ITS EFFECT ON SMALL GRAINS PRODUCTION IN SERBIA Radivoje Jevtić^{1*}

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AGRICULTURAL ECONOMICS

BOOK OF ABSTRACTS
SECTION: AGRICULTURAL ECONOMICS

ANALYSIS OF THE STATE OF TOBACCO PRODUCTION IN MACEDONIA WITH SPECIAL REFERENCE TO THE YOUNG WORKING POPULATION Silvana Pashovska^{1*}, Katerina Kareska¹

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Abstract

Tobacco production is a significant branch, from which about 30,000 families exist and brings foreign currency inflow of about 120 million euros per year, which is certainly enough incentive for the state to be oriented towards the maintenance and development of this branch. In fact, tobacco is our strategic export-oriented branch and in the past decade it has recorded stable and sustainable production (24,000 tons of tobacco were exported in 2020, and 30,000 tons of tobacco were exported in 2021), which provides a significant foreign exchange inflow to the state budget. In order to achieve greater effects and sustainability of this significant industrial culture, special emphasis should be placed on the management and organization of the tobacco production process, with mandatory motivation and stimulation of younger people who are less and less present in this sphere. In this context, we mean not only subsidies as the only way of support, but also education and encouraging the creation of a mandatory business plan, as well as the purchase of modern agricultural machinery through the program for rural development. For the past harvest of 2022, the purchase price of tobacco, which is a primary condition for further production and which reached a record level of 285 denars per kilogram, which is an increase of 40% compared to previous years, was particularly stimulating. of course, it will give a positive signal to the tobacco producers who will still see tobacco production as a primary activity, from which they will provide a livelihood for their families, but also an opportunity to make a profit.

Keywords: *sustainability, workforce, subsidies, purchase price, perspectives.*

PLANT BIOTECHNOLOGY

BOOK OF ABSTRACTS
SECTION: PLANT BIOTECHNOLOGY

MOLECULAR EVALUATION OF FOUR PEPPER ANDROGENIC REGENERANTS Marija Pockovska¹, Svetalana Glogovac², Ankica Kondić Špika², Fidanka Trajkova^{1*}, Liljana Koleva Gudeva¹

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Abstract

The anthers from six pepper genotypes, two hybrids Edita F1, Homera F1, and 4 cultivars: Duga bela, Una, Amfora and Kurtovska kapija were used in two-year androgenesis experiment. The anthers were isolated and cultivated on suitable nutrient media, following appropriate protocols. All tested pepper genotypes responded differently in terms of callus and androgenic embryos formation. Four androgenic regenerants (Edita_R1, Edita_R2, Edita_R3 and Edita_R4) from the genotype Edita F1 were used for molecular evaluation and compared with the donor genotype. The DNA was extracted according to the CTAB protocol, modified by Somma (2004). SSR markers Hpms1-117, Hpms 1-168, Hpms 1-274, EPMS 650 and CAMS 117 were used for molecular analysis. The molecular evaluation of the regenerants showed that all androgenic regenerants had the same allele for all SSR loci as donor genotype Edita F1. Additionally, all androgenic regenerants were homozygotes for the five tested loci.

Key words: *Capsicum annum L., androgenesis, androgenic plants, SSR markers.*

BOOK OF ABSTRACTS
SECTION: PLANT BIOTECHNOLOGY

MICROTUBERIZATION – POSSIBILITY FOR DEVELOPMENT OF SEED MATERIAL FROM POTATO (*Solanum tuberosum* L.) Irena Petrova^{1*}, Liljana Koleva Gudeva¹, Fidanka Trajkova¹

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Abstract

Potato (*Solanum tuberosum* L.) varieties Marabel, Ultra, Agata, Sunshine и Agria were used for development of potato seed material by method of microtuberization. The research experiment was conducted in Laboratory of Plant Biotechnology in Teaching Centre Strumica, Faculty of Agriculture, Goce Delcev University starting with potato sprouts and nodes as two different types of explants. The starting explants were cultivated on MS medium (Murashige and Skoog, 1962) supplied by different concentrations and combinations of cytokinins and auxins. The initiation of microtuberization was conducted on MS medium and the process was stimulated by 4%, 6% and 8% sucrose, respectively. The development of microtubers from the genotype Sunshine was stimulated by addition of 8% sucrose in the medium. The best medium for stimulation of microtuberization for the genotype Sunshine was MS + 6mg/l BAP + 2mg/l NAA + 8% C12H22O11. In the Agata genotype, increasing the sucrose percentage in the MS medium by 4% and 8% resulted in obtaining 100% microtuberization. Also, sucrose percentage in MS medium higher than 8% resulted in microtubers development in the genotype Ultra. To increase the volume of the formed microtubers, the cultures were passaged on a new MS medium enriched with the following composition MS + 4mg/l BAP + 4mg/l KIN + 8% C12H22O11.

Key words: *in vitro*, sucrose, auxin, cytokinin, MS medium.

DETERMINATION OF PHOTOSYNTHETIC PIGMENTS IN FRUITS FROM PEPPER ANDROGENIC PLANT Marija Pockovska¹, Fidanka Trajkova^{1*}, Liljana Koleva Gudeva¹

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Abstract

Series of cultures of anthers from different genotypes of pepper (*Capsicum annuum* L.) were cultivated to determine their androgenic potential during the two-year research. Six pepper genotypes (Edita F1, Homera F1, Duga bela, Una, Amfora and Kurtovska kapija) were used in the research with different number of anthers as starting material. The anthers were isolated from pepper buds in appropriate developmental stage were cultivated on suitable nutrient media, following appropriate protocols. Bela duga and Edita F1 resulted in the formation of different number of androgenic embryos. As a final result, only one fully acclimatized androgenic plant (Edita_R1) of the Edita F1 was obtained. The content of photosynthetic pigments in ripe fruits from the androgenic plant Edita_R1 was analysed and compared to the same physiological parameters in ripe fruits from mother genotype Edita F1. The average content of chlorophyll a, chlorophyll b and chlorophyll a+b in the ripe fruits from the androgenic plant Edita_R1 was 2.27 mg/g fresh weight, 6.59 mg/g fresh weight and 6.12 mg/g fresh weight, respectively. The average content of chlorophyll a, chlorophyll b and chlorophyll a+b in the ripe fruits from mother genotype Edita F1 was determined as 2.37 mg/g fresh mass, 5.74 mg/g fresh mass and is 6.26 mg/g fresh mass, respectively. The average value of the content of carotenoids in the fruits of androgenic plant Edita_R1 was 6.28 mg/g fresh weight which was significantly higher as compared to 1.18 mg/g fresh weigh in the fruits of the mother genotype Edita F1.

Key words: *Capsicum annuum* L., anthers, androgenic embryo, chlorophylls, carotenoids.

DEVELOPMENT OF AN EFFICIENT *in vitro* CALLUS PROLIFERATION PROTOCOL FOR ENDANGERED MEDICINAL PLANT (*Ferula tadshikorum* Pimenov) Dilafruz Jamalova^{1*}

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Abstract

Ferula tadshikorum Pimenov is a perennial monocarpic species, a large life cycle is carried out in 23-27 (30) years. As part of medicinal preparations, the plant exhibits expectorant and anticonvulsant properties in exudative diathesis, pulmonary tuberculosis, otitis, lymphadenitis. The aim of the present study was to improve the callus proliferation protocol for *F. tadshikorum* under in vitro conditions. For callus induction, hypocotyl and root explants taken from 14-20-day old plantlets germinated in Murashige and Skoog (MS) media were cultured in MS media with 27 plant growth regulator (PGR) combinations. Murashige and Skoog (MS) medium with 2 mg/l NAA and 0,5 mg/l Kin; 0,5 mg/l 2,4-D and 0,5 mg/l Kin; 2.0 mg/l 2,4-D and 1.0 mg/l Kin; 1.0 mg/l NAA and 2.0 mg/l BAP was most effective (90%) for the proliferation of callus for root explants.

Key words: *medicinal plants, phytohormones, Ferula L., callusogenesis, seedling explants, clonal reproduction, in vitro culture, cytokinin, auxin.*

PLANT PRODUCTION

BOOK OF ABSTRACTS
SECTION: PLANT PRODUCTION

OPPORTUNITIES – ALTERNATIVES FOR APPLICATION OF AGROECOLOGICAL MEASURES AND USE OF POST-HARVEST RESIDUES Ljupco Mihajlov^{1*}, Natalija Markova Ruzdik¹

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Abstract

In most cases, the standard cultivation of cereal crops by agricultural producers is carried out by applying agricultural practices, which are unsustainable on long term. Especially the treatment of post-harvest residues (mostly burning the stubble of rice, wheat and barley), contributes to increase the risk faster and mostly irreversible or very slow reversible degradation of natural resources. The treatment of the post-harvest residues must be in accordance with the strategies and practices of good agricultural practice, which are compatible with the EU strategy in the field of agricultural policy. Only in Bregalnica region, on an annual level, around of 100 000 tons (96.082 tons) of “post-harvest residues” remain on productive agricultural arable land. These amounts are obtained from around 31 100 hectares of arable land on which the most common cereal crops (wheat, corn, barley, rye and oats) are grown. On average, from all crops, on an annual level, about 3,2 t/ha of post-harvest aboveground plant biomass remained, which represents a significant resource, that is often used irrationally and sometimes harmful to the environment, by agricultural producers. The practice of agricultural cereal crop producers has been analysed and alternative approaches for using post-harvest residues have been proposed. The additional financial implications for farmers, which can be achieved by proper treatments of the post-harvest residues are emphasized. Proposed measures and activities for sustainable management of plant residues after harvest are explained.

Key words: *cereals, agricultural practices, degradation, sustainable management.*

INTRODUCTION AND DETERMINATION OF NEW TOMATO HYBRIDS Daniela Todevska^{1*}, Sanja Kostadinovic Velickovska¹, Igor Iljovski², Biljana Kovacevik¹, Fidanka Ilieva¹, Marjan Crvenkovski²

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Abstract

The determination of the organoleptic characteristics in tomato *Lycopersicon esculentum* Mill. is a significant part in the basic needs and requirements of the market, but also in increasing the export potential. The aim of the research is the selection of new red tomato hybrids *Lycopersicon esculentum* Mill. According to their organoleptic, morphological and sensory characteristics, for possible commercialization. In the research, 23 coded new indeterminate hybrids of red tomato were analyzed and compared with 5 already present commercial hybrids (Brave F1, Adriatik F1, Matissimo F1, Alamina RZ F1, Signora F1). The tomato was produced from seedlings by a registered nursery grower Agro Koni, and it was planted in sheltered areas at a grower in Tirana, R. Albania. The properties that were examined: type of tomato (1 late / 5 early), plant strength (1 weak / 5 strong), length of internodes (1 long / 5 short), fruit quality (1 bad / 5 excellent), size of fruit (1 small / 5 large), as well as fruit color, fertility potential (yield), as well as overall evaluation of the plants in a rank from 1 (bad) to 5 (excellent). The relationships between analyzed properties, descriptive and the variance's analysis provided an insight into those hybrids that satisfy the methodological requirements. Based on the results and determination of new hybrids with improved properties from the existing ones, the needs of the market and consumers are influenced. According to the genetic potential and phenotypic characteristics, 3 new hybrids (TME221276, TME220244 and TME220245) were determined, which satisfied the examined criteria, thus giving the opportunity to be included in the cluster of commercial hybrids on the market.

Key words: *tomato, indeterminate hybrids, sensory analysis.*

BOOK OF ABSTRACTS
SECTION: PLANT PRODUCTION

USING THE BBCH SCALE AND GROWING DEGREE DAYS TO IDENTIFY THE GROWTH STAGES OF WINTER OILSEED RAPE GENOTYPES IN THE SKOPJE REGION Igor Iljovski¹, Ile Canev¹, Daniela Todevska²

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Abstract

Identifying the growth stages on oilseed rape accurately is essential for effective crop management. Two commonly used methods for identifying growth stages are growing degree days (GDD) and BBCH scale, for measure a heat accumulation on daily temperatures and describes the growth stages of plants. The main goal of this research is using a combination of these methods, where can identify the growth stages in production period. The three-year field experiments 2015/16 - 2017/18 were located in the Skopje Region, with two genotypes in 30 variants and 4 replications. Sowing was on October 1, with 8 kg ha⁻¹ seeding rate. To register the stages of development was used BBCH scale for oilseed rape. Growing degree days - GDD was determined by the formula with corrections for Tmax and Tmin values calculated. Germination (09 BBCH), was 7 days in the first and third year and 79 °C - 65 °C GDD and 8 days in the second year - 65 °C GDD. The flowering (63 BBCH), begins at 202 days in the first, - 809 °C GDD, 199 days in the second year - 649 °C GDD, and 198 day third year with 633 °C GDD. Senescence (BBCH 97), began on days 254, with accumulate 1530 °C GDD, days 258 - 1577 °C GDD, and days 265 with 1542 °C GDD in 3, 1 and 2 years. All data obtained from the research is aimed at meeting the needs of producers and researchers related to rapeseed production in order to ensure optimal production.

Key words: *GDD, Accumulate temperature, Tmax, Tmin.*

HETEROOTHIC EFFECT OF SOME QUANTITATIVE TRAITS IN F1 DIALLEL HYBRIDS OF VARIOUS TOBACCO TYPES Jane Aleksoski^{1*}

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Abstract

The mode of inheritance and heterotic effect were studied in ten F1 crosses obtained by one-way diallel crossing between five parental genotypes: MV-1, P 76/86, Adiyaman, Basma-Djebel and P 66 9 7. The following quantitative traits were studied: the number of leaves per stalk, length of leaves from the middle belt of the stalk and yield of green leaf mass per stalk and per hectare. The trial was set up in the experimental field of Scientific Tobacco Institute - Prilep, using a randomized block design with four replications in the period 2018-2019. Traditional cultural practices were applied during the growing season of tobacco in the field. The aim of this work was to study the mode of inheritance of the quantitative traits, to detect heterosis in the F1 generation and to assess its economic viability. Analysis of variance determined statistically significant differences in traits between parents and their hybrids in the two-year investigation. The most common mode of trait inheritance is partially dominant, then intermediate. The negative heterosis on the number of leaves has P 76/86 x P 66 9 7. The hybrids MV-1 x Adiyaman, P 76/86 x Basma-Djebel, P 76/86 x P 66 9 7 and Basma-Djebel x P 66 9 7 have a positive heterosis on the length of the leaves. Oriental hybrids, where one of the parents is P 66 9 7, have positive heterosis in the yield of green leaf mass per stalk. The investigation provides very useful guidance for future successive selection activities.

Key words: *tobacco, diallel analysis, inheritance, dominance, heterosis.*

BOOK OF ABSTRACTS
SECTION: PLANT PRODUCTION

CORN PRODUCTION IN R. MACEDONIA AND POSSIBILITIES FOR ITS CULTIVATION WITHOUT INTERVENTIONAL IRRIGATION Mite Ilievski^{1*}, Dragica Spasova¹, Biljana Atanasova¹, Dusan Spasov¹

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Abstract

Corn is an annual plant from the sub-group of millet grains. In Macedonia, there are relatively good soil and climate conditions for its production. It is the third cereal crop in terms of representation on arable land, after wheat and barley. In 2021, 130 769 tons of corn were produced. The total annual production of wheat, barley and corn grain in 2021 was 526 045 tons. Of the other cereal plants, rye, rice and oats are produced in much smaller quantities. These quantities of domestically produced corn do not meet domestic demand. Taking into account the agrotechnical measures applied in the production of corn and the soil-climatic conditions that prevail in Macedonia, this article gives a special review of the problems faced by this production, as well as the possibilities and measures for its production without interventional irrigation.

Key words: *Zea mays, yield, measures, irrigation, grain.*

MACRONUTRIENT AVAILABILITY OF DIFFERENT ORIENTAL TOBACCO VARIETIES GROWN UNDER THE SAME CONDITIONS Biljana Jordanoska Shishkoska^{1*}, Valentina Pelivanoska¹, Marija Srbinoska¹

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Abstract

Nitrogen, phosphorus and potassium, are most essential macronutrients required for the growth and development of all plants, including oriental tobacco. Their availability in the soil determines the overall health and growth of tobacco plants, so given the focus of sustainable agriculture, proper management of soil macronutrients is necessary while at the same time, reaching the requirement of high crop productivity and quality. In order to evaluate the macronutrient content and impact factors influencing their availability, different varieties of oriental tobacco were chosen for a field experiment (P-23, P-79, Basma and Elenski). Plants were grown under the same agrotechnical and environmental conditions, on the colluvial soil type. Total content of N, P and K were determined in the soil and leaf samples, and respectively, their mobile forms in soil samples. Availability ratios are presented by available and total content as direct measure of the potential effectiveness of the selected macronutrient in soil. Results show that availability and uptake of given macronutrients are significantly influenced by many factors. Analysing the soil properties and availability of N, P and K to plants gives helpful insight in applying certain measures for specific agricultural and environmental management purposes.

Key words: *plants, nutrients, influence factors.*

SOIL FERTILITY AS A PREREQUISITE FOR SUSTAINABLE TOBACCO PRODUCTION IN THE MUNICIPALITY OF DOLNENI Valentina Pelivanoska^{1*}, Biljana Jordanoska Shishkoska¹

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Abstract

No agricultural system will be sustainable, if it is not economically profitable for the producers and for the society itself, which always tends to increase the productivity of the soil. Tobacco production and land management in our country has a long history; therefore, the precise determination of soil fertility parameters is of essential importance. The main purpose of this study was determining spatial distribution of tobacco soil properties as useful strategy for guiding the agricultural production and field management on specific site. Furthermore, diagnosing the soil fertility provides us with proper and rational fertilization recommendations, as an integral part of sustainable tobacco production. Soil properties: pH, humus content, total nitrogen, available phosphorus and potassium, carbonates and physical clay were analyzed on 153 topsoil samples (0-30 cm) for monitoring purposes. Samples were selected from municipality of Doleni, part of the Pelagonia tobacco production region that occupies almost 50% of the total areas for tobacco production in our country. Results show that soil properties are spatially varied. On the basis of the performed classifications, 54 % of the soil samples have low humus and nitrogen content, 65 % of the samples have low available phosphorus content and only 6.5 % have low available potassium content. The soil reaction varies widely within the limits that are suitable for tobacco production, and most of the sampled soils are loamy. In this region, mainly complex fertilizers such as 8:22:20, 10:30:20 and 6:24:12 satisfy the needs of most tested soil samples.

Key words: *soil properties, Pelagonia, spatial distribution.*

PLANT PROTECTION

***Acidovorax citrulli*- CAUSING BACTERIAL FRUIT BLOTCH OF WATERMELON FRUITS
IN STRUMICA REGION Sasa Mitrev¹, Emilija Arsov^{1*}**

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Abstract

During August 2019/20, fruit blotch symptoms on mature watermelon fruits caused by *Acidovorax citrulli*, for the first time were observed in the village of Mokrievio, Strumica region, on the Bibo and Olakala watermelon varieties. *Acidovorax citrulli* is the causal agent of bacterial fruit blotch (BFB) of cucurbit plants. In recent years, the disease has been spread to many parts of the world, mainly via the inadvertent distribution of contaminated commercial seeds. So far, *A. citrulli* has already been reported in the Europe EPPO region, such as Turkey, Israel, Greece, Hungary, Italy, and Serbia, but in these reported countries, *A. citrulli* is under very careful control, and hygiene measures have already been taken. *A. citrulli* has been added to the EPPO A1 List version 2022-09 (https://www.eppo.int/ACTIVITIES/plant_quarantine/A1_list).

Because of the costly lawsuits filed by growers against seed companies and the lack of efficient management methods, BFB represents a serious threat to the cucurbit industry, primarily to watermelons and melons. Despite the economic importance of the disease, little is known about the basic aspects of *A. citrulli* pathogenesis. In our research, for the first time, on the basis of the fruit symptoms, pathogenicity on watermelon young fruit and seedlings, results of biochemical tests, ELISA test, and Real-time PCR analyses compared with positive controls, the pathogen was identified as *Acidovorax citrulli*.

In the investigation field, from where watermelon fruits were collected, significant economic losses (up to 70%) were diagnosed. Considering the fact that this pathogen is on the EPPO A1 List, we already informed our Ministry of Agriculture, and it is very important to implement eradication measures to prevent further spread of this bacterium across the region.

Key words: *fruit blotch symptoms, mature watermelon fruit, biochemical tests, PCR analyses.*

RAMULARIA LEAF SPOT - A POTENTIAL THREAT TO BARLEY PRODUCTION IN NORTH MACEDONIA Vesna Župunski^{1*}, Radivoje Jevtić¹

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Abstract

Ramularia collo-cygni (*Rcc*) is a causal agent of Ramularia leaf spot (RLS) that emerged as an economically important seed-borne disease in the last 30 years. RLS causes yield losses of up to 35 % and it is reported as a serious threat of barley production all over the world. Although the fungus co-exists with the host plant from early development stages the RLS symptoms occur late in the season as rectangular reddish-brown necrotic spots usually surrounded by a chlorotic halo. RLS symptoms are visible on both sides of the leaf blade and are very hard to be distinguished from other barley diseases or physiological leaf spots without using molecular techniques. Difficulties in distinguishing RLS from other abiotic and biotic factors of leaf spotting complex, asymptomatic phase of fungal development, and lack of regulations controlling RLS distribution through barley seed trade are major reasons that could jeopardize RLS management and barley production. During the visual inspection of barley production in 2016. in Kumanovo and Bitola the symptoms of RLS were observed on leaves, spikes and awns. Due to slow growing nature of the fungus and low frequencies of *Rcc* isolation, PCR-based identification was also applied and the presence of RLC on suspected leaves was confirmed. Since reports on the specificity of species-specific primers for *Rcc* identification in post-flowering growing stages are rare, this study confirmed not only the presence of RLS in North Macedonia but also the specificity of species-specific primers for identification of *Rcc* population originating from North Macedonia.

Key words: *Ramularia collo-cygni*, seed-borne disease, PCR.

EFFECT OF BORON (B) NUTRITION ON DEVELOPMENT OF GRAY MOLD IN PEPPER (*Capsicum annuum* L.) Dusan Spasov^{1*}, Biljana Atanasova¹, Biljana Kovacevik¹, Dragica Spasova¹, Mite Ilievski¹

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Abstract

Pepper (*Capsicum annuum* L.) grown in humid and warm conditions is susceptible to the development of diseases, especially gray rot, caused by *Botrytis cinerea*. Adequate fertilization that provides sufficient boron (B) in plant tissues, especially in the fruit, is suggested as an alternative to control the pathogen. The effect of the microelement boron (B) on the development of gray mold in hot pepper, variety Fortes, was determined. The survey was conducted in commercial greenhouses, with hot water heating, in locality of Bansko, Republic of Macedonia, during 2022. Foliar application of fungicides and boron (B), in the form of 11% borethanolamine, showed phytotoxicity symptoms from boron (B) on the leaves of pepper plants and increased disease development. Further research should be done to determine the relationship between fungicides and the microelement boron, which in mutual treatment cause phytotoxicity in pepper.

Key words: *microelements, Botrytis cinerea, pepper, phytotoxicity*

MONITORING OF THE SPECIES FROM NOCTUIDAE FAMILY IN TOBACCO FIELDS USING LIGHT TRAP Vesna Krsteska^{1*}, Stanislava Lazarevska², Biljana Jordanoska Shishkoska¹

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Abstract

Larvae of *Helicoverpa armigera*, *Agrotis segetum* and *Agrotis ipsilon* can cause extensive damage on tobacco plants. The studies were carried out on tobacco fields in Prilep from March to the end of October 2020/21. The light trap is used to determine the flight and the quantitative representation of adults. In 2020 a total of 76 adults of *H. armigera*, 80 of *A. segetum* and 14 of *A. ipsilon* were caught, and 74 moths of *H. armigera*, 45 of *A. segetum* and 25 adults of *A. ipsilon* in 2021. The *H. armigera* moths were determined in the second decade of June 2020 and in the third decade of June 2021, until the second decade of October. The maximum flight was during August 2020/21. The *A. segetum* moths were determined in the first decade of May 2020/21, until the first decade of September 2021 and until the third decade of September 2020. The maximum flight was from the third decade of May to the first decade of June and in the first decade of August 2020/21. The *A. ipsilon* flight in 2020 was determined in June and from August to the first decade of September. The moth's flight in 2021 was determined in April, then in June to the first decade in July and from the end of July to the middle of September. The maximum flight was in the first decade of August 2020/21. For the control of Noctuidae species, it is required constant monitoring of the flight of the adults.

Key words: *H. armigera*, *A. segetum*, *A. ipsilon*.

IMPACT OF DISEASE SEVERITY ON INFECTED BUNCHES UPON A YIELD OF GRAPE VARIETY VRANEC, CAUSED BY *Plasmopara viticola* (Berk. & M.A. Curtis) Berl. & De Toni Gligor Bojkov^{1*}, Emilija Arsov¹, Sasa Mitrev¹

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Abstract

It is essential to assess the severity of Downy mildew in vineyards to predict yield loss accurately. The software platform 'image J' was used to detect and quantify the disease severity by measuring infected berries and diseased leaves relative to healthy tissue. Image-based techniques provide more objective, accurate, and repeatable measurements than visual scoring. Two different plots were compared: A-Control canopy, where the bunches were sprayed only once with a contact fungicide Folpet to prevent yield losses, and B-Standard fungicides treatment, which followed the usual spray schedule during the growing season. Multiple regression analysis was used to predict grape yield loss during the observation period. The researchers also investigated multicollinearity among independent variables to create the most accurate regression model for prediction. The results of the study showed that Downy mildew development on leaves did not affect grape yield, while infected bunches were the most significant factor for quantitative yield reduction. This information could help vineyard managers make more informed decisions regarding the use of fungicides and disease control strategies to minimize yield losses caused by Downy mildew.

Key words: *P. viticola*, disease severity, multiple regression analysis, quantitative measurements.

BIOLOGICAL CONTROL OF GREEN MOULD DISEASE AND MUSHROOM FLY USING BIOFUNGICIDE *Bacillus subtilis* Ch-13 AND BOTANICAL INSECTICIDE AZADIRACHTIN (TECHNICAL SOLUTION) Ivana Potočnik^{1*}, Tanja Drobnjaković¹, Svetlana Milijašević-Marčić¹, Jelena Luković¹, Miloš Stepanović¹, Dejan Marčić¹, Emil Rekanović¹

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Abstract

The result of the study was accepted technical solution of disease/pest control of cultivated mushroom (*Agaricus bisporus* L.) based on biological pesticides (Biogenesis d.o.o., Serbia): microbial biofungicide *Bacillus subtilis* Ch-13 (Ekstrasol 1×10^8 CFU/cm³) and botanical bioinsecticide azadirachtin (Ozoneem trishul 1 %). Effectiveness of bio/pesticides in disease/pest control and their impact on mushroom yield were evaluated in large and small-scale experiments. Efficacy of biofungicide in control of *Trichoderma aggressivum* Samuels and W. Gams (green mould disease) was evaluated in comparison with chemical fungicide prochloraz (2×1.5 mL). Biofungicide was applied in different procedures, in two (2×30 mL/m²), three (30 + 2×15 mL/m²), or six split doses (6×10 mL/m²). The recommended application programs in pathogen control was achieved when applied three (53.57-58.43%) or six times (63.05%). Biofungicide significantly improved yield in all different procedures, compared to untreated control in both small-scale and large-scale experiments (5.07-12.12%). Furthermore, the impact of the bioinsecticide azadirachtin (4 × 0.5 mL/m²) on the density of mushroom fly *Lycoriella ingenua* (Dufour) (Sciaridae: Diptera) was compared to the effects of the chemical insecticide malathion (2×0.3 mL/m²). The average number of flies on yellow sticky traps per each mushroom row was significantly lower in the experimental chamber comparing to two controls. The results of our study suggest that biofungicide *Bacillus subtilis* Ch-13 and bioinsecticide azadirachtin may provide a good alternative to conventional chemicals. The study was funded by grant 451-03-47/2023-1/200214 of the Ministry of Science, Technological Development and Innovation, Republic of Serbia.

Key words: *Trichoderma aggressivum*, *Lycoriella ingenua*, *Agaricus bisporus*; biopesticides.

BIOLOGICAL CONTROL OF SCAB DISEASE (*Venturia inaequalis*) USING BACILLUS ISOLATES IN *IN VITRO* AND *IN VIVO* CONDITIONS Dzansel Bukovec^{1*}, Marija Todorovska Ivkovic², Ana Nikolovska², Sofia Kostandinovska¹, Natalija Atanasova-Pancevska¹, Dzoko Kungulovski¹

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Abstract

Apple scab, caused by the pathogenic fungus *Venturia inaequalis*, is a major problem in apple production. In consequence, the control of this disease depends on the use of fungicides. More attention is brought towards finding strategies to deal with and control plant diseases in a natural way. The objectives of this study were to isolate a pure culture of *V. inaequalis* from infected apples, in order to identify possible bacterial antagonists that inhibit the sporulation of the fungus for development of biocontrol agent from the selected antagonists as an alternative for toxic fungicides. In the laboratory tests, eight bacterial isolates, marked as AA/1, AA/2-1, AA/2-2, AA/9, AA/11, AA/15, AA/19-2 and AA/20, were used. The isolates are the property and deposited in the collection of microorganisms at RCAMB "d-r Kungulovski". Microdilution and microdilution method for assessment of their antifungal activity were conducted. Further *in vitro* tests on apples to confirm the previously obtained results were carried out. The best growth of *V. inaequalis* was observed on SDA plate, with a colony size of 43 cm. Using the diffusion method, bacterial isolates AA/1, AA/2, AA/11, AA/15 and AA/19 exhibited the largest zones of antifungal activity, with the size of zones being 25, 25, 23, 23, 25, 30 mm, respectively. The results suggest that the tested bacterial isolates that showed significant antifungal activity against *V. inaequalis* can be used as an adequate alternative for the existing chemical fungicides.

Key words: *antibiosis, antifungal activity, bacteria, scab, fruiting.*

QUALITY CONTROL AND FOOD SAFETY

MULTIPLIED BENEFITS FROM A COMPLEX SELF-SUSTAINABLE TECHNICAL SYSTEM FOR PRODUCING MEAT AND MEAT PRODUCTS Darko Veljanovski^{1*}, Vangelica Jovanovska¹

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Abstract

Examined several parameters during operation and production, including parameters of operation of a biogas plant, parameters during biogas production, and parameters during operation of a meat industry. Researches, trails and tests were done in order to emphasize the multiple benefits of the operation of the complex self-sustaining technical system for the production of meat and meat products. That system includes several smaller subsystems, closely related to each other which, according to the researches, represent a perfectly functional unit that results in the production of high-quality meat products, but also eggs and electricity from the waste materials of those two subsystems. The production of electricity in the part of this complex system, even better known as green or bioenergy, with the conducted tests shows that it does not affect at the quality of the products in the slightest, also its production does not affect the pollution of the environment or the products themselves. The results obtained from numerous researches and tests are fully in support of proving that multiplied benefits are a positive result of the operation of a complex self-sustaining technical system for the production of meat products. Every modern society should have at least one such system for food production, and in parallel with that, production of electrical (bio) energy with zero pollution, for healthy environment which reproduces healthy population.

Key words: *technical system, biofuel - biogas, bioenergy, consumer eggs, meat products.*

THE INFLUENCE OF THE PERSONAL HYGIENE AND HEALTH OF MILKMEN IMPROVEMENT ON THE MILK SAFETY AND COMPOSITION ON SMALL DAIRY FARMS
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Abstract

The personal hygiene and health of milkmen improvement influence on the milk safety and composition on 128 small household farms in different regions of Serbia, producing mostly milk, having 5–15 cows, a milk cooler and at least one milking machine, was evaluated during six visits, by the following indicators: 1. the state of hands hygiene, 2. the condition of clothing hygiene and footwear, 3. gloves wearing and hygiene, and 4. regularity of the health check of milkmen, rated on a scale of 1 to 5. The samples were taken during visits after cooling and tested for milk protein and fat content, somatic cell count (SCC) and the total number of microorganisms (TNM), using Gerber method, Kjeldahl method, Fossomatic TM and ISO 4833-1:2013 methods, respectively. The IBM SPSS program was used for statistical data processing. A trend of continuous improvement of all hygienic values was observed in relation to the ordinal number of visits, except for indicator 3 (wearing and hygiene on gloves), when deterioration during the fourth visit compared to the previous was observed. No significant differences were found between the farm visits for indicator 4 (regularity of the health check of milkmen). TNM mean scores increased significantly after every visit ($F=9.63$, $P<0.0001$). SCC scores varied very significantly between visits ($F=5.17$, $P<0.0001$). The number of visits tended to show a significant influence on the milk fat rate ($F=2.221$; $P<0.1$).

Key words: *improvement, milkmen, hygiene, milk, safety, composition, small dairy farms.*

MASTITIS MAKE CHANGES IN THE ANTIOXIDANT ENZYMES CAPACITY OF RAW MILK FROM DAIRY COWS IN EARLY LACTATION Dimitar Nakov^{1*}, Aco Kuzelov¹, Slavča Hristov², Katerina Belichovska³, Branislav Stanković², Jelena Miočinović²

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Abstract

Early postpartum is the period when cows experience a significant increase in physiological stress levels followed by increased susceptibility to mastitis. The aim of this study was the evaluation of enzymatic antioxidant status through the activity of superoxide dismutase (SOD) and glutathione peroxidase (GPX) in milk collected from cows with mastitis in comparison with healthy cows. The two years prospective study was carried out to assess the changes occurring in the activity of antioxidant enzymes SOD and GPX in milk in two physiological periods: the period from the beginning of lactation until 21st day in lactation and the period from 22nd to 42nd day in lactation. The cows were allocated in groups regarding the season years of calving. The enzyme activity was determined in milk serum using spectrophotometric methods. The average test day milk yield of the dairy cows included in the survey ranged from 28.15±0.485 to 28.79±0.472 kg. There was a statistically significant positive correlation between the activity of SOD and GPx in milk serum. Health disorders of the mammary gland showed a statistically significant influence on GPx activity in milk serum ($p < 0.05$), but there wasn't a statistically significant influence on SOD activity in milk serum. The milk yield on test days had a statistically significant influence on GPx activity in milk serum. The GPx activity in milk serum can be used as a predictive biomarker for the determination of mammary gland health status in early lactation.

Key words: *glutathione peroxidase, superoxide dismutase, mastitis.*

OPTIMIZATION OF RAPID AND SIMPLE HPLC-DAD METHOD FOR ANALYSIS OF GLYCOALKALOIDS SOLANINE AND CHACONINE IN POTATOES Irena Petrova^{1*}, Violeta Ivanova-Petropulos, Liljana Koleva-Gudeva, Sasa Mitrev

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Abstract

A simple and rapid HPLC-DAD method has been developed for separation of glycoalkaloids solanine and chaconine in potatoes. Several HPLC method variables have been tested, including series of mobile phases with different amount of organic modifier acetonitrile in the mobile phase, the effect of buffer concentration and pH, as well as the effect of temperature and flow rate on the retention and resolution of the analysed analytes. Separation of solanine and chaconine was performed on a Shimadzu Shim-pack GIST C18 column (250 mm × 4 mm I.D., 5 µm particle size). Satisfactory resolution and relatively short analysis time were obtained when separation was performed at ambient temperature with isocratic elution, using the optimal mobile phase consisting of 30 % (v/v) acetonitrile and 70 % KH₂PO₄ with concentration of 20 mM and pH 6,57. The flow rate on the mobile phase was 1 mL/min and detection of solanine and chaconine was performed on a wavelength of 204 nm.

Key words: *solanine, chaconine, HPLC optimization.*

IMPLEMENTATION AND FUNCTIONING OF HACCP PRINCIPLES IN THE MACEDONIAN WINERIES: A MULTIPLE CASE STUDY Daniela Nikolovska Nedelkoska^{1*}, Biljna Risteska¹, Tatjana Kalevska¹, Vesna Antoska Knights¹, Vezirka Jankuloska¹, Sashko Martinovski¹

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Abstract

Wine is considered as a food and must be produced under conditions that will ensure the safety of the product for human consumption. The HACCP system is the internationally recognized as a food safety tool, and must be applied during the entire food production process. The implementation of a food safety management system based on the principles of HACCP in the wineries should minimise the number and extent of exposures to hazards and improve overall safety of the wine. In this study, an exploratory multiple case study approach was adopted in order to provide better understanding of the process of implementation and functioning of the HACCP system in the Macedonian wineries. Twelve Macedonian wineries (cases) of varying size and annual production participated in the study. Two methods for collecting empirical data have been applied: survey by applying a questionnaire sent via e-mail and face-to-face interview. Using survey data, the key factors affecting the functioning of the HACCP system in the Macedonian wine industry were analyzed. The findings provide evidence that the most common motives for the implementation of HACCP system in the wineries are: enhanced compliance with regulation, improved communication and control, and implemented traceability system. Also, the results showed that the main factors that hinder the implementation and functioning of HACCP system are: excessive documentation, lack of time, and lack of knowledge relevant to food safety (especially among micro sized wineries).

Key words: *food safety management systems, wine.*

MICROBIOLOGICAL QUALITY OF MACEDONIAN WHITE BRINED CHEESE Borce Makarijoski^{1*}

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Abstract

In this scientific paper the microbiological quality of Macedonian white brined cheese was determined. Four best variants of Macedonian white brined chesses were analysed for their microbiological parameters. From pathogenic microflora the following parameters were examined: total number of Coliforms, *E. Coli*, Pathogenic staphylococci, Molds, Yeast, *Listeria* and *Salmonella*. From lactic acid bacteria the following parameters were examined: the total number of *Lactococcus* bacteria and the total number of *Lactobacillus* bacteria. In all examined cheese samples pathogenic bacteria were not detected. *Lactococcus* bacteria was dominant bacteria in all four cheese variants at the beginning of ripening period till day 20. After that and at the end of ripening period (60 day) the *Lactobacillus* bacteria were predominant.

Key words: *microbiological quality, white brined cheese, bacteria.*

SENSORY CHARACTERISTICS OF COLD PRESSED SUNFLOWER OIL WITH THE ADDITION OF AROMATIC HERBS Katerina Temelkovska¹, Gorica Pavlovska¹, Valentina Pavlova¹, Viktorija Stamatovska¹

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Abstract

Cold pressed sunflower oil is unrefined oil with great biological value and good sensory properties. Due to its chemical composition, this oil easily oxidizes, creating harmful products for human health. Various artificial and natural stabilizers are added to prevent oxidation. Essential oils or aromatic herbs are used as natural stabilizers, which also change the sensory properties of the oils. The oil analyzed here is cold pressed sunflower oil to which fresh aromatic herbs have been added, such as: rosemary, garlic, parsley and mint. One aromatic herb is added to each bottle of oil, and one bottle of oil is without additives. The oils are stored for 6 weeks in the dark, and then the sensory characteristics of these oils are assessed through validated questionnaires and sensory tests. The following characteristics of the oils were determined through a series of hedonistic and visual tests: aroma, color, clarity, taste, crunchiness and chewiness. The aromatic herbs that are added do not affect the crispness and chewiness, but they do affect the smell, taste, color and clarity. The oil without additive and the oil with the addition of rosemary have the most acceptable smell and taste, and the highest grades for color and clarity, apart from these two oils (without additive and with the addition of rosemary), also have the oil with the addition of garlic.

Key words: *rosemary, garlic, parsley, mint.*

OLEOGELS – INNOVATIVE TECHNOLOGY FOR REPLACING ANIMAL FATS IN MEAT PRODUCTS Tanja Stojanovska¹, Tatjana Kalevska¹, Daniela Nikolovska Nedelkoska¹, Eleonora Delinikolova¹

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Abstract

The changes in lifestyle of modern consumers have increased demand for healthier meat products. Animal fat, which is an integral part of emulsified meat products, is directly related to the occurrence of chronic diseases and overweight. Polyunsaturated vegetable oils are healthier for human consumption, but their liquid consistency can pose a problem when directly applied in the technological process. Oleogels, obtained with innovative technology for gelling vegetable oils with the help of gelators and their application in meat products is a new approach to create healthier meat products with an improved fatty acid profile. This paper aims to review the different approaches for obtaining oleogels and the latest trends for their use in meat products.

Key words: *oleogels, gelators, vegetable oils, meat products.*

PHENOTYPIC AND EXTERIOR COMPARISON OF SALERS BEEF CATTLE WITH OTHER BEEF CATTLE BREEDS Daniel Simakoski^{1*}

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Abstract

Livestock farming is an important branch of animal husbandry in our country, whose production is mainly based on individual small farmers, predominantly consisting of dairy breeds such as Holstein Friesian and their crosses. According to the National Program for the Development of Livestock Farming in our country, the percentage of specialized beef farms for extensive meat production is relatively small, both in the private and public sectors. Salers cattle are a specialized breed intended for meat production, most commonly raised under the cow-calf system. This work will comparatively present the phenotypic, exterior, and linear measures of this breed of cattle in relation to other beef cattle breeds for meat production. The indexes for calculating the external and linear measures will be computed using the ICAR method, and the results will be statistically processed using appropriate statistical variation methods. The results obtained for Salers beef cattle, which are targeted for high-quality meat production, will provide a significant basis for selection in animal husbandry production, as well as an opportunity to adapt to the genetic and phenotypic traits of our beef cattle breeds for meat production.

Key words: *cattle, beef breeds, quality, linear measures, comparison.*

CHEMICAL COMPOSITION AND ANTIOXIDANT ACTIVITY OF XAD-7 EXTRACTS FROM LINGONBERRY (*Vaccinium vitis-idaea* L.) Sanja Kostadinovic Velickovska^{1*},
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Abstract

The chemical composition and antioxidant activity of XAD-7 extracts from Lingonberry (*Vaccinium vitis-idaea* L.) were object of this study. Cyanidin-3-*O*-galactoside, cyandin-3-*O*-glucoside and cyanidin-3-*O*-arabinoside were the most abundant anthocyanins. The results from electron transfer reactions analyzed by cyclic voltammetry of lingonberry extracts showed a current increase and had the ability to exchange electrons with the electrode. While the shape from cyclic and square wave voltammetry appeared similar for XAD-7 extract and its fractions, lingonberry samples differ in current intensity. In cyclic voltammograms, CF and XAD-7 extract showed the highest intensities. The results of AF were lower, nevertheless, antioxidant activity was detected. In square wave voltammograms, the ability to transfer electrons was as follows: XAD-7 extract > AF > CF. Phosphate buffer as solvent control had no effects. To sum up, lingonberry extracts showed electron transfer reactions with the highest potential for the XAD-7 extract.

Key words: *lingonberry extracts, Cyanidin-3-*O*-galactoside, cyandin-3-*O*-glucoside and cyanidin-3-*O*-arabinoside, antioxidant activity, cyclic voltammetry.*

SOIL SCIENCE AND HYDROLOGY

REDUCING GREENHOUSE GAS EMISSIONS IN AGRICULTURE: CHALLENGES AND POSSIBILITIES Biljana Balabanova^{1*}, Verica Ilieva¹, Sasa Mitrev¹

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Abstract

Global agriculture is affected by climate change that could significantly impact productivity. Large-scale afforestation and biomass for energy production as well as population and income growth, will exacerbate the competition for land. Agriculture is an important contributor to climate change, accounting directly for 10%–12% of anthropogenic greenhouse gas (GHG) emissions and also for around 70% of land use change emissions, mainly through deforestation. Soil acts as source and sinks for greenhouse gases (GHG) such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). Microbial activity, root respiration, chemical decay processes, as well as heterotrophic respiration of soil fauna and fungi produce GHGs in soils. Related emission flux rates largely depend on soil water content (humidity), soil temperature, nutrient availability, and pH value, plus land-cover-related parameters. Thus, meteorological and climatological parameters, as well as land-use management information, are paramount. Drivers can be separated into proximal drivers that influence soil emissions in the direct environment and distal drivers that effect soil emissions on larger scales. Considering the present study, we include the use of the following models: a) spatially explicit model of land-use choices to determine the possible effects of future changes in the drivers of land-use choices; and b) crop model - model that estimates spatially explicit profiles of GHG emissions from cropland with varying crop genetic productivity shifters, management systems, and climate scenarios.

Keywords: *soil emissions, greenhouse gases, climate change.*

Acknowledgment: Authors express their acknowledgment to the project: Carbon Initiative for Climate-resilient Agriculture – CARBONICA, Funded by the European Union.

ISOLATION, SCREENING AND CHARACTERIZATION OF CELLULOLYTIC BACTERIA FROM DIFFERENT SOIL SAMPLES FROM PELAGONIA REGION Dzoko Kungulovski¹, Natalija Atanasova-Pancevska¹, Elena Damcevska- Josifovska^{1*}

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Abstract

Cellulose is the most abundant renewable natural product in the biosphere (Feng et al., 2007), so cellulolytic microorganisms are fundamental for the transformation of cellulose into sugars that are essential nutrients for various organisms and for biofuels (Arifoglu and Ögel, 2000). Additionally, since the annual production of cellulose is estimated at 4.0×10^7 tons (Bakare et al., 2005), large quantities of industrial and agricultural cellulosic waste have accumulated due to inefficient use (Lee et al., 2008). Different kind of soils could potentially support several microbes with potent cellulolytic enzyme activities and therefore the exploration of those communities could be useful for biotechnology as well as for ecological conservation. The goal of this study was to conduct a survey for bacteria with cellulolytic potential, isolated from soils originating in Pelagonia Region. To select for microorganisms with cellulolytic potential, qualitative cellulolytic activity was determined by culturing microorganisms in media containing cellulose as the only carbon source. After screening, fifteen colonies were isolated capable of degrading cellulase. Determination revealed the isolates were identified as *Bacillus* spp, *Bacillus weihenstephanensis*, *Pseudomonas putida* and *Staphylococcus* spp. This study gives an overview of the potential microorganism that could be used for cellulose degradation in various biotechnological applications and for sustainable agricultural waste treatment.

Key words: *bacteria, enzymes, agricultural waste, Bacillus.*

THE PRESENCE OF *Escherichia coli* AND *Enterococcus* IN THE WATER OF THE FIFTH CANAL AND BLACK RIVER NEAR BITOLA Tatjana Blazhevska^{1*}, Valentina Pavlova¹, Viktorija Stamatovska¹, Vesna Knights¹, Mihajlo Sviderski², Eleonora Delinikolova¹

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Abstract

Water is a natural resource necessary for all living organisms. In our research, the research material is water. As measuring points for sampling for analysis are: measuring point 1 (Crna Reka near the village of Novaci), measuring point 2 (fifth channel exit of Bitola), measuring point 3 (fifth channel near the village of Kravari) measuring point 4 (fifth channel before flowing into the Crna Reka), measuring point 5 (Crna Reka before being mixed with water from the fifth channel), measuring point 6 (Crna Reka after mixing with water from the fifth channel) and measuring point 7 (Crna Reka near the village of Skocivir). In order to determine the quality of water from sanitary-hygienic aspect, the following microbiological tests have been made: determining the number of *Escherichia coli*, with a membrane filtration method made according to the ISO 9308-1:2000 standard for water quality and determination of the number of *Enterococcus* with membrane filtration according to the ISO 7899-2:2000 standard. The number of types of microorganisms tested indicates an increase in the number of microorganisms in the channel (measuring point 2, 3 and 4) which, at the measuring point 6 (junction of Crna Reka with the channel), are transmitted in the Crna Reka. And with that, not only the Crna River is getting polluted, but also the entire environment. All this indicates that the cleaning of the channel and the watercourse should become an obligation before the competent institutions but also the obligation of each individual is to protect his environment.

Key words: *microorganisms, contamination, environment, monitoring, wastewater.*

THE INFLUENCE OF DIFFERENT CLIMATIC TYPES ON THE NUMBER OF *Bacillus* spp. ISOLATED FROM SOIL IN NORTH MACEDONIA Natalija Atanasova-Pancevska¹, Dzoko Kungulovski¹, Elena Usta Petrova¹, Nikola Radmanovik¹, Ognen Boskovski¹, Edi Frcovski¹, Hristijan Premcevski¹, Sofija Kostandinovska^{1*}

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Abstract

Soil microorganisms play an important role in the biogeochemical processes of various elements vital to plant growth and animal life. Understanding and predicting the effects of climate change on soil microorganisms and their role in the ecosystem is a major challenge and provides an opportunity to focus research efforts on one of the most pressing problems facing our planet. *Bacillus* is a widely distributed genus with 347 species and 7 subspecies known to date. Members of this genus are capable of forming spores that are resistant to extreme heat, bactericidal agents and chemical disinfectants. Many *Bacillus* species are used in medicine and agriculture to produce antibiotics and also serve as probiotics in foods. Climate, as an abiotic factor, influences soil microorganisms by controlling the rate of soil formation and the chemical composition of the soil. Most soil microbiology studies focus on the diversity and abundance of soil microorganisms and on documenting the effects of environmental changes on these microorganisms. This new research trend can be applied to *Bacillus* spp. from soils in North Macedonia in the three climate types represented, mainly due to the climatic differences between them. This research focuses on the determination of soil geochemical parameters and microbiological analyses. A total of 36 strains of *Bacillus* spp. were isolated, 6 of which showed antimicrobial activity against certain test microorganisms. According to the results, it was also found that the diversity of *Bacillus* species changes depending on the soil microenvironment under the influence of different climatic conditions.

Key words: soil bacteria, climate change, agriculture, antibiotics, probiotics.

VITICULTURE, ENOLOGY AND FRUIT PRODUCTION

BOOK OF ABSTRACTS
SECTION: PRESENTATIONS OF COMPANIES

**PHENOLIC PROFILE OF MACEDONIAN RED WINES Violeta Ivanova-Petropulos^{1*},
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Abstract

Wine possesses a variety of recognized beneficial effects on human health, such as anti-inflammatory, antimicrobial, and anti-aging effects, as well as prevention of cardiovascular diseases. All these effects are due to the high content of phenolic compounds, such as stilbenes, anthocyanins, flavonols, flavan-3-ols and phenolic acids. In this study, red wines from Vranec, Cabernet Sauvignon and Merlot varieties (*V. Vinifera* L.) have been analysed using high-performance liquid chromatography coupled with diode array detector and online mass spectrometry (HPLC-DAD-ESI-MS and MS/MS) in order to determine their phenolic profile. All wines presented a complex phenolic profile represented by anthocyanins, pyranoanthocyanins, flavonols, hydroxycinnamic acids and their derivatives, stilbenes, gallic acid and flavan-3-ols. Vranec wine, which is characterized with deep red colour, showed highest concentration of all phenolic families compared to Cabernet Sauvignon and Merlot wines, indicating the important role of variety in differentiation of phenolic composition.

Key words: *phenolic compounds, red wine, HPLC-DAD-ESI-MS.*

BOOK OF ABSTRACTS
SECTION: PRESENTATIONS OF COMPANIES

QUALITY OF RED WINES FROM VRANEC, MERLOT AND FRANKOVKA GRAPE VARIETIES FERMENTED BY TWO DIFFERENT YEAST STRAINS Fidanka Ilieva^{1*}, Antonio Petrov¹, Sanja Kostadinovic Velickovska¹, Violeta Dimovska¹, Daniela Todevska¹

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Abstract

The aim of this research is to determine the quality of red wines from grape varieties Vranec, Merlot and Frankovka using wine yeasts from the French manufacturer SELECTYS® LA DÉLICIEUSE and baker's yeast seeded in a ratio of 0.25 g/L. The research was done during 2020 and 2021 in the Vinica vineyard, where the three grape varieties are grown at an altitude of 400 to 520 m. The determination of the quality of the young wines was done in the State Phytosanitary Laboratory, where the presence of sugars, alcohol, total acids, volatile acids, the presence of free and total SO₂ were determined with FOSS WINESCAN, while the presence of micro and macro elements in the wines was determined with ICP/MS. As part of the study, a polyphenolic profile of the wines obtained was established using the method of Folin Ciocalteu. Statistical analysis of the data was performed using the Pearson correlation coefficient between the chemical characteristics of the wines and the yeasts used for the study. The choice of yeasts used for fermentation is important to obtain high quality wines to satisfy consumer tastes and market requirements.

Key words: yeasts, wine, fermentation.

ISOTOPIC ($^{87}\text{Sr}/^{86}\text{Sr}$) DETERMINATION OF WINE FROM THE TIKVES AREA Ivan Boev^{1*}

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Abstract

This paper presents research that was done in the direction of introducing a method of determining the origin of wine by applying the methods of strontium isotope geochemistry. Namely, strontium isotopes are widely used in the world today to determine the origin of wine. For this purpose, a certain number of samples were collected from the area of Tikvesh and the obtained results are shown in fig. 1.

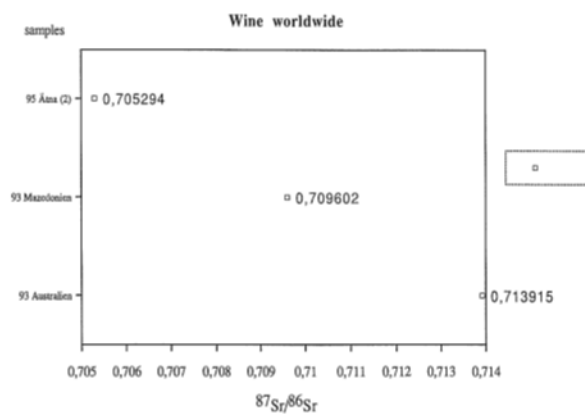


Fig. 1. Determining the origin of Tives wine using strontium isotopes $^{87}\text{Sr}/^{86}\text{Sr}$ (Max-Planck Institut Mainz, Germany)

PRESENTATIONS OF COMPANIES

BOOK OF ABSTRACTS
SECTION: PRESENTATIONS OF COMPANIES

ROBOTICS FOR AGRI FOOD PRODUCTION: OPPORTUNITIES AND CHALLENGES

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Abstract

To meet the demand feeding a world population, agriculture in 2050 will need to produce almost 60 percent more food. Climate change affects every aspect of food production. Expanding agricultural land to feed the world in 2050 is not a sustainable solution. Pressure on natural resources for increasing agro food production is more difficult than in the past. The key to feeding more people could be in finding efficient use of the land, increased labor productivity, innovative technology and social innovation. Labor participation in agri food production is declining. Labor productivity is often low and unpredictable. Innovative technologies like artificial intelligence (AI), analytics techniques and robotics are leading the transition to sustainable agri food production in the years that lay ahead of us. Robotic technologies will enable the labor to become more efficient and remain inter sectorial competitive. First wave is basic automation, mechanical devices and systems that automate repetitive labor intensive tasks. The second waves are augmented work technologies and optimized production systems. The third wave are trusted autonomous systems.

Key words: *food production, labor productivity, robots, artificial intelligence, autonomous systems.*

BOOK OF ABSTRACTS
SECTION: PRESENTATIONS OF COMPANIES

BALANCED, COMPLEX LIQUID FERTILIZERS FOR FOLIAR APPLICATION Mladen Lilov^{1*}

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Abstract

Plant fertilization is an essential factor in obtaining high yields of quality produce. For their normal development, agricultural crops need certain amounts of macro and micronutrients. Liquid complex fertilizers are widely used in agriculture. Foliar feeding of plants leads to: uniform distribution and complete absorption of nutrients, much faster development of the leaf mass, strengthening of the stem, development of a stable root system. Foliar nutrition allows for feeding plants that have just been planted and whose root system is not yet well developed, and also for emergency intervention on plants stressed by adverse climatic conditions. The complex liquid fertilizers developed by us are completely balanced in terms of the macro and microelements they contain. They are created with different proportions of nutritional elements according to the specific requirements of agricultural crops depending on the phases of their development. The macro (N, P, K, Mg, Ca) and micro elements (Mo, Zn, Fe, Cu, Mn, B) contained in them are completely water-soluble and are in the form that is as easily absorbed by plants as possible. The trace elements included in their composition are in chelated form for maximum availability. With the liquid fertilizers developed in this way, a number of tests were carried out in agricultural institutes, and an increase in yields and an improvement in the quality of the production were recorded for the treated crops.

Key words: *liquid fertilizers, stabilized, complex, balanced, trace elements.*

PRESENTATIONS OF COMPANIES WITHOUT ABSTRACT

DRYING VEGETABLES AND FRUITS WITH SOLAR ENERGY AND HEAT PUMP - AGRO SOLAR LTD, village Karaorman, 2000 Stip, Republic of North Macedonia, z.trajkov@gmail.com

HOW AGFUTURA TECHNOLOGIES CONTRIBUTES TO THE DIGITALIZATION OF THE AGRICULTURAL SECTOR IN MACEDONIA - AGFUTURA TECHNOLOGIES, Jurij Gagarin 45/1-1, 1000, Skopje, info@agfutura.com

EUROPEAN FUNDING OPPORTUNITIES - POSSIBILITIES AND CHALLENGES

**CARBON INITIATIVE FOR CLIMATE-RESILIENT AGRICULTURE – CARBONICA,
HORIZON EUROPE, 101087233 Biljana Balabanova, Verica Ilieva, Sasa Mitrev**

**BUILDING A NETWORK FOR COOPERATION AND MULTIDISCIPLINARY SCIENTIFIC
APPROACH IN THE FIELD OF ANIMAL WELFARE, COST ACTION CA21124 LIFT:
LIFTING FARM ANIMAL LIVES – LAYING THE FOUNDATIONS FOR POSITIVE ANIMAL
WELFARE (LIFT) Dimitar Nakov**

**PLASTICS MONITORING DETECTION REMEDIATION RECOVERY, COST ACTION,
CA20101, PRIORITY Vineta Srebrenkovska, Biljana Balabanova**

CEEPUS programme - opportunities and challenges Violeta Ivanova Petropulos

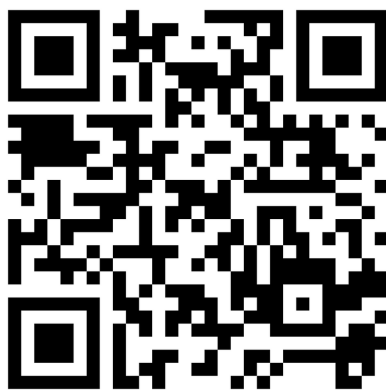
**UTILIZATION OF DIGITAL AND IT TOOLS IN AGRICULTURE SECTOR, SOCIO-
ECONOMIC IMPACT OF THE COVID-19 CRISIS IN AGRICULTURE, UNDP Local Office
Skopje, North Macedonia Fidanka Trajkova, Sasho Risteski, Lazo Dimitrov**

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- ❖ **LION – Sveti Nikole**

BOOK OF ABSTRACTS

**3rd INTERNATIONAL MEETING
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