

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



**2nd INTERNATIONAL MEETING
AGRISCIENCE & PRACTICE
(ASP 2019)**

BOOK OF ABSTRACTS

**12th April 2019
Stip, Republic of North Macedonia**

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Publisher:
Faculty of Agriculture, Goce Delcev University

The abstracts are technically edited according to the Template for Abstracts, without additional editing of the main text. The results and writing style are presented in the original form provided by the authors.

CIP - Каталогизација во публикација
Национална и универзитетска библиотека "Св. Климент Охридски", Скопје

631/635(062)(084.3)

INTERNATIONAL meeting agriscience & practice (ASP 2019) (2 ; 2019 ;
Stip)

Book of abstracts / 2nd international meeting agriscience & practice (ASP 2019), 12th
April 2019 Stip, Republic of North Macedonia.

- Stip : Goce Delcev University, Faculty of agriculture, 2019. - [62] стр. ; 25 см

ISBN 978-608-244-619-6

а) Земјоделство - Собири - Апстракти
COBISS.MK-ID 110141706

**2nd INTERNATIONAL MEETING AGRISCIENCE & PRACTICE
ASP 2019**

Organized by

**FACULTY OF AGRICULTURE
GOCE DELCEV UNIVERSITY - STIP, REPUBLIC OF NORTH MACEDONIA
12 April 2019, Stip, Republic of North Macedonia**

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

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TABLE OF CONTENTS

AGRICULTURAL ECONOMICS	10
INTEGRATING STUDIES AND ENTREPRENEURSHIP. CASE: ELOSA OSK. ANNIKA MICHELSON ..	11
PERSPECTIVES AND POSSIBILITIES FOR DEVELOPMENT OF TOBACCO PRODUCTION IN THE REPUBLIC OF MACEDONIA SILVANA PASOVSKA, TRAJKO MICESKI	12
PLACEMENT OF INFORMATION SYSTEMS IN AGRIBUSINESS GORAN MIHAJLOVSKI.....	13
THE IMPACT OF SOCIAL MARKETING ON IMPROVING CONSUMER AWARENESS OF THE IMPORTANCE OF SPICE IN FOOD MAJA ANGELESKA, KRISTINA J. GACOSKA (NO PARTICIPATION)..	14
PLANT BIOTECHNOLOGY	15
WASTE MATERIALS DERIVED BIO-EFFECTORS USED AS GROWTH PROMOTERS FOR STRAWBERRY PLANTS. AN AGRONOMIC AND METABOLOMIC STUDY BRANKICA SPASEVA, ZIAD AL CHAMI, SANDRA ANGELICA DE PASCALI, IVANA CAVOSKI, FRANCESCO PAOLO FANIZZI	16
GENETICALLY MODIFIED CROPS - CURRENT STATE, ISSUES AND PERSPECTIVES FIDANKA TRAJKOVA, LILJANA KOLEVA GUDEVA	17
MAIN MOLECULAR MARKERS IN PLANT GENETICS - MINI REVIEW MARIYA TODOROVA ZHELYAZKOVA, SVETLANA YORDANOVA GEORGIEVA, DEYANA GENCHEVA GENCHEVA (NO PARTICIPATION)	18
ASSESSMENT OF ANTIMICROBIAL AND ANTIOXIDANT ACTIVITIES OF <i>NEPETA NUDA</i> PLANT EXTRACTS DETELINA PETROVA, MILENA PETROVA, MARIA ROGOVA, MIROSLAVA ZHIPONOVA, PETIA HRISTOVA, GANKA CHANEVA	19
SPECTROPHOTOMETRIC DETERMINATION OF THE CONTENT OF PHOTOSYNTHETIC PIGMENTS IN SOME DECORATIVE SPECIES GROWN IN <i>IN VITRO</i> AND <i>IN VIVO</i> CONDITIONS IVANA VELESANOVA, FIDANKA TRAJKOVA, LILJANA KOLEVA GUDEVA	20
IMPROVING THE DOMINANCE OF SURFACE DUST ABSORPTION VS. BULK DEPOSITION IN MOSS TISSUE CROSS BIO-INDICATION PROCESS OF METALS DEPOSITION IN ENVIRONMENT BILJANA BALABANOVA, MAJA LAZAROVA, BLAZO BOEV	21
PLANT PRODUCTION.....	22
BREEDING OF ABIOTIC STRESS IN BARLEY - PROBLEMS, ACHIEVEMENTS AND PERSPECTIVES DRAGOMIR VALCHEV, DARINA VALCHEVA.....	23
A VIRTUAL PLANT PRODUCTION MANAGEMENT PLATFORM ANNIKA MICHELSON	24
USE OF SEAWEED EXTRACTS IN THE LETTUCE (<i>LACTUCA SATIVA</i> L.) PRODUCTION JOSÉ FILIPE GOMES LOPES; KIRIL BAHCEVANDZIEV, LEONEL PEREIRA	25
NEW PERSPECTIVE MALE STERILE HYBRID LINES OF BURLEY TOBACCO ILIJA RISTESKI KAROLINA KOCOSKA	26
THE SIZE AND NUMBER OF MIDDLE BELT LEAVES IN SOME VARIETIES OF WILD TOBACCO KAROLINA KOCOSKA, ILIJA RISTESKI	27
STUDY OF THE INFLUENCE OF LEAF FERTILIZER PANAMIN AGRO ON PLANT GROWTH, RESISTANCE TO BIOTIC AND ABIOTIC STRESS, PRODUCTIVITY AND QUALITY OF THE GRAIN IN WHEAT AND BARLEY DRAGOMIR VALCHEV, DARINA VALCHEVA.....	28
CHEMICAL COMPOSITION OF OATS GROWN IN CONDITIONS OF ORGANIC PRODUCTION ADRIJANA BUROVSKA, DRAGICA SPASOVA, BILJANA ATANASOVA, DUSAN SPASOV, MITE ILIEVSKI	29
THE INFLUENCE OF ORGANIC FERTILIZERS ON THE GROWTH AND YIELD OF BROCCOLI (<i>BRASSICA OLERACEA</i> L. VAR. <i>ITALICA</i>) DANIELA DIMOVSKA, LJUPCO MIHAJLOV, FIDANKA TRAJKOVA, LILJANA KOLEVA GUDEVA, IGOR ILJOVSKI.....	30
SPECIFICS OF SYMBIOTIC NITROGEN FIXATION IN LEGUMINOUS PLANTS - WITH A VIEW OF CHICKPEA (<i>CICER ARIETINUM</i> L.) MONIKA GLIGOROVA, LJUPCO MIHAJLOV	31
COMPARATIVE STUDY OF HYDROPONICALLY AND AQUAPONICALLY CULTIVATED PLANT SPECIES ALEXANDER TOMOV, DETELINA PETROVA, ANELIYA RAICHEVA, GANKA CHANEVA	32
ASSESSMENT OF AGRO-MORPHOLOGICAL VARIABILITY IN RICE BY MULTIVARIATE ANALYSIS VERICA ILIEVA, NATALIJA MARKOVA RUZDIK, LJUPCO MIHAJLOV, MITE ILIEVSKI.....	33

ARSENIC UPTAKE AND TRANSLOCATION IN SOYBEAN PLANTS IN NEUTRAL SOIL ENVIRONMENT LJUPCO MIHAJLOV, BILJANA KOVACEVIK, NATALIJA MARKOVA RUZDIK, VESNA ZAJKOVA PANEVA.....	34
IMPACT OF SOME HERBICIDES AND HERBICIDE COMBINATIONS ON SOWING CHARACTERISTICS OF CORIANDER (<i>CORIANDRUM SATIVUM</i> L.) GROZI DELCHEV (NO PARTICIPATION)	35
PLANT PROTECTION.....	36
FIRST REPORT OF HEALTH CONDITION OF POTATO SAMPLES FROM BORDER CROSSINGS IN THE REPUBLIC OF NORTH MACEDONIA MAJA PETRUSHEVA, SASA MITREV, EMILIJA ARSOV.....	37
THE IMPACT OF CLIMATE CHANGE ON SHIFT OF PREDOMINANT RUST PATHOGENS IN SERBIA RADOVOJE JEVTIĆ, VESNA ŽUPUNSKI, MIRJANA LALOŠEVIĆ	38
THE USE OF PREDATORS FOR THE CONTROL OF <i>FRANKLINIELLA OCCIDENTALIS</i> (THYSANOPTERA: THRIPIDAE) FOR PEPPER IN PROTECTED AREA DUSAN SPASOV, BILJANA ATANASOVA, DRAGICA SPASOVA, MITE ILIEVSKI	39
<i>PAENIBACILLUS ALVEI</i> DZ-3 WITH HIGH ANTIFUNGAL ACTIVITY PROTECTS APPLE FRUITS AGAINST <i>BOTRYTIS CINEREA</i> GRAY MOLD NATALIJA ATANASOVA-PANCEVSKA, DZOKO KUNGULOVSKI, VIOLETA BOSKOVSKA, IVAN KUNGULOVSKI	40
ONE STEP REAL-TIME POLYMERASE CHAIN REACTION USING FOR THE DETECTION OF <i>PLUM POX POTYVIRUS</i> CVETANKA KULUKOVSKA, EMILIJA ARSOV, SASA MITREV.....	41
PHYTOPLASMA INFECTION CAUSES PHYSIOLOGICAL CHANGES IN SYSTEMIC PEPPER LEAVES MIROSLAVA ZHIPONOVA, GALINA IVANOVA, EMILIJA ARSOV, DETELINA PETROVA, SASA MITREV, GANKA CHANEVA	42
GLOBAL WARMING AND INCREASED INFLUX OF PESTS ON TOBACCO VESNA KRSTESKA, STANISLAVA LAZAREVSKA, PETRE STOJANOSKI	43
PHENOTYPIC AND PATHOGENIC CHARACTERIZATION OF <i>COLLETOTRICHUM</i> SPP. ASSOCIATED WITH BITTER ROT ON APPLE FRUITS IN POST-HARVEST STORAGE BILJANA KOVACEVIK, MITREV SASA.....	44
EFFICACY OF SOME HERBICIDES AND HERBICIDE TANK MIXTURES IN DURUM WHEAT (<i>TRITICUM DURUM</i> DESF.) GROZI DELCHEV (NO PARTICIPATION)	45
QUALITY CONTROL AND FOOD SAFETY	46
INFLUENCE OF DEEP AUTOLYSIS ON THE QUALITY AND SHELF LIFE OF MEAT STEFAN G. DRAGOEV.....	47
THE INFLUENCE OF DIFFERENT CONCENTRATIONS OF PLANT ESSENTIAL OILS ON GROWTH AND REPRODUCTION OF <i>SALMONELLA ENTERITIDIS</i> JASMINA STOJILJKOVIC, METODIJA TRAJCHEV, MILENA PETROVSKA, DIMITAR NAKOV	48
THE EFFECT OF DIFFERENT STARTER CULTURES ON QUALITY AND SENSORY CHARACTERISTICS ON KASHKAVAL CHEESE GORDANA DIMITROVSKA, MARIJA PETKOVSKA, LJUPCE KOSHOSKI, ELENA JOSHEVSKA, KATERINA BOJKOVSKA.....	49
ANALYTICAL CHALLENGES IN CHEMICAL CHARACTERIZATION OF MEDICINAL AND AROMATIC PLANTS BILJANA BALABANOVA.....	50
NUTRITIVE AND SENSORY CHARACTERISTICS OF FERMENTED CUCUMBER VALENTINA PAVLOVA, GORDANA ŠEBEK, TATJANA BLAZHEVSKA, LJUBICA KOSTADINOVA.....	51
APPLICABLE GUIDELINES FOR THE EXISTING RULES FOR LABELLING FOOD PRODUCTS JULIJANA SAZDOVA, GORAN ANTONIEVSKI, DEJAN METODIJESKI, ACO KUZELOV	52
CONSUMER PREFERENCES AS DETERMINANT OF THE SUCCESSFUL QUALITY MANAGEMENT OF DAIRY PRODUCTS KATERINA BOJKOVSKA, NIKOLCHE JANKULOVSKI, GORAN MIHAJLOVSKI, ELENA JOSHEVSKA, GORDANA DIMITROVSKA.....	53
APPLICATION OF SPICES IN THE DAIRY INDUSTRY KRISTINA J. GACOSKA, MAJA ANGIJELESKA (NO PARTICIPTION).....	54
SENSORY EVALUATION OF PROBIOTIC YOGHURT INOCULATED WITH DIFFERENT STARTER CULTURES ISMAILI MUHHAREM, MAKARIJOSKI BORCHE, PRESILSKI STEFCHE, TRAJCHEVSKI SASHO	55
STARTER CULTURES EFFECT ON pH AND SH DYNAMICS OF INOCULUM DURING FERMENTATION PERIOD OF PROBIOTIC YOGHURT ISMAILI MUHHAREM, MAKARIJOSKI BORCHE, PRESILSKI STEFCHE, TRAJCHEVSKI SASHO.....	56

STABILITY OF OIL FROM OILSEED RAPE WITH GARLIC UNDER VARIOUS CONDITIONS HRISTINA EFTINZIJOSKA, GORICA PAVLOVSKA	57
EVALUATION OF BACTERICIDAL ACTIVITY OF SELECTED WILD MACROFUNGI EXTRACTS AGAINST <i>ESCHERICHIA COLI</i> DANIELA NIKOLOVSKA NEDELKOSKA, TATJANA KALEVSKA, NATALIJA ATANASOVA-PANCEVSKA, MITKO KARADELEV, ZORA UZUNOSKA, DZOKO KUNGULOVSKI	58
COMPARISON OF THE RHEOLOGICAL CHARACTERISTICS OF BIO-FORTIFIED FLOUR OBTAINED FROM SOFT WHEAT VARIETIES TRESKA AND RADIKA MARIJA MENKINOSKA, TATJANA BLAZHEVSKA, VIKTORIJA STAMATOVSKA	59
HYGIENIC SANITATION IN THE DAIRY INDUSTRY IN THE PRODUCTION OF COW CHEESE AS A FACTOR FOR OBTAINING A HYGIENICALLY CORRECT PRODUCT ACCORDING TO THE EU STANDARDS FOR STANDARDIZATION AND CERTIFICATION VANGELICA JOVANOVSKA, DIMITRA JOVANOVSKA, DARKO VELJANOVSKI, MILA ARAPCHEVSKA, KATERINA SHAMBEVSKA	60
EFFECT OF EXTENDED AGING UPON TEXTURAL ASPECTS OF TRADITIONAL BULGARIAN DRY- CURED HAM DILYANA GRADINARSKA, DANIELA MITREVA, KATYA YALKOVA-YORGOVA, DESISLAVA VLAHOVA-VANGELOVA, ACO KUZELOV	61
INFLUENCE OF THE STERILIZATION PROCESS ON THE PHYSICOCHEMICAL AND NUTRITIONAL PROPERTIES OF MEAT VEGETABLE PATE MARIA MOMCHILOVA, DILYANA GRADINARSKA, DINKO YORDANOV, TODORKA PETROVA, IVAN BAKALOV, NIKOLAY PENOV, NADEZHDA PETKOVA	62
GAS CHROMATOGRAPHY ANALYSIS OF OMEGA-3 FATTY ACIDS CONTENT IN FISH OIL SUPPLEMENTS MILA ARAPCHESKA, ZEHRA HAJRULAI – MUSLIU, RISTO UZUNOV, JOVANKA TUTESKA, VANGELICA JOVANOVSKA.....	63
RAW MILK MICROBIOLOGICAL QUALITY INFLUENCE ON PROTEIN CONTENT DRAGAN ILIEVSKI, BILJANA TRAJKOVSKA, ALEKSANDRA GROZDANOVSKA, LJUPCHE KOCHOSKI	64
NON – DESTRUCTIVE STUDY OF ACID MILK COAGULATION PETYA BOYANOVA, PETAR PANAYOTOV, ATANASKA BOSAKOVA-ARDENSKA, VLADIMIRA GANCHOVSKA	65
EVALUATION OF THE QUALITY OF RAW MILK FOR YOGURT PRODUCTION TATJANA KALEVSKA, DANIELA NIKOLOVSKA NEDELKOSKA, VIKTORIJA STAMATOVSKA, ZORA UZUNOSKA, SASKO MARTINOVSKI, VEZIRKA JANKULOSKA.....	66
QUANTITATIVE CHARACTERISTICS OF RABBIT HYBRIDS DARKO ANDRONIKOV, ACO KUZELOV, JULIJANA SAZDOVA, KIRO MOJSOV, ACO JANEVSKI, SONJA JORDEVA, SASKA GOLOMEOVA	67
CHEMICAL COMPOSITION, ANTIRADICAL AND ANTIMICROBIAL ACTIVITY OF EXTRACTS AND COLD-PRESSED EDIBLE OILS FROM MACEDONIAN NUTTY FRUITS SANJA KOSTADINOVIC VELICKOVSKA, VIOLETA DIMOVSKA, FIDANKA ILIEVA, MIHAJLOV LJUPCO, BILJANA KOVACEVIK	68
SOIL SCIENCE AND HYDROLOGY.....	69
THE CONTENT OF INORGANIC NITROGEN IN THE WATER FROM THE FIFTH CHANNEL NEAR THE CITY OF BITOLA TATJANA BLAZHEVSKA, MARIJA MENKINOSKA, VALENTINA PAVLOVA, ZORA UZUNOSKA.....	70
VITICULTURE, ENOLOGY AND FRUIT PRODUCTION	71
SELECTION AND CHARACTERISATION OF WILD YEASTS OF WINERY INTEREST FROM DOG ROSE (<i>ROSA CANINA</i> L.) DZOKO KUNGULOVSKI, NATALIJA ATANASOVA-PANCEVSKA, MARIJA TODOROVSKA- IVKOVIC, IVAN KUNGULOVSKI	72
PROCESS AND DEVICE FOR IN VIVO PREPARATION OF GRAPE /WINE/ FOODSTUFFS FROM GRAPELS GEORGE MICHEV (NO PARTICIPATION)	73
YIELD AND MINERAL COMPOSITION OF GRAPEVINE AS AFFECTED BY MAGNESIUM AND IRON FOLIAR NUTRITION HRISTINA POPOSKA, DUSKO MUKAETOV, DUSKO NEDELKOVSKI	74
INVESTIGATION OF THE CORRELATIONS BETWEEN QUANTITATIVE TRAITS WHICH DETERMINE YIELD IN THE VINE CULTIVAR BOLGAR AND THE HYBRID COMBINATION BOLGAR X RUSSALKA VENELIN ROYCHEV, DUSHKO NEDELKOVSKI	75
POTENTIAL AND POSSIBILITIES OF REBO - NEW GRAPEVINE VARIETY (<i>VITIS VINIFERA</i> L.) IN GROWING CONDITIONS IN REPUBLIC OF MACEDONIA DUSHKO NEDELKOVSKI, KLIME BELESKI, GORAN MILANOV, VENELIN ROYCHEV, VIOLETA DIMOVSKA.....	76

AGRO-BIOLOGICAL AND TECHNOLOGICAL CHARACTERISTICS OF RKATSITELI WINE GRAPE VARIETY, GROWN IN TIKVEŠ VINEYARDS KIRE PANOVSKI, VIOLETA DIMOVSKA, FIDANKA ILIEVA, DARKO MINDEV	77
VINEYARD IRRIGATION SYSTEMS CONTROLLED ONLINE THROUGH GMS MODULE EFREMCO NIKOLOV, DIMITRIJA ANGELKOV, VIOLETA DIMOVSKA, FIDANKA ILIEVA	78

AGRICULTURAL ECONOMICS

BOOK OF ABSTRACTS
SECTION: AGRICULTURAL ECONOMICS

INTEGRATING STUDIES AND ENTREPRENEURSHIP. CASE: ELOSA OSK. Annika Michelson^{1*}

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Abstract

HAMK University of Applied Sciences has carried out trials on integrating studies with entrepreneurship from 2013 to 2017. During that time there has been three student companies with share capital - AgriTeams, Coteus and Elosa OSK. The length of study is 4 years. The study companies can be established first or the second year of study in spring time. Students collect the money that is put into the company as shares when it is established. The number of students in the companies is usually larger in the beginning when establishing the company than at the end. The main challenge is to get a good leader of the company and to get all company workers to contribute the same amount of work into the company. The leader must have good financial, communication and management skills. The students either sell the company to a new study group or close down their business when ending their studies.

Key words: entrepreneurship, AgriTeams, Coteus, Elosa OSK, company leader

PERSPECTIVES AND POSSIBILITIES FOR DEVELOPMENT OF TOBACCO PRODUCTION IN THE REPUBLIC OF MACEDONIA Silvana Pasovska^{1*}, Trajko Miceski²

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Abstract

Tobacco production, with its socio-economic significance, is a source of subsistence, engagement and income for a large part of the population, as well as income from the export of the state. Over the past decade, the World Health Organization has made efforts to reduce tobacco areas through the FCTC (Framework Convention on Tobacco Control), but it succeeds only in developed EU member states, while in other parts of the world is not so, which means that production is maintained at a stable level. This Framework Convention is aimed at addressing some of the world's important issues such as: illegal tobacco and tobacco products trade, control of harmful ingredients in cigarettes and tobacco smoke, retail, wholesale and international trade. The Republic of Macedonia does not envisage measures to reduce tobacco production because of the sensitivity and socio-economic aspect, this issue has been left on after Macedonia's EU entry in the EU when tobacco production plans align with the EU rules. Tobacco production in Macedonia in the last few years is around 25,000 tons per year, whose real increase requires more human resources, which in the next period is not certain (there will be an aging of the population and the emigration of young people in the cities and abroad). Threats always exist, which are different developments on the external market, competition from neighboring countries producing oriental tobacco (Turkey, Greece and Bulgaria), as well as from some far-eastern countries. The spread of some new tobacco products that are not very dependent on tobacco production in the field, such as so-called electronic cigarettes and similar products, are also a real threat.

Key words: strategy, subsidies, price policy, production trends, sustainable development

PLACEMENT OF INFORMATION SYSTEMS IN AGRIBUSINESS Goran Mihajlovski^{1*}

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Abstract

Today, the need for timely information is essential, especially for business entities working in the field of agribusiness, which are on a constant race on the world market to prove their own quality and services they offer. Therefore, the organizational ownership of agribusiness is very important, because with good ownership and teamwork, it is possible to obtain quality use of collected information and data for the company's benefit. What is missing in terms of mode of acceptance, direction, and classification of information in agribusiness is missing of the use and presentation of information. In today's modern concept of agribusiness development, what is lacking in every company is to have a presenter who will be tasked with collecting all agribusiness information and data to classify the information and, as a priority, to make such information online on a daily basis the portal from the company. Because quality presentation with timely received information may have led to the successful operation of any business entity in the area of agribusiness economic market. The essence of this paper is to show the general functional structure, and exchange of information in agribusiness, and as such make a more competitive economic market.

Key words: information, agribusiness, development

[NO PARTICIPATION]

~~THE IMPACT OF SOCIAL MARKETING ON IMPROVING CONSUMER AWARENESS OF
THE IMPORTANCE OF SPICE IN FOOD~~ Maja Angeleska^{1*}, Kristina J. Gacoska¹
(No participation)

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Abstract

~~Today, health is at the heart of all national and international policies and development strategies. Public marketing involves the use of marketing principles and techniques in a way that would influence the target group to voluntarily accept, reject, modify or abandon behavior for the benefit of individuals, groups or society as a whole in order to improve the quality of life. By applying marketing in the realization of the vision and mission of strategies that promote health and healthy lifestyle, it contributes to a better resolution of social problems and better functioning of the society as a whole. As a result of the frequent use in the food and cosmetics industry, medicine and household, spice plants take on more and more areas in intensive agricultural production day by day, while their place in the food industry was taken long ago. Spices are flavors that are added in food to give it a suitable smell, taste, which contributes to better perception and assimilation of food. The purpose of this research is to point out the importance of social marketing to the development of people's awareness of improving nutrition and health promotion, while spices are taken as a separate group that will be explored in greater detail. Investing in one's own health is one of the primary goals that ultimately contributes to a culture of living. The use of marketing in the implementation of socially beneficial changes in the field of public health and nutrition is becoming more and more popular.~~

~~**Key words:** healthy food, marketing activities, spice plants~~

PLANT BIOTECHNOLOGY

WASTE MATERIALS DERIVED BIO-EFFECTORS USED AS GROWTH PROMOTERS FOR STRAWBERRY PLANTS. AN AGRONOMIC AND METABOLOMIC STUDY Brankica Spaseva^{1*}, Ziad Al Chami¹, Sandra Angelica De Pascali², Ivana Cavoski¹, Francesco Paolo Fanizzi²

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Abstract

Recently, a novel concept of bio-effectors has emerged to describe a group of products that are able to improve plant performance more than fertilizers. In this study, three different agro-industrial residues, i.e. brewers' spent grain (BSG), fennel processing residues (FPR) and lemon processing residues (LPR) were chosen as potential bio-effectors. A greenhouse soilless pot experiment was conducted on strawberry plants (*Fragaria x ananassa* var. *Festival*) in order to study the effect of BSG, FPR and LPR water extracts, at different concentrations, on plant growth and fruit quality. Their effect was compared with humic-like substances as a positive/reference control (Ctrl+) and with Hoagland solution as a negative control (Ctrl-). Agronomic parameters and the nutrient uptake were measured on shoots, roots and fruits. Metabolomic profiling tests were carried out on leaves, roots and fruit juices through the NMR technique. Plants treated with the FPR extract showed better vegetative growth, while plants treated with the BSG extract gave higher yield and better fruit size. Metabolomic profiling showed that fruits and roots of plants treated with FPR and LPR extracts had higher concentrations of sucrose, malate and acetate, while BSG treated plants had higher concentrations of citrate and β -glucose. In conclusion, according to the results achieved, the bio-effectors used in this study promote plant growth and fruit quality regardless of their nutritional content. In conclusion, according to the results achieved, the bio-effectors used in this study promote plant growth and fruit quality regardless of their nutritional content.

Key words: biostimulants, agro-industrial waste, nuclear Magnetic Resonance (NMR), strawberry, growth promotion, fruit quality

BOOK OF ABSTRACTS
SECTION: PLANT BIOTECHNOLOGY

GENETICALLY MODIFIED CROPS - CURRENT STATE, ISSUES AND PERSPECTIVES

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Abstract

The main aim of genetic engineering is to introduce, increase or delete certain characteristic of an organism which is achieved with gene manipulation. The first foreign gene was successfully incorporated into tobacco plant in 1983. Since, there are about 12% (179.7 million hectares) of global cropland produced genetically engineered crops in 2015 (FAO, 2015). Data for 2015 show that genetically modified varieties were commercially available for nine food crops (soybeans, maize, apple, canola, sugar beet, papaya, potato, squash and eggplant) three nonfood crops (alfalfa, cotton and poplar) and two types of flowers (carnation and rose). The most genetical engineering is done for herbicide, insect and virus resistance, as well as improvement of abiotic stress resistance, crop quality and ripening delay. Together with development and introduction of new genetically modified crops, consumers' and environmentalists' awareness about eventually their harmful consequences was growing worldwide, including the Macedonian consumers. In this paper, the current state and issues of genetically modified crops will be discussed, with a specific emphasis of environmental risk assessment of genetically modified crops for Macedonian conventional agriculture, Macedonian cases of detection of genetically modified seeds and food and Macedonian legislation of genetically modified crops.

Key words: GM crop, consumer awareness, environmentalist awareness, GM crop environmental risk assessment, GM legislation

[NO PARTICIPATION]

~~MAIN MOLECULAR MARKERS IN PLANT GENETICS – MINI REVIEW~~ Mariya Todorova
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Abstract

~~The storage of plant genetic resources is essential for the preservation of ecological balance of the planet Earth and for the life in the future generations. In this aspect, molecular markers are an important tool for identifying species, determining the level of genetic diversity, studying phylogenetic relationships and developing adequate and effective strategies to conserve genetic resources. Two types of DNA markers technologies are used in studies on plant genetic diversity: hybridization based markers and PCR based DNA markers. RFLP (Restriction Fragment Length Polymorphism) markers were first used in 1975 and are the most widely used hybridization based molecular marker to identify DNA sequence polymorphism. The various types of PCR based markers such as RAPD (Randomly Amplified Polymorphism), AFLP (Amplified fragment length polymorphism, ISSR (Inter Simple Sequence Repeats), and SSR (simple sequence repeat) are utilized by plant researchers. SNPs markers (DNA sequence based) are the most commonly employed markers for the determination of genetic diversity in various plants. Due to the fact that each technique has its own advantages and disadvantages, new techniques are constantly developed. The present review describes different molecular techniques that can be used for the evaluation of plant genetic diversity and DNA fingerprinting.~~

Key words: genetic diversity, DNA markers, RFLP, AFLP, ISSR, SSR, SNP

ASSESSMENT OF ANTIMICROBIAL AND ANTIOXIDANT ACTIVITIES OF *Nepeta nuda* PLANT EXTRACTS Detelina Petrova^{1*}, Milena Petrova², Maria Rogova¹, Miroslava Zhiponova¹, Petia Hristova², Ganka Chaneva¹

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Abstract

The antioxidant and antimicrobial activities of chloroform and methanol Soxhlet extracts from dry *N. nuda* leaves were investigated. For antimicrobial activity, seven Gram-positive and five Gram-negative bacterial strains, as well as two fungal species were tested. Crude extracts of *N. nuda* plant showed various degrees of antimicrobial activity toward microbial pathogens. The most susceptible bacterial strain was *Bacillus cereus*. The methanol extract of *N. nuda* presented the highest anti-*Enterococcus faecalis* activity (16 mm inhibition zone). All tested Gram-negative bacterial strains were completely resistant toward *N. nuda* extracts and no antifungal activity against *Candida albicans* and *Saccharomyces cerevisiae* was detected. After Soxhlet extraction procedure, the highest amount of total phenolic compounds was found in the methanolic extract, which correlated with the higher antioxidant capacity. Generally, the chloroform extract obtained from *N. nuda*, showed significantly lower phenolic content, as well as a decreased antioxidant activity.

Acknowledgement: This research is funded by Ministry of Education and Science, Republic of Bulgaria, grant D01-217/30.11.2018.

Key words: *N. nuda*, antimicrobial activity, antioxidant activity

SPECTROPHOTOMETRIC DETERMINATION OF THE CONTENT OF PHOTOSYNTHETIC PIGMENTS IN SOME DECORATIVE SPECIES GROWN IN *IN VITRO* AND *IN VIVO* CONDITIONS Ivana Velesanova^{1*}, Fidanka Trajkova¹, Liljana Koleva Gudeva¹

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Abstract

The photosynthetic activity of species ageratum *Ageratum* sp., decorative cabbage *Brassica oleracea* cv. Kyoto red given and carnation *Dianthus* sp. was determined by examining of the content of chlorophyll a, chlorophyll b, chlorophyll a+b and carotenoids. The content of photosynthetic pigments from in vivo conditions was determined in the sprouting and flowering phenophase. The pigments from in vitro conditions were examined in shoot culture, obtained from meristematic explants, after 30 and 60 days of initial explants placement on MS medium. Extraction of photosynthetic pigments was performed with 96% C₂H₅OH. Absorbance was determined on UV/VIS spectrophotometer JANWAY 6305 for chlorophyll at 665 nm, chlorophyll b at 649 nm and carotenoids at a wavelength of 470 nm. The content of photosynthetic pigments is lower in in vitro conditions. Generally, in in vivo conditions, the value of photosynthetic pigments is higher at the sprouting phenophase. The average content of chlorophyll a showed that carnations from in vitro conditions had higher value as compared to carnations from in vivo conditions, as an exception from the rule. The flowering of carnation in in vitro conditions was a proof that the photosynthetic activities began earlier in this culture, even in in vitro conditions. The content of chlorophyll b in carnation in in vitro conditions was almost the same as in in vivo conditions. The content of carotenoids in ageratum in in vivo conditions was much higher as compared to the in vitro conditions.

Key words: chlorophyll a, chlorophyll b, chlorophyll a+b, carotenoids, shoot culture

IMPROVING THE DOMINANCE OF SURFACE DUST ABSORPTION VS. BULK DEPOSITION IN MOSS TISSUE CROSS BIO-INDICATION PROCESS OF METALS DEPOSITION IN ENVIRONMENT Biljana Balabanova^{1*}, Maja Lazarova², Blazo Boev²

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Abstract

Mosses have been used for biomonitoring in a number of different ways which may lead to rather different results, and some kind of classification seems necessary at this point. *Epigeic* mosses (growing on the ground) are preferred in the regional surveys in Europe. Trace elements may be absorbed on the moss from the atmosphere either as soluble chemical species in wet deposition or contained in particles from dry deposition. Part of the trace element content of particulates may eventually be released by weathering and reabsorbed by the moss. Whereas uptake efficiencies for particulate-bound trace elements are generally poorly known, Ions may be subject to active uptake into cells or attached on the moss surface by physical and chemical forces. Methods are available to distinguish between intracellular and surface-bound fractions of elements. Main problem with issue moss-biomonitoring are reveal as: a) transport of soluble compounds from the soil into moss tissue, particularly during periods with excessive soil/water contact. Although mosses do not have a root system, influence from this source cannot be disregarded, in particular in areas with low atmospheric deposition and b) windblown mineral dust from local soil.

As far as the surface bound fraction is concerned, little is known about the binding mechanisms, but the fact that different metals show rather large differences in their retention capacity, indicates that both simple cation exchange on negative surface charges and complex formation with ligands on the moss surface are involved. Laboratory analysis using scanning electron microscopy (emission SEM, TESCAN VEGA3) has been involved for determination of the dry deposition occurred within two species (*Homalothecium lutescens* and *Homalothecium sericeum*) from the genus *Homalothecium*.

Key words: moss bio-indication, *Homalothecium lutescens*, *Homalothecium sericeum*, heavy metals, air deposition

PLANT PRODUCTION

BREEDING OF ABIOTIC STRESS IN BARLEY - PROBLEMS, ACHIEVEMENTS AND PERSPECTIVES Dragomir Valchev¹, Darina Valcheva^{1*}
(Plenary lecture)

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Abstract

The study was conducted at the Institute of Agriculture - Karnobat, Bulgaria for the period 1989 - 2019. We studied varieties and perspective barley lines. The yields, the elements of productivity and grain quality were reported. The results are statistically processed and analyzed. There have been established varieties and lines with stable yields, with high resistance to abiotic stress. New varieties of barley with high cold and dry resistance are presented. A model of barley variety resistant to abiotic stress has been developed.

Key words: barley, abiotic stress, yield, quality

A VIRTUAL PLANT PRODUCTION MANAGEMENT PLATFORM Annika Michelson^{1*}

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Abstract

In European Union farmers are required to keep field plot book-keeping with actions undertaken on each farm field plot. This has traditionally been done by keeping a written documentation. Each plot has also soil analyse results that are located in separate documents. Much informal information about the field plots has not before been in a written form, such as where are compaction problems, too much or too little water. It has also been a challenge to coordinate the work carried out at the farm as there are annually several new students involved in running the farm. We had a need for gathering up all information virtually in one place and make easy access for both teachers and farm workers to the platform. During the Nutrient and Energy Efficient Farm project a virtual plant production management platform was developed for HAMK University of Applied Sciences Mustiala educational and research farm in Finland. The farm has 184 ha cultivated land and 40 main field plots. Each field plot is divided into sub-plots so the total number of subplots is ca. 80. Wordpress blog environment was used as a documentation platform. Basic information and activities carried out at each field plot were documented by text, photos and videos. Soil analyse results were added to the platform. A drone and sensors are used in monitoring the farm plant production. The platform has open access.

Key words: field, efficiency, education, maps, drone, sensors, wordpress

USE OF SEAWEED EXTRACTS IN THE LETTUCE (*Lactuca sativa* L.) PRODUCTION José Filipe Gomes Lopes¹; Kiril Bahcevandziev^{1,2*}, Leonel Pereira³

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Abstract

The aim of this study was to test the application of different seaweed extracts in the lettuce (*Lactuca sativa* L.) production and assess its effects. An experiment with pots was done, adding three different types of seaweed extracts: *Sargassum muticum* (Phaeophyceae), *Ascophyllum nodosum* (Phaeophyceae), *Saccorhiza polyschides* (Phaeophyceae). The *Ascophyllum nodosum* seaweed extract was provided by ADP-Adubos de Portugal, S.A., while the other seaweeds were collected in the Portuguese coast, in Buarcos, Figueira da Foz. The preparation of the extracts included *Sargassum muticum* and *Saccorhiza polyschides* were prepared with water at 25° C and 80° C, to verify if the water temperature influences the extraction of the nutrients from the seaweeds. The leaf number and the plant nutrient composition were evaluated. The statistical analysis revealed significant differences between the treatments. The treatment with the *Sargassum muticum* 25° C extract led to a greater production and a higher concentration of macro-nutrients (Ca, P, F), therefore presenting higher quality and being more profitable for the producer.

Key words: plant, biofertilizer, biostimulant, biotechnology

NEW PERSPECTIVE MALE STERILE HYBRID LINES OF BURLEY TOBACCO Ilija Risteski^{1*}, Karolina Kocoska¹

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Abstract

Every tobacco growing country must have an optimum varietal structure which will include higher number of varieties with different characteristics. One of them are the varieties of Burley tobacco, which raw material participates in the composition of blend cigarettes with about 30%. Such a high share of the raw material obliges the varieties from which it was obtained to give not only good yields but also good quality, with simultaneous resistance to some economically significant diseases. In order to improve the varietal structure, new varieties should be created that will meet the newly established requirements. This motivated the breeders at the Scientific Tobacco Institute – Prilep, through intervarietal hybridization of the available genetic base (varieties, breeding lines and other starting material) and properly identified goals, to obtain new hybrid lines in male sterile form. Burley tobacco lines which were included in the comparative trials (B-206 A/15 CMS F1 and B-204/15 CMS F1), in most of the characteristics exceeded the check varieties, reaching statistical significance level of 1% and 5 %. The above lines, due to their better yields and quality, are expected to draw the attention of the domestic public and wider, which was actually the purpose of this research.

Key words: selection, tobacco, Burley, yield, price, income, chemistry

THE SIZE AND NUMBER OF MIDDLE BELT LEAVES IN SOME VARIETIES OF WILD TOBACCO Karolina Kocoska^{1*}, Ilija Risteski¹

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Abstract

In contrast to the cultivated type *N. Tabacum*, which has haploid number of chromosomes (24), wild tobacco species differ in the number of chromosomes and also in morphological properties, such as: stalk, leaf number, flowers and plant height. Some wild tobaccos species have the same number of chromosomes as the cultivated tobacco and can easily be used for crossbreeding. This should be emphasized because the most important reasons for crossing are plant resistance to diseases and inheritance of some morphological traits, e.g. higher leaf number, shorter vegetation period, etc. The trial was set up in the experimental field of the Scientific Tobacco Institute – Prilep in 2014-2015 and it included the following species: *N. Rustica*, *N. alata*, *N. longiflora*, *N. petunia hybrida*, *N. repanda*, *N. glutinosa*, *N. miarsii*, *N. undulate*. The obtained results were compared with the check variety P 12-2/1. The aim of the study was to analyze some morphological traits (length, width and number of middle belt leaves) of tobaccos grown in the region of Prilep and to compare them with the cultivated species *N. Tabacum*. The results of the study will be of benefit to tobacco breeders. Data on morphological measurements were statistically processed using the following parameters: mean error of the average (\bar{c}), standard deviation (σ) and coefficient of variation $cV\%$.

Key words: tobacco, wild species, leaves, selection

STUDY OF THE INFLUENCE OF LEAF FERTILIZER PANAMIN AGRO ON PLANT GROWTH, RESISTANCE TO BIOTIC AND ABIOTIC STRESS, PRODUCTIVITY AND QUALITY OF THE GRAIN IN WHEAT AND BARLEY Dragomir Valchev^{1*}, Darina Valcheva¹

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Abstract

Influence on leaf fertilizer Panamin Agro on plant growth, resistance to biotic and abiotic stress, productivity and quality of the grain in wheat and barley has been studied. The study was conducted from 2017-2018 year at the Institute of Agriculture - Karnobat, Bulgaria. It was found that at 100% of the nitrogen fertilization dose and 2 treatments with Panamin Agro and at 50% of the nitrogen fertilization dose and 3 treatments with Panamin Agro wheat yields increased by 23.3% and 22.2% respectively and barley by 23.4% and 25.2% respectively.

Key word: wheat, barley, fertilizing, yield and grain quality

CHEMICAL COMPOSITION OF OATS GROWN IN CONDITIONS OF ORGANIC PRODUCTION Adrijana Burovska^{1*}, Dragica Spasova¹, Biljana Atanasova¹, Dusan Spasov¹, Mite Ilievski¹

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Abstract

The research was conducted in 2015 and 2016, at 11 oats genotypes in terms of organic production. Three of the populations were domestic: Krivogashtani, Trebenishta and Kuchevishte. The rest were introduced varieties, including Rajac, Slavuj and Lovcen from Serbia and varieties: Kupa, Baranja, Explorer, Shampionka and Istra from Croatia. On average, for both years, the variety Shampionka has the highest protein content (14.80%), which indicates that the grain has a high nutritional value. There is a statistically significant difference among the examined genotypes. The percentage of fat in oats, grown organically, in both years of research is statistically different in different genotypes. On average, in both years of research, the fat content ranged from 2.31% in the population Trebenishta, up to 4.47% in the population of Krivogashtani. The variety Baranja is with the highest ash content in the grains (4.35%) in average, for the research period. In the same group a, is ranked variety Shampionka, with 4.30%. Among the genotypes there is statistically significant difference. It is characteristic that for the period 2015-2016, all examined genotypes belong to group a, that is, all varieties and populations contain high cellulose content. A statistically significant difference between varieties and populations was established. Analysis of variance for the quality of oats grain shows that the content of protein, fat and ash values are relatively constant in the years examined. The conditions in the years of research had a weaker effect on the genotype. The strength of the genotype is 65.06%, 67.06% and 72.04%, respectively. The three properties are influenced by the interaction between the genotype and the conditions of the year.

Key words: variety, population, proteins, fats, ash, cellulose

THE INFLUENCE OF ORGANIC FERTILIZERS ON THE GROWTH AND YIELD OF BROCCOLI (*Brassica oleracea* L. var. *italica*) Daniela Dimovska^{1*}, Ljupco Mihajlov¹, Fidanka Trajkova¹, Liljana Koleva Gudeva¹, Igor Iljovski²

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Abstract

The experiment was conducted in order to determine the influence of organic fertilizers on the growth dynamics and yield of broccoli grown in the open field. It used the variety Verdija F1 which was grown in Skopje region during one year (2018). The treatments were as follows: Ø control-without use of organic fertilizer, V-1 -foliar treatment with Biohumus, V-2 -foliar treatment with Orgalife, V-3 - foliar treatment with Bio - Vital, They were treated every 10 days, starting on 19.08, three times during vegetation. The following traits were to examine dynamics of growth and yield. According to the results obtained it can be established that by the use of organic fertilizer Orgalife the considerable higher yield on the central flower gave the treatment V-2 (6.98 t/ha) in comparison to control treatment (5.41 t/ha). Statistically significant differences, at the level of 0.05 with the LSD test, were obtained between V-2 and control. The results obtained for the average height of the plants during the three treatments showed that there are highly statistically significant differences at the level of 0.01 between V-2 (55.6 cm) and control. According to the results obtained, it can be concluded that the V-2 has given the best results in both the increment of the plant and the yield obtained.

Key words: broccoli, organic fertilizer, yield, growth dynamics

SPECIFICS OF SYMBIOTIC NITROGEN FIXATION IN LEGUMINOUS PLANTS - WITH A VIEW OF CHICKPEA (*Cicer arietinum* L.) Monika Gligorova^{1*}, Ljupco Mihajlov¹

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Abstract

Nitrogen is a limiting nutrient for plant growth. Leguminous plants have an ability to use nitrogen from the air and it is the best-known benefit of them. In reality, plants do not receive nitrogen from the air, but from *Rhizobium* bacteria that live in the form of nodules on the plant roots. Nitrogen fixation is an important process in maintaining the life of planet Earth, because it enables the transfer of inert gases nitrogen (N₂) into an ammonium ion (NH₄⁺), which increases the amount of mineral nitrogen in the soil. *Rhizobia*, once inoculated in the soil, may remain low in the absence of a suitable host. A plant begins symbiosis with secretion of flavonoids, which are detected by bacteria. Flavonoids vary in different plant species and they are recognized only by specific bacterial species. Chickpea (*Cicer arietinum* L.) is a leguminous plant that is used in human diet and has great agro-technical significance. Typically for the chickpea, as well as other legumes, is that it comes into symbiosis with nitrogen-fixing bacteria and thus can receive atmospheric nitrogen. In this paper the results of soil agrochemical analysis of our experiment, the difference between nitrogen content in the soil samples at the beginning and at the end of the vegetation are presented. The initial nitrogen content values were 1.50 mg/g, while at the end of the vegetation 1.80 mg/g.

Key words: symbiosis, inoculation, nodules, soil

COMPARATIVE STUDY OF HYDROPONICALLY AND AQUAPONICALLY CULTIVATED PLANT SPECIES Alexander Tomov^{1*}, Detelina Petrova¹, Aneliya Raicheva¹, Ganka Chaneva¹

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Abstract

Comparative study between hydroponically and aquaponically grown plants - *Pisum sativum* L., *Zea mays* L. and *Lactuca sativa* L. was performed. The highest growth rates of maize (*Zea mays* L.) were recorded in the aquaponic system, whereas in pea plants (*Pisum sativum* L.) the best growth was observed in the hydroponic system. The aquaponic and hydroponic cultivation of lettuce (*Lactuca sativa* L.) had the same beneficial effect on its growth. The chlorophyll and carotenoid content in the leaves of *P. sativum* and *L. sativa* was highest in hydroponic cultivation but in *Z. mays* maximum pigment content is recorded in the aquaponic system. The amount of reducing sugars in maize and lettuce increased during the aquaponic cultivation. In maize and lettuce, the activity of antioxidant enzymes – superoxide dismutase, catalase and guaiacol peroxidase, was increased, thereby stabilizing their antioxidant status and favoring their growth. In general, the three species responded differently to the aquaponic method of cultivation. Trying to find the benefits of aquaponics, we found that it is actually a species-specific method, depending on the plant species, fish species and cultivating conditions.

Key words: hydroponics, aquaponics, oxidative stress

ASSESSMENT OF AGRO-MORPHOLOGICAL VARIABILITY IN RICE BY MULTIVARIATE ANALYSIS Verica Ilieva^{1*}, Natalija Markova Ruzdik¹, Ljupco Mihajlov¹, Mite Ilievski¹

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Abstract

The present work was carried out to assess the agro-morphological variability in fourteen rice varieties using principal component analysis, linear correlation and cluster analysis. A principal component analysis was utilized to examine the variation and to estimate the relative contribution of traits for total variability. All tested Italian varieties were grown in 2014 and 2015 under agro-ecological conditions in the Republic of Macedonia. Three components in the PCA analysis with Eigenvalues > 1 contributed 75.59% variability existing in the rice varieties for yield contributing traits. In this study, PC1 accounted for 30.81% of the total variability, contributed by traits like 1 000 grain weight, panicle length, a weight of grains per panicle and plant height. PC2 had the contribution from the traits like the number of plants per m², plant height and panicle length which accounted for 25.08% of the total variation. Grain yield and panicle length had contributed 19.71% of the total variation in PC3. Only Ulisse and San Andrea showed positive values among all three main components. Grain yield showed a significant positive correlation with the number of plants per m² (r= 0.185). On the other side, the number of plants per m² was in negative correlation with the weight of grains per panicle (r= -0.593). A negative correlation was also established between the number of grains per panicle and 1 000 grain weight (r= -0.752). Using cluster analysis, two main cluster groups with subgroups were extracted. Thus, the results revealed genetic variability exists in the studied varieties and can help breeders to achieve higher yield in rice.

Key words: *Oryza sativa* L., principal component analysis, cluster analysis, linear correlation

ARSENIC UPTAKE AND TRANSLOCATION IN SOYBEAN PLANTS IN NEUTRAL SOIL ENVIRONMENT Ljupco Mihajlov¹, Biljana Kovacevik^{2*}, Natalija Markova Ruzdik¹, Vesna Zajkova Paneva³

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Arsenic is a highly toxic metalloid that is classified as a non-threshold class-1 carcinogen. The enhance of knowledge about the plant cultivars that avoid the transport of As in its edible plant parts is of great importance. The goal of this study was to investigate the ability of soybean to take up arsenic from contaminated soil and translocate it in to the plant parts in order to make an assessment of its potential risk for human and animal health. The experiment was performed in a controlled environment in pots. Two types of naturally polluted soils with pH 6.9 and different other chemical and mechanical properties were collected from the Zletovo mining area. Soil and plant samples were digested and analyzed by ICP-MS. The geoaccumulation index reveals moderately to high contamination of investigated soils with As. The assessment of bioaccumulation in plant tissues was determined by calculating the bioaccumulation (BAF) and the biotranslocation factor (BTF). The results showed that soybean possesses low ability to take up As from soil and act as an excluder, accumulating it mostly in the roots followed by the leaves and shoots. Arsenic content in the pod and seed was found to be under the limit of detection (<0.1 mg/kg) in all cultivars indicating that soybean grown in As polluted soils does not possess risk for human and animal health and that the chemical and mechanical composition of the soil does not have influence on its bioaccumulation when it comes to the neutral type of soil.

Key words: heavy metal, bioaccumulation, biotranslocation, soil properties, excluder

[NO PARTICIPATION]

~~IMPACT OF SOME HERBICIDES AND HERBICIDE COMBINATIONS ON SOWING CHARACTERISTICS OF CORIANDER (*Coriandrum sativum* L.)~~ Grozi Delchev^{1*}
(No participation)

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Abstract

~~The research was conducted during 2013 – 2015. Under investigation was Bulgarian coriander cultivar Lozen 1 (*Coriandrum sativum* L.). Factor A included no treated control, 6 soil-applied herbicides – Tender EC, Silba SC, Sharpen 33 EC, Merlin flex 480 SC, Smerch 24 EC, Raft 400 SC and 5 foliar-applied herbicides – Kalin flo, Eclipse 70 DWG, Sultan 500 SC, Corrida 75 DWG, Lontrel 300 EC. Factor B included no treated control and 1 antigraminaceous herbicide – Tiger platinum 5 EC. Soil-applied herbicides were treated during the period after sowing before emergence. Foliar-applied herbicides were treated during rosette stage of the coriander. Herbicides Merlin flex and Lontrel and herbicide combinations Merlin flex + Tiger platinum and Lontrel + Tiger platinum proven decrease germination energy of the coriander seeds. Laboratory seed germination and lengths of primary germ and primary root are decreased by herbicide Merlin flex and herbicide combination Merlin flex + Tiger platinum only. Herbicide Merlin flex and herbicide combination Merlin flex + Tiger platinum do not proven decrease waste grain quantities. High yields of coriander seeds are obtained by foliar treatment with antigraminaceous herbicide Tiger platinum after soil-applied herbicides Raft, Smerch, Sharpen, Silba and Tender. Tank mixtures of Tiger platinum with foliar herbicides Kalin flo, Eclipse, Sultan, Corrida and Lontrel also lead to obtaining of high seed yields. The use of the soil-applied herbicide Merlin flex does not increase the seed yield, due to its higher phytotoxicity against coriander. Alone use of soil-applied or foliar-applied herbicides leads to lower yields due to they must to combine for full control of weeds in coriander crops.~~

~~Key words: coriander, herbicides, herbicide combinations, seed yield, sowing characteristics~~

PLANT PROTECTION

FIRST REPORT OF HEALTH CONDITION OF POTATO SAMPLES FROM BORDER CROSSINGS IN THE REPUBLIC OF NORTH MACEDONIA Maja Petrusheva^{1*}, Sasa Mitrev², Emilija Arsov²

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Abstract

Surveys relate to performing health examinations from import, as well as taking samples at the border crossings (entry place), in the Republic of North Macedonia for the period from 2014 to 2017, in seed and mercantile potatoes, were examined. Phytopathogenic bacteria, fungi, viruses, nematodes, and various types of insects can cause potato diseases. In order to ensure good protection measurement from all harmful organisms, a good knowledge of the conditions of occurrence of harmful organisms, their biology, the manner of their transmission, knowledge of the conditions of the occurrence of the infection and its development, as well as the symptoms and the damages caused in plants. The tests are in accordance with the monitoring programme for seeds and mercantile potatoes, and they refer to prove the presence or absence of the following harmful organisms:

- bacterial wilt and brown root of potato – *Ralstonia solanacearum*
- potato crab – *Synchytrium endobioticum* perc.
- ring root of potatoes – *Clavibacter michiganensis* subsp. *sepedonicum*
- cystolic nematodes of *Globodera pallida* (Stone) Behrens and *Globodera rostochiensis* (Wollenweber) Behrens in potatoes.

Individually, per years as well as the total for all years of the research 2014, 2015, 2016 and 2017 at the border crossing Tabanovce were the largest number of performed health visual inspections as well as laboratory-analyzed samples. The largest import of mercantile potato was made in 2014 - 3,044,758 t, and at least in 2017 - 110,267 t. The largest import of seeds material is imported in 2017 - 7,386,041t, while at least imported in 2016 - 842,005 t. In the period from 2014 to 2017, about 50% more seed potatoes were imported (10,723,672 t). For the period from 2014 to 2017, the annual import averages around 2.680.918 t of seed potatoes and 1.368.619 t of mercantile potatoes.

Key words: potato, harmful organisms, imports, border crossings

**THE IMPACT OF CLIMATE CHANGE ON SHIFT OF PREDOMINANT RUST PATHOGENS
IN SERBIA** Radivoje Jevtić¹*, Vesna Župunski¹, Mirjana Lalošević¹

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Abstract

The impact of climate change on wheat production has become a global problem. It has been reported that temperature increase of 1°C results in decrease of wheat yields by 6%. Moreover, changes in climatic element patterns can cause changes in pathways of distribution and predominance of economically important pathogens. Nowadays, pest control is challenging and many efforts have been made in determining damage thresholds and developing mathematical models for forecasting wheat disease incidence and yield losses. Knowing that occurrence of wheat diseases is a result of the combined effects of biotic and abiotic factors, the main objective in this study was to analyze the most dominant factors that influence outbreak and disease index of yellow rust in agro-ecological conditions of Serbia. The most influencing factors on obligate parasites occurrence were analyzed using regression models with biotic together with abiotic factors as predictors. The data were analyzed in respect to 2006-2013 and 2014-2017 periods since the shift of predominant rust pathogens occurred in 2014. The most influencing factors on yellow rust occurrence in the period 2014-2017 were: powdery mildew index ($P=0.007$), total rainfall in January ($P=0.061$), temperature in January ($P<0.001$) and temperature in February ($P<0.001$). These predictors gave the model for yellow rust occurrence with coefficient of determination (R^2) of 80.1% and coefficient of prediction (R^2_{pred}) of 72.2%. The results of this study pointed out that the influencing predictor variables for plant disease occurrence should not be analyzed separately, but as a complex of biotic and abiotic environmental factors.

Key words: wheat, climate change, rusts

THE USE OF PREDATORS FOR THE CONTROL OF *Frankliniella occidentalis* (Thysanoptera: Thripidae) FOR PEPPER IN PROTECTED AREA Dusan Spasov^{1*}, Biljana Atanasova¹, Dragica Spasova¹, Mite Ilievski¹

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Abstract

Although chemical pesticides play a vital role in controlling the number of harmful insects, they also contribute to accelerated pollution of soil, air and water. Due to the frequent use, insects become resistant to active ingredients very quickly, they destroy the natural enemies of the pests, and have a harmful effect on humans. It is a method of controlling pests such as insects, mites, weeds and plant diseases using other organisms. It relies on predation, parasitism, herbivory, or other natural mechanisms. Accordingly, the application of biological protection, that is, the use of living organisms (predators and parasites) in plant protection programmes in protected areas, takes on a larger scale worldwide rather than the use of chemical pesticides. The aim of our research was determining the effectiveness of predatory mite *Amblyseius swirskii* (Mesostigmata: Phytoseiidae) and predatory bug *Orius laevigatus* (Hemiptera: Anthocoridae) on reducing the population of Western flower thrips (*Frankliniella occidentalis*). Experiment was set in greenhouses in Strumica region, in three localities (Prosenikovo, Banica, Dabile), during 2018, in a commercial pepper production. The results obtained correspond to our expectation in controlling the population of the trips. Predators proved to be effective in reducing the number of thrips population.

Key words: pepper, Western flower thrips, *Amblyseius swirskii*, *Orius laevigatus*

***Paenibacillus alvei* DZ-3 WITH HIGH ANTIFUNGAL ACTIVITY PROTECTS APPLE FRUITS AGAINST *Botrytis cinerea* GRAY MOLD** Natalija Atanasova-Pancevska^{1*}, Dzoko Kungulovski¹, Violeta Boskovska¹, Ivan Kungulovski²

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Abstract

Agriculture is the main source of food for humans. However, agricultural practices are threatened by various abiotic and biotic stresses, which require more resources exploitation to avoid decreased productivity. Among these challenges, phytopathogens are responsible for 10 and 20% of yield losses in both developed and underdeveloped countries respectively, where fungi like *Botrytis* spp., *Aspergillus* spp., *Mucor* spp., *Fusarium* spp., *Thielaviopsis* spp., *Verticillium* spp., *Ustilago* spp., *Rhizoctonia* spp. and *Puccinia* spp. are in the first line of implication. *Botrytis cinerea* is a fungus that causes gray mold on many fruit crops. Despite the availability of a large number of botryticides, the chemical control of gray mold has been hindered by the emergence of resistant strains. In the last few years, a new ecofriendly and cost-effective approach continuing to use beneficial soil bacteria to control plant pathogens. This kind of microorganism is referred to as Plant Growth Promoting Bacteria (PGPBR). PGPBR can affect plant growth by providing elementary elements essential for plant growth, producing secondary metabolites like phytohormones, antibiotics, biologically active compounds etc., and suppressing or decreasing phytopathogens via competition. In this work, the bacterial isolate *Paenibacillus alvei* DZ-3 was tested for its ability to inhibit mycelial growth and spores germination *in vitro* and *in vivo* to demonstrate the antagonistic efficiency against *Botrytis cinerea* affecting apple fruits.

Key words: antagonistic efficiency, fungicides, apple fruits

ONE STEP REAL-TIME POLYMERASE CHAIN REACTION USING FOR THE DETECTION OF PLUM POX POTYVIRUS Cvetanka Kulukovska^{1*}, Emilija Arsov², Sasa Mitrev²

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Abstract

Plant viruses are group of pathogens that cause important loses in different fruit production and they have great economic importance. They are obligate parasite forms and for their replication they used plant cells. One of the most important virus on the fruit is *Prunus* species, and the one that causes great economic losses is *Plum pox virus* (PPV), causal agent of Sharka disease. *Plum pox potyvirus* (PPV) is a filamentous virus that can be a part of phloem tissue in fruit-production species of *Prunus*, including apricots, peaches and plums. Since its discovery, Sharka has been considered as a calamity in plum orchards. In highly susceptible plum varieties presented in Macedonia, such as Požegača and Stenlej, PPV causes a premature fruit drop and reduces fruit quality, which leads to total yield loss. The same symptoms and loses are obviously in the peach and cherry garden. Eight PPV strains (PPV-M, PPV-D, PPV-EA, PPV-C, PPV-Rec, PPV-W, PPV-T and PPV-CR) have been recognized so far. Three major strains (PPV-M, PPV-D and PPV-Rec) are the most widely dispersed and occur frequently in many European countries. Other strains are of minor importance due to their limited host preferences or geographic distribution. In our research, plum hosts from several variety of plums were included in laboratory test analyses, such as plant parts (phloem, buds, flowers, leaves and fruits) and parts of them in different periods of the year (spring, summer and winter period 2017/18). The presence or absence of symptoms were considered for comparison. DAS-ELISA and Real Time PCR molecular techniques are included to confirm the presence and concentration of PPV in different plant material (leaves, stem, flower and fruit). By usage of DAS-ELISA tests, and a universal set of antibodies (BIOREBA), has proved the presence of virus of plum pox in all examined samples, especially from samples collected in spring, and in winter and early spring season, the virus status is on lower level. Testing found high concentrations of viral antigens in plant samples (OD 1.485 - 1.556, for 30 min). Results analysis from One step Real Time RT-PCR, show specific product for PPV that generate specific FAM-labeled amplification curve, and the Ct of the amplification curve is lower to 35 for positive samples. Total number of 10 DAS-ELISA positive samples (plum leaves), were confirmed with Real Time PCR with amplification curve with Ct≤35.

Key words: *Plum pox virus*; Sharka disease; DAS-ELISA, RT-PCR, PPV-M and PPV-D

PHYTOPLASMA INFECTION CAUSES PHYSIOLOGICAL CHANGES IN SYSTEMIC PEPPER LEAVES Miroslava Zhiponova¹, Galina Ivanova², Emilija Arsov^{2*}, Detelina Petrova¹, Sasa Mitrev², Ganka Chaneva¹

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Abstract

Phytoplasmas are group of phytopathogens that are commonly transmitted by insects and reside in the phloem causing reduction of yield and good quality. Stolbur phytoplasma is associated with diseases of hundreds of plant species including pepper, tomato and potato from *Solanaceae* family, with great economic importance. Recent multilocus genetic analyses on leaves collected from pepper plants from localities on the territory of the Republic of North Macedonia, confirmed stolbur infection accompanied with decreased chlorophyll content and increased carotenoids level. Leaves of two pepper varieties from different localities were investigated - sweet red pepper, variety Kurtovska kapija *Capsicum annum* var. *annuum*, (Strumica region), and *Capsicum annum* var. *cerasiforme* (Kocani region). As a continuation of this research, in the present study asymptomatic leaves (without chlorosis) from the same plants were collected and analysed for systemic response in respect to pigment content, reducing sugars level and antioxidant parameters. Leaves from uninfected control plant from both pepper varieties, were compared with asymptomatic leaves from stolbur affected plants. In contrast to the control, the asymptomatic leaves proved to be with increased pigment content. On the other hand, their reducing sugars level were strongly reduced. The same negative tendency was observed for the total antioxidant activity and total quantity of phenolics, while the flavonoids content was more variable. The obtained data demonstrate correlation between the stolbur infection and inhibited plant physiological state with putative role of carotenoids rather than phenolics in the defence response. The analysed parameters can be applied in combination with the genetical approach for fast screening of phytoplasma infection and its impact on the plant development.

Key word: pigments, reducing sugars, phenolics, flavonoids, antioxidant activity

GLOBAL WARMING AND INCREASED INFLUX OF PESTS ON TOBACCO Vesna Krsteska^{1*},
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Abstract

Global warming causes increased influx of pests on tobacco. *Dociostaurus maroccanus*, *Phthorimaea operculella*, *Dolycoris baccarum*, *Eurydema ornata*, *Nezara viridula* are cosmopolitan and highly adaptable species. They attack many crops and weeds. During 2016/2017 pest occurrence on 100 tobacco plants/decade, in 4 replications was investigated. Climate conditions in 2016/2017 were favourable for pests' increased occurrence. *P. operculella*, *D. baccarum* and *N. viridula*, were identified in all development stadiums on tobacco and *D. maroccanus*, *E. ornata* only as an adult. *D. maroccanus* damages tobacco leaves and makes irregular holes. In 2016/2017, the Moroccan locust was found in increased number (379 and 316, respectively), compared to its usual occurrence. Most numerous populations were recorded in: August- 2016 and July- 2017. *P. operculella* larvae create tunnels in tobacco leaf, feed on parenchyma, leaving only the epidermis. During the investigations, 886 damaged stalks by potato tuber-moth in 2016 and 1059 stalks in 2017 were found. In 2016/2017 the population reached its maximum in July. The species of Pentatomidae family suck the sap of tobacco plants and leaves are pierced and deformed. In 2016, on tobacco plants were found 627 samples of *D. baccarum*, 282 adults of *E. ornata* and 19 samples of *N. viridula*. In 2017 bigger population: 1044 samples of hairy-hield-bug, 489 samples of red-cabbage-bug and 65 samples of southern green-stink-bug were observed. In September, the biggest quantitative representation of the investigated pentatomids in both years was registered. Those harmful species can produce high economic losses on tobacco. They can be controlled by using IPM strategies.

Key words: *D. maroccanus*, *P. operculella*, *D. baccarum*, *E. ornata*, *N. viridula*, quantitative representation

PHENOTYPIC AND PATHOGENIC CHARACTERIZATION OF *COLLETOTRICHUM* SPP. ASSOCIATED WITH BITTER ROT ON APPLE FRUITS IN POST-HARVEST STORAGE

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Abstract

Postharvest diseases are major problem in long storage of apple (*Malus pumila* Mill.) worldwide. Among them, bitter rot caused by *Colletotrichum* spp. complex (*C. gleosporioides* and *C. accutatum*) is one of the prevalent. The pathogen affects the fruit pre-harvest in orchards and/or post-harvest in storage, resulting in considerable economic losses. Advanced symptoms of bitter rot and anthracnose canker, with dark - brown to black fruiting bodies called acervuli, were visible on stored apple fruits grown in the region of Berovo, Republic of Macedonia. Acervuli bear abundant one-celled fusiform macroconidia. Two groups of fungal isolates were obtained using standard laboratory procedure on PDA medium. The first group formed white mycelium that become smoke-grey with the time forming black aggregated conidiomata. The second group formed white areal mycelium with orange-pink colour on the reverse side with orange-pink conidiomata that appear black on the reverse side. One-celled elliptic to fusiform macroconidia are observed on PDA medium. Microconidia were not observed. The pathogenicity of the isolates was tested by wound inoculation of healthy 'Idared' apple fruit. After ten days, post-inoculation lesions up to 2-3 cm in diameter were developed on inoculated fruit while the control remained healthy. Acervuli was also developed in the rotted areas of inoculated fruits. Biological and morphological characterization of isolates was performed *in vitro*. The isolates were preliminary identified based on the morphology, temperature of growth and sensitivity of pesticides. Due to the overlapping morphological characters, species delimitation based on morphology alone is hardly possible in the genus of *Colletotrichum*. Multilocus sequence analyses combined with a polyphasic approach is generally suggested for species differentiation.

Keywords: post harvest disease, apple, anthracnose, acervuli

[NO PARTICIPATION]

~~EFFICACY OF SOME HERBICIDES AND HERBICIDE TANK MIXTURES IN DURUM WHEAT (*TRITICUM DURUM* DESF.)~~ Crozi Delchev^{1*}
(No participation)

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Abstract

~~The research was conducted during 2015–2017. Bulgarian durum wheat cultivar Elbrus (*Triticum durum* Desf.) was under investigation. Factor A included untreated control and 4 antigraminaceous herbicides—Axial 050 EC, Topic 080 EC, Traxos 045 EC and Scorpio super 7.5 EB. Factor B included untreated control and 4 antibroadleaved herbicides—Biathlon 4 D, Lintur 70 WG, Granstar super 50 SG and Secator OD. All of antigraminaceous herbicides, antibroadleaved herbicides and their tank mixtures were treated in tillering stage of the durum wheat. Self-sown plants of Clearfield canola in durum wheat crops are successfully controlled by herbicide Biathlon only. Self-sown plants of Clearfield and ExpressSun sunflower are controlled by herbicides Biathlon, Lintour and Secator. Self-sown plants of coriander are controlled by herbicides Lintur, Granstar super and Secator. Self-sown plants of milk thistle are controlled by herbicides Lintur and Secator. There is synergism in herbicide Traxos and very good efficacy against *Bromus arvensis* L. There is antagonism in herbicide tank mixture Scorpio super + Lintur and decreasing of the efficacy against *Galium aparine* L., *Chamomilla recutita* Rauchert, *Myagrum perfoliatum* L., *Cirsium arvense* Scop. and *Apera spica-venti* P.B. For complete control of all weeds and self-sown plants in durum wheat crops, two herbicides should be combined—both antigraminaceous and antibroadleaved.~~

Key words: durum wheat, weeds, self-sown plants, herbicides, herbicide tank mixtures, efficacy, selectivity

QUALITY CONTROL AND FOOD SAFETY

INFLUENCE OF DEEP AUTOLYSIS ON THE QUALITY AND SHELF LIFE OF MEAT Stefan G. Dragoev^{1*}
(Plenary lecture)

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Abstract

The aim of this paper was to make a critical review of the Influence of deep autolysis on the quality and shelf life of meat. The nature of the process of deep autolysis of meat was firstly commented. Some factors stimulating the meat deep autolysis development were discussed. The main role of relationship between deep autolysis process and the meat spoilage was shown. Practical guidelines for the processors about utilization of meat in a state of deep autolysis were made.

Key words: deep autolysis, meat, deterioration, discoloration, warm over flavour, drip loss, spoilage

THE INFLUENCE OF DIFFERENT CONCENTRATIONS OF PLANT ESSENTIAL OILS ON GROWTH AND REPRODUCTION OF *Salmonella enteritidis* Jasmina Stojiljkovic¹, Metodija Trajchev², Milena Petrovska³, Dimitar Nakov^{2*}

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Abstract

Plant essential oils have been reported to possess antimicrobial properties and therefore have potential usage as natural antimicrobials of food. The aim of the study was to examine the antimicrobial effect of sweet basil and thyme essential oils against growth and reproduction of *Salmonella enteritidis* reference test strain ATCC 13076 and food isolated *Salmonella enteritidis* - epidemic strain (group D) cultivated on plate. Therefore, the samples were prepared as a dip application from different concentrations of sweet basil and thyme essential oils (1; 2.5 and 5%) with initial concentration of bacteria from 10⁹ CFU/mL and were cultivated on plate. The control samples were prepared as dip application of bacteria without added essential oils. All samples were exposed at 37°C and 46°C. The growth of *Salmonella enteritidis* reference test strain ATCC 13076 and *Salmonella enteritidis* - epidemic strain was observed only in the control samples without added sweet basil and thyme essential oils. There wasn't any growth of *Salmonella enteritidis* in the samples dipped in the 1; 2.5 and 5% sweet basil and thyme essential oils. The results from the ANOVA indicate that the utilized essential oils in combination with temperature regime was significantly ($p < 0.001$) reduced the Log₁₀ concentration (enumeration) of the booth strains of *Salmonella enteritidis*. These results support the possibility of using sweet basil and thyme essential oil as natural preservatives in food to contribute in the reduction of *Salmonella enteritidis* at acceptable levels in view to prevent the risk for consumers.

Key words: *Salmonella*, sweet basil, thyme

THE EFFECT OF DIFFERENT STARTER CULTURES ON QUALITY AND SENSORY CHARACTERISTICS ON KASHKAVAL CHEESE Gordana Dimitrovska^{1*}, Marija Petkovska¹, Ljupce Koshoski¹, Elena Joshevska¹, Katerina Bojkovska¹

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Abstract

The kashkaval cheese is a traditional milk product and has a significant place in the milk industry of the Republic of North Macedonia. In this research the influence of three different starter cultures of three variants of kashkaval cheese (A, B, C) has been examined on the quality and sensory characteristics of kashkaval cheese. The starter cultures that were used in variant A (TCC 4 - Chr. Hansen) contained the following bacteria strains: *Str. thermophilus* Lb. *bulgaricus*, the variant B (SH 092 E – Sacco cleriei): *Str. thermophilus*, Lb. *bulgaricus* and Lb. *helveticus* and the variant C (TREDMIX): *Str. thermophilus*, Lb. *bulgaricus*, *Str. lactis* and Lb. *helveticus*. The contents of main components during ripening and storage of cheese were monitored. The impact of the above mentioned three different starter cultures was determined during the process of ripening of the kashkaval.

Key words: milk, kashkaval cheese, ripening, quality

ANALYTICAL CHALLENGES IN CHEMICAL CHARACTERIZATION OF MEDICINAL AND AROMATIC PLANTS Biljana Balabanova^{1*}

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Abstract

Metallic ions play an important role in the metabolism of the living organisms and are the integral components of plants. The safe use of medical and aromatic plants requires the absence of toxic heavy metals in the products. However, the toxic and heavy metals may be present in the plant products due to environmental contamination during production, harvesting and processing of the plant for manufacturing of the plant product. The World Health Organization (WHO) has thus established maximum concentration limits for these elements in order to ensure the safe use of herbs. Therefore, it is important to determine the current metal levels in herbs and their parts used for medical and nutritional applications in order to determine any potential contamination. These concentrations are in the trace and ultra-trace range; thus analytical experience is needed for appropriate sample preparation, subsequent measurement by a suitable method and finally the evaluation and interpretation of the data obtained. In this investigation, possible sample preparation methods as well as analytical methods suitable for the given analytical task were summarized. Based on the sample matrix, the metals to be determined and their expected concentration range, and the sample preparation method as well as the subsequent analytical instrument have to be carefully chosen, optimized and validated.

Key words: herbs, aromatic plants, ICP-MS, microwave digestion method, toxic metals, essential elements

NUTRITIVE AND SENSORY CHARACTERISTICS OF FERMENTED CUCUMBER Valentina Pavlova^{1*}, Gordana Šebek², Tatjana Blazhevaska¹, Ljubica Kostadinova¹

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Abstract

The basic technological patterns for the different ways of conserving the gherkins (*Cucumis sativus* L.) from the greenhouses of MGS Trans-Gevgelija have been presented in this paper. Sensory changes occurring when canning cucumber, nutritional value and health benefits from consuming fermented vegetables have been discussed. The nutritive value of fresh and pasteurized samples of the variety Satina for the 2017 season has been determined. The results obtained showed that the nutritive and sensory characteristics of fermented gherkins depend on the method of preparation and preservation. During the processing, the gherkins lose their part, or receive part of their nutritional properties depending on how they have been processed. Fermented gherkins have a greater nutritional value, because with the fermentation themselves products like vitamins B, vitamin C, lactic acid and the like are created. If they are not treated further, they are a good source of probiotics because they contain lactic acid bacteria. Excessive eating of fermented gherkins is harmful primarily because of the high content of salt in them that increases blood pressure. This harmful effect can be reduced if in vegetables instead of sodium salt, potassium salt is added, which may again give metallic taste to the product.

Key words: vegetables, fermented food, health benefits

BOOK OF ABSTRACTS
SECTION: QUALITY CONTROL AND FOOD SAFETY

APPLICABLE GUIDELINES OF THE EXISTING RULES FOR LABELLING FOOD PRODUCTS Julijana Sazdova^{1*}, Goran Antonievski¹, Dejan Metodijeski², Aco Kuzelov³

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Abstract

This paper is intended for consumers to check how careful they are when purchasing certain food products, whether food operators comply with guidelines on how to provide food information to consumers in a transparent manner and in accordance with national legal rules. It should be emphasized that this paper serves merely to provide consumer data on whether food operators supply proper and unified information to consumers.

Key words: information, list of ingredients, nutritional properties, shelf life

CONSUMER PREFERENCES AS DETERMINANT OF THE SUCCESSFUL QUALITY MANAGEMENT OF DAIRY PRODUCTS Katerina Bojkovska^{1*}, Nikolche Jankulovski¹, Goran Mihajlovski¹, Elena Joshevska¹, Gordana Dimitrovska¹

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Abstract

The strategic goal of managing the quality of milk is a premium product with a high level of internal and external quality characteristics. In order to succeed, the most of the activities in the management process should focus on those quality features that are recognizable for the average consumer of milk. For this purpose, an indicative survey of a sample of 1,137 respondents from the young population was conducted. The results show that young consumers from the internal quality characteristics mostly value the taste and quantity of milk fats in the category 2.8% -3.2%, while from the external quality characteristics they value the price and origin of the product or the origin of the milk. The origin of the milk is not fully utilized in the promotional efforts of the producers in its promotion, especially in the sub-segment of urban young consumers, which would clearly differentiate the producers, but they would also have a competitive advantage on the domestic and international market.

Key words: consumer preferences, market, quality, quality management, milk

[NO PARTICIPATION]

~~APPLICATION OF SPICES IN THE DAIRY INDUSTRY~~ Kristina J. Gacoska^{1*}, Maja Angeleska¹

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Abstract

~~Spices are products of plant origin, which give them a distinctive taste and smell to the foodstuffs, thereby improving digestion. Spices contain various aromatic substances: essential oils, aldehydes, glycosides, esters, resins, oils and more. Spices are used in the food industry throughout the technological process, as well as households, every day, in order to achieve certain sensory properties of food. Because they are added in small quantities, they lack that they have no nutritional meaning, but it can be said that they are added exclusively to improve the taste and smell of food. According to the definition, the spices are individual parts of higher plants or whole plants, mainly of tropical areas that, due to the content of essential oils, alkaloids, glycosides and other aromatic compounds cause a certain taste and smell. Because they are added in small quantities, they have a disadvantage, and this is their low nutritional value, but it can therefore be said that they are added exclusively to improve the taste and smell of food. Certain spicy plants also have healing properties and with their action can improve the work of the stomach, intestines and liver. Through an adequate selection of foods and a particular type of spices, a person can influence the improvement of his overall physiological state. The use of spices in the dairy industry is of great importance for the human being, because milk and dairy products are the basis for everyday nutrition.~~

~~Key words: healthy foods, spice plants, dairy products~~

SENSORY EVALUATION OF PROBIOTIC YOGHURT INOCULATED WITH DIFFERENT STARTER CULTURES Ismaili Muhhareem^{1*}, Makarijoski Borsche¹, Presilski Stefche¹, Trajchevski Sasho²

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Abstract

Today's consumer choice is mostly based on products that provide health benefits, such as probiotic yoghurt. The consumer does not tolerate consistency defects, poor firmness or gel viscosity, and also its acid taste, so our goal was to make comparison between different probiotic yoghurts (different starter cultures) and to choose the one that is most suitable for consumer use, product that has the best consumer acceptance. Starter cultures that were used in production process were with the following commercial names: ABT-2, ABT-6 and ABT-10 consisting of *S. thermophilus*, *L. acidophilus* and *B. bifidus*. The sensory evaluations showed that the sample C was most preferred by panellists.

Key words: probiotic yoghurt, evaluation, starter cultures

STARTER CULTURES EFFECT ON pH AND SH DYNAMICS OF INOCULUM DURING FERMENTATION PERIOD OF PROBIOTIC YOGHURT Ismaili Muhhareem^{1*}, Makarijoski Borche¹, Presilski Stefche¹, Trajchevski Sasho²

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Abstract

Fermented dairy products are produced by fermentation process of lactose by using microorganisms especially lactic acid bacteria. Probiotics are living microorganisms, which when ingested in sufficient amounts, beneficially influence the health of the host by improving the composition of intestinal microflora. Nowadays, the popularity of these products is growing, not only because of their organoleptic properties, but also because of their nutritional value and health benefits. Probiotic yogurt is a dairy product obtained by milk fermentation process, by adding a probiotic starter culture. The goal of this survey was to follow the pH and SH values of inoculum during fermentation period of probiotic yogurt manufactured with three different starter cultures, which are with the following commercial names: ABT-6, ABT-750 and ABT-10 consisting of *Streptococcus thermophilus*, *Lactobacillus acidophilus* and *Bifidobacterium bifidus*.

Key words: yoghurt, inoculum, active acidity, titrable acidity, fermentation

STABILITY OF OIL FROM OILSEED RAPE WITH GARLIC UNDER VARIOUS CONDITIONS Hristina Eftinzijoska¹, Gorica Pavlovska^{1*}

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Abstract

Rapeseed oil is obtained by cold pressing of rape seeds. It is performed at low temperature and therefore all valuable components were maintained, which give it great biological value. At high temperature, light, oxygen and heavy metals, oils oxidize and harmful oxidation products, peroxides are created. Rapeseed oils "Fila" were analyzed, in which the garlic was added to increase their stability. The peroxide number of this oil was determined under different conditions which involved change in the volume of the oil in the bottle, the light and the time of storage. One and two weeks after storing the oil in the dark, the only oil which was not for use was the one with volume of 250 mL and its peroxide number was 7.87. Three and four weeks later, the oils of 250 and 500 mL had a peroxide number greater than 7.5 or had peroxides more than the permissible. All oils kept in the light had higher peroxide numbers compared to oils kept in dark, under the same conditions. All analyzed oils after 3 and 4 weeks on the light, have peroxides more than the permitted according to the Oils Rules and fats and oils quality. The light and time of storage are proportional, while the volume of the oil is inversely proportional to the peroxide number.

Key words: cold pressed oil, peroxide number, analysis, oil volume

EVALUATION OF BACTERICIDAL ACTIVITY OF SELECTED WILD MACROFUNGI EXTRACTS AGAINST *Escherichia coli* Daniela Nikolovska Nedelkoska^{1*}, Tatjana Kalevska¹, Natalija Atanasova-Pancevska², Mitko Karadelev², Zora Uzunoska¹, Dzoko Kungulovski²

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Abstract

The increasing failure of chemotherapeutics and antibiotic resistance exhibited by pathogenic microorganisms has led to the evaluating of novel sources for their antimicrobial potential. Nature is a generous source of compounds with antimicrobial activity. However, a large number of natural products with the potential to act as antimicrobials still await further investigation. In this study, antimicrobial activities of the extracts from four wild mushrooms: *Amanita echinocephala*, *Russula medulata*, *Ishnoderma benzoinum* and *Laetiporus sulphureus* were evaluated against Gram-negative bacterium *Escherichia coli*. The antimicrobial potential of the methanolic mushroom extracts was investigated by the microdilution method. Mild inhibitory activity was observed in 3 out of 4 mushroom species included in the study. The extracts were further tested for bactericidal activity and minimum bactericidal concentration (MBC) values were determined. The tested microorganism was most sensitive to the examined extracts of *Laetiporus sulphureus* (MBC=62.5 mg/mL). Even though the results revealed in this study may suggest that tested wild macrofungi extracts possess mild antimicrobial activity, their antimicrobial potential against other microorganisms need to be further elucidated.

Key words: mushroom, antimicrobial activity, microdilution method, minimum bactericidal concentration (MBC)

COMPARISON OF THE RHEOLOGICAL CHARACTERISTICS OF BIO-FORTIFIED FLOUR OBTAINED FROM SOFT WHEAT VARIETIES TRESKA AND RADIKA Marija Menkinoska^{1*}, Tatjana Blazhevska¹, Viktorija Stamatovska¹

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Abstract

The dough rheology is very important for the prediction of the final bakery product quality such as mixing behavior, sheeting and baking performance, and based on starch gelatinization data the overall cooking behavior and product properties can be determined. The aim of this research was to examine the impact of agronomic bio-fortification on the rheological properties of dough. In this research are included 7 samples obtained by adding high quality chelate fertilizers at different stages of wheat growth: Fe soil (1), Fe soil + foliar (2), Fe foliar (3), Control (4), Zn soil (5), Zn soil + foliar (6) and Zn foliar (7). From farinograph data for water absorption it is concluded that all variants for variety Treska and Radika have approximate values with minimal differences compared with variant 4. According to the data obtained for the level of softness, it is concluded that all variants for both varieties of dough are with medium quality. According to the qualitative number, all variants of both varieties belong to quality group B₂, with the exception of variant 2 for the variety Treska and variant 5 for the variety Radika which belongs to the quality group C₁. From the farinograph analysis it can be concluded that bio-fortification did not have a significant effect on the technological quality of the flour. Extensographic analysis showed that for variety Radika from variants 1, 2 and 7 were obtained flour with higher extensibility, resistance and energy in comparison with the variety Treska.

Key words: dough, farinograph, extensigraph

HYGIENIC SANITATION IN THE DAIRY INDUSTRY IN THE PRODUCTION OF COW CHEESE AS A FACTOR FOR OBTAINING A HYGIENICALLY CORRECT PRODUCT ACCORDING TO THE EU STANDARDS FOR STANDARDIZATION AND CERTIFICATION

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Abstract

The subject of the analysis is the production equipment, human resources and the produced finished product - cow cheese, in which different procedures for sanitation are used due to the application of various technologies at work. Studies have shown that hygienic sanitation gives satisfactory results. The responsibility and positive influence of the employees has been confirmed. The results of the examined bacteriological correctness of the equipment showed a greater and better effect when performing the machine compared to the manual cleaning. From the analysis of the key parameters in the CIP (Clean-In-Place) system, it was found that the shorter duration of cleaning is correlated with faster flow and higher temperature and concentration of assets. From the recirculating agents, the base and the acid, more clouding occurs in the base material. Finally, from the examined bacteriological correctness of the finished product, cheese, it has been confirmed that the product is completely hygienically straight and healthy for consumption. Hygienic sanitation in the dairy industry is the most critical operation in the milk processing processes and is of great importance for obtaining a quality, healthy and hygienically straightforward finished product.

Key words: CIP (Clean-In-Place) system, cheese production equipment, human resources, finished product

EFFECT OF EXTENDED AGING UPON TEXTURAL ASPECTS OF TRADITIONAL BULGARIAN DRY-CURED HAM Dilyana Gradinarska^{1*}, Daniela Mitreva¹, Katya Yalkova-Yorgova¹, Desislava Vlahova-Vangelova¹, Aco Kuzelov²

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Abstract

The objective of this study was to determine the effect of prolong ripening and drying on quality aspects of traditional Bulgarian dry cured ham. After 8, 18 and 36 months of aging comparative textural profiling of dry cured ham were performed. Ham sensory profile as well as physico-chemical, morphological characteristics, proteolysis index and Warner-Bratzler shear force of were investigated. Excessive aging up to 36 months of dry-cured ham lead to high hardness and lower sensory values. Hams of longer ripening and drying had statistically significant increased proteolysis index and lower values of WBSF. Morphological analysis revealed statistically significant qualitative and quantitative differences between sample groups. Thus, miofibrillar fragments increased remarkably in samples with higher proteolysis index scores. In addition, longest aging hams showed increased degradation for a total myofibrillar structure. Warner-Bratzler shear force (WBS) had a significant relationship with the sensory variables, such as softness, chewiness, and rate of breakdown.

Key words: meat product, excessive ripening, texture, morphological changes, Warner-Bratzler Shear Force, proteolytic index

INFLUENCE OF THE STERILIZATION PROCESS ON THE PHYSICOCHEMICAL AND NUTRITIONAL PROPERTIES OF MEAT VEGETABLE PATE

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Abstract

The aim of this research was to investigate possibility of meat vegetable sterilized pate production with reduced fat content and functional ingredient supplementation, as well as to evaluate thermal effect on physicochemical and lipid content of the final products. In the study, ten experimental groups of poultry pate were produced with different level and type of fat substitution with inulin and lentil powder. Residual quantity of fructans were examined to evaluate the thermal effect on functional ingredients. Analysis upon changes in lipid fraction was performed in order to determine appropriated thermal effect in different pate content. The pate from sample 4 and 6 in which the amount of recipe fat was reduced and partially substituted with inulin or lentil had most acceptable nutritional characteristic.

Key words: canned meat, pate, inulin, lentil, sterilization effect

GAS CHROMATOGRAPHY ANALYSIS OF OMEGA-3 FATTY ACIDS CONTENT IN FISH OIL SUPPLEMENTS Mila Arapcheska^{1*}, Zehra Hajrulai – Musliu², Risto Uzunov², Jovanka Tuteska³, Vangelica Jovanovska¹

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Abstract

Fish oils are excellence source of omega-3 polyunsaturated fatty acids. Two main bioactive components responsible for health benefits of fish oil are omega-3 fatty acids: eicosapentaenoic (EPA) and docosahexaenoic (DHA), which are essential for humans as cannot be synthesized by the human body. They have been shown to lower risks of cardiovascular disease and reduce inflammation. Fish oil dietary supplements are widely available at various health food stores and pharmacies. The main objective of this study was to analyze omega-3 fatty acids content in encapsulated fish oil dietary supplements present at local market. Samples of four commercial types of encapsulated fish oil products sold on the local market were analysed by gas chromatography (GC-FID). The content of their eicosapentanoic acid (EPA) and docosahexaenoic (DHA) content was examined. The obtained values for EPA and DHA content in analyzed samples were lower than product declared values ranging from 6.06% to 10% for EPA and from 0.45% to 8% for DHA. These results indicate that the label claims for EPA and DHA for analyzed encapsulated fish oil products are presented with reasonable accuracy.

Key words: eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), GC-FID

RAW MILK MICROBIOLOGICAL QUALITY INFLUENCE ON PROTEIN CONTENT Dragan Ilievski^{1*}, Biljana Trajkovska², Aleksandra Grozdanovska¹, Ljupche Kochoski²

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Abstract

Increased somatic cell count and total plate count in milk are often associated with mastitis in dairy cows. Alterations appearing in milk with increased somatic cell count are mainly addressed to increased pH value, the unfavourable ratio of casein fractions, changes in coagulation capability of milk, reduced yield and cheese quality. Casein is participating with approx. 80% of the total milk protein, which makes it one of the most important parts of the protein content. Numerous parameters impact raw milk selection for cheese production, but the most important is still casein. Together with raw milk microbiological quality (total plate count and somatic cell count) varies also casein content. During the research, a large number of raw milk samples with different quality was analysed. The aim of the research was to determine the impact of total plate count and somatic cell count, depending on the season, on changes in raw milk physical-chemical characteristics, with special attention on casein. Raw milk samples were tested with LactoScope FTIR Advanced (Delta Instruments). The results obtained, indicate a significant connection between raw milk microbiological quality and total casein content. Raw milk microbiological quality when obtained from healthy dairy animals depends mostly on farm conditions and GHP, but also on raw milk manipulation until processing. From the results obtained, we can conclude that raw milk microbiological quality is one of the most important indicators for milk selection during the production process.

Key words: casein, somatic cells, cheese

BOOK OF ABSTRACTS
SECTION: QUALITY CONTROL AND FOOD SAFETY

NON – DESTRUCTIVE STUDY OF ACID MILK COAGULATION Petya Boyanova^{1*}, Petar Panayotov¹, Atanaska Bosakova-Ardenska², Vladimira Gančovska²

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Abstract

The acid coagulation is the main processing step in the yoghurt production and has a great impact on yogurt texture, microstructure and rheology, contributing to the overall sensory and visual product perception by the consumer. The objective of this paper was to study the different stages of acid gel formation by turbidimetric and conductivimetric methods. The non-destructive methods used allow the differentiation of three regions: latent phase (pH = 6,3 ÷ 6,0), exponential phase (pH = 5,9 ÷ 5,4) and phase of protein structure formation of demineralized casein micelles (pH = 5,3 ÷ 4,6). The mathematical model obtained by the three-parameter sigmoid function can be used in future studies to predict the change in conductivity during acid coagulation.

Key words: yoghurt, conductivity, coagulation

BOOK OF ABSTRACTS
SECTION: QUALITY CONTROL AND FOOD SAFETY

EVALUATION OF THE QUALITY OF RAW MILK FOR YOGURT PRODUCTION Tatjana Kalevska^{1*}, Daniela Nikolovska Nedelkoska¹, Viktorija Stamatovska¹, Zora Uzunoska¹, Sasko Martinovski¹, Vezirka Jankuloska¹

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Abstract

Yogurt is one of the most popular fermented products. From a nutritious aspect yogurt is very similar to the milk from which it was made, partly changed, with certain therapeutic effects linked with the starter cultures added in the production process. The research includes the examination and presentation of results for the physical-chemical composition, the inhibitory substances and the hygienic quality of the raw milk for yogurt production, the technology, the physical-chemical composition and the microbiological quality of the yogurt. According to the results obtained from the research, the milk fat content amounts to 3.78%, proteins 3.23%, lactose 4.68%, and dry matter 12.76%. The average number of somatic cells in the milk is 248.400/ml, and the total number of bacteria is 199.000/ml. No antibiotics had been detected in the milk, and the content of aflatoxins is 0.010µg/kg. The average value of the acidity and pH of the milk are 6.79^oSH and 6.68 respectively. The microbiological quality of the produced yogurt is in accordance with the requirements of the Regulations for the special requirements for the microbiological criteria of food.

Key words: quality, row milk, yogurt

QUANTITATIVE CHARACTERISTICS OF RABBIT HYBRIDS Darko Andronikov^{1*}, Aco Kuzelov², Julijana Sazdova³, Kiro Mojsov¹, Aco Janevski¹, Sonja Jordeva¹, Saska Golomeova¹

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Abstract

As a material for this research we used hybrids of crossed individuals of the so-called Flemish giant rabbit and New Zealand white rabbits (group ON), who fed *ad libitum* with industrially pelleted food. The study included six rabbits, three male and three female. The defined live weight of 1800 to 2500g of the rabbits was achieved in 77 days, after which the rabbits were slaughtered. The paper presents the results of the research on fattening and slaughtering properties, as well as determining the utilization of rabbit meat. The average live weight of male rabbits was 2792 g, and randman was 47.92%, while for female rabbits the average live weight was 2695g and randman was 48.61%. The average share of the back of the carcass in male/female rabbits was 28.02% and 27.34%, on the dorsal part was 20.93% and 22.65%, while on the front of the carcass was 25.26% and 25.39%.

Key words: rabbit, hybrids, live weight

CHEMICAL COMPOSITION, ANTIRADICAL AND ANTIMICROBIAL ACTIVITY OF EXTRACTS AND COLD-PRESSED EDIBLE OILS FROM MACEDONIAN NUTTY FRUITS

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Abstract

The chemical composition, antiradical and antimicrobial activity of cold-pressed edible oils from nutty fruits (almond and walnut) and oils from poppy seed and wheat germ from North Macedonia were studied. Regarding the fatty acid composition, the highest level of oleic acid was determined in almond oil ($67.6 \pm 0.02\%$) whereas poppy seed oil was the richest sources of linoleic acid with abundance of $72.3 \pm 0.06\%$. The highest level of α -tocopherol (23.8 ± 0.01 mg/100 g of oil) was quantified in almond oil while γ -tocopherol was the most abundant in walnut and wheat germ oil. Wheat germ oil was the richest source of phytosterols (3894 ± 155.0 mg/kg) with domination of β -sitosterol and campesterol. Although DPPH radical is less sensitive against phenolic compounds in comparison to ABTS radical, its relationship with tocopherols and tocotrienols was indicative. Poppy seed oil had the lowest level of tocopherols, but it indicated the highest antibacterial activity against *Listeria monocytogenes* and antifungal activity against *Candida albicans*.

Key words: extracts, nutty fruits, antiradical activity, antimicrobial activity

SOIL SCIENCE AND HYDROLOGY

THE CONTENT OF INORGANIC NITROGEN IN THE WATER FROM THE FIFTH CHANNEL NEAR THE CITY OF BITOLA Tatjana Blazhevsk^{1*}, Marija Menkinoska¹, Valentina Pavlova¹, Zora Uzunoska¹

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Abstract

Water plays an important role in everyday life. Therefore, the subject of the analysis was the water along the upstream of the fifth channel MM1, MM2, MM3, which is located in the city of Bitola and the Crna River - MM4 where the channel inflows into the river. The survey was conducted in May and November. The following chemical parameters were made: the content of ammonia and nitrites in the water was determined spectrophotometric, pH value with a pedometer, determination of nitrates with UV pastel, the consumption of potassium permanganate was determined by boiling in acidic environment and titration according to Kubel-Tiemann. From the obtained results, it can be concluded that the largest ammonia load (2,2mg / L) is in the measuring point MM3, while the same values where the channel inflows in Crna Reka in MM4 are reduced. One of the recommendations is the implementation of treatment for wastewater treatment before being discharged into the rivers.

Key words: wastewater, communal water, pollution, environment

VITICULTURE, ENOLOGY AND FRUIT PRODUCTION

SELECTION AND CHARACTERISATION OF WILD YEASTS OF WINERY INTEREST FROM DOG ROSE (*Rosa canina* L.) Dzoko Kungulovski^{1*}, Natalija Atanasova-Pancevska¹, Marija Todorovska-Ivkovic², Ivan Kungulovski²

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Abstract

Rosa canina, commonly known as the dog rose, is a variable climbing, wild rose species native to Europe, northwest Africa, and western Asia. The plant is high in certain antioxidants. Wild starter cultures for wine production need to be selected in order to produce quality and unique wine. The study aims to isolate the *Saccharomyces* yeasts on the surface of various dog rose were surveyed to obtain yeast strains suitable for fermenting a novel, highly specific, domestic wine with unique enological characteristics.

The yeasts were isolated from dog rose juice. From the samples collected, 34 putative yeast strains were isolated based on their colony morphology and microscopic observations. Among them, 10 isolates that grew on YPD agar plates containing 40% dextrose were selected. A diversity of 3 yeast strains with tolerance to high alcohol and osmotic pressure was isolated. Among the isolates studied, 100% showed to be resistant to osmotic stress with sucrose, 3 yeast strains showed alcohol tolerance, 13 yeast strain grown at temperature of 37°C. 23 yeast strains of isolates showed to be resistant to 150 mg/L SO₂. All isolates produce high amount of CO₂. This study has shown that wild yeasts isolated from dog rose have highly potential in production of authentic, regional-specific wines as well as organic, natural wines and wines with lower alcohol concentration. These isolates could contribute for the improvement of the wine quality and also could be used to create an identity for the wine produced in local regions.

Key words: dog rose, wild yeasts, authentic wines

[NO PARTICIPATION]

~~PROCESS AND DEVICE FOR *IN VIVO* PREPARATION OF GRAPE /WINE/ FOODSTUFFS
FROM GRAPES~~ George Michev^{†*}

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Abstract

~~The invention relates to a process for *in vivo* preparation of grape foodstuffs and a device for its application which allow for the process of alcoholic fermentation of variable kinetics to occur in the juice of a wine. The process includes the girdling of wines in the phase of 10–12 days after overblowing of catkins and in the beginning of the grape skin coloration, implanting a device in the girdling spot which plays the role of a micro-fermenter and carrying an immobilized dry oenologically active pure yeast culture. The device consists of two, one or ½ semi-cylindrical modules, each of them having internal and external walls, longitudinally interconnected with narrow walls and transversely with a silicone membrane with micro-return valves on the side of the entrance section of the module and a macro-porous permeable membrane on the side of the exit section of the module, which form a space for inserting the immobilized oenologically active pure yeast culture. The continuation of the module in its section above the membrane with micro-return valves transforms into a hollow entrance section for attachment to the phloem tissue on the side of the leaves, and the continuation of the module in its section under the macro-porous permeable membrane transforms into a hollow exit section for attachment of the device to the phloem tissue on the side of the cluster. Different ways of application of the process and the device, as provided for by the invention, give the possibility to synthesize the planned quantities of alcohol, carbohydrates and biologically active substances, depositing in the grape berries which respectively turns them into grape foodstuffs, including wines, with planned qualities, applicable in the rational and dietetic nutrition.~~

~~**Key words:** alcoholic fermentation, micro-fermenter, pure yeast culture, implanting~~

YIELD AND MINERAL COMPOSITION OF GRAPEVINE AS AFFECTED BY MAGNESIUM AND IRON FOLIAR NUTRITION Hristina Poposka^{1*}, Dusko Mukaetov¹, Dusko Nedelkovski¹

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Abstract

The aim of this study was to evaluate foliar fertilizers (Magni mag helat and Magni fer helat) effects on yield, quality parameters and nutrient contents of the leaves of vine cultivar Cardinal in comparison to control variant (without foliar fertilizer). Yield, berry and leaf samples were collected in three consecutive years (2012-2014) in “Tikvesko” vine area, Republic of Macedonia. Field trials has been organised according the method of random block system with three variants (including control variant - I) in three repetitions. The foliar fertilizers were applied in concentration of 0.5 %, four times during the vegetation period (before and after blooming, buckshot berries and veraison). Pooled data for 3 years indicated that Mg and Fe fertilizers application affected the yield of grape and its quality. Fertilized Variant III had higher average yield with 14.87 t/ha. A substantial influence of foliar fertilizers on analysed element contents in leaves has been proven. Results from leaf tissue showed that foliar fertilizer treatments increased N, P, K, Ca, Mn and Cu, but decreased Zn content. The 3-years average content of macro and micro elements showed significantly higher content of P (0.35 %) and Ca (3.03 %) and insignificantly higher content of N (2.25 %), Mn (133.24 ppm) and Cu (18.18 ppm), at Variant II.

Key words: berries, cardinal, element, fertilization, quality

INVESTIGATION OF THE CORRELATIONS BETWEEN QUANTITATIVE TRAITS WHICH DETERMINE YIELD IN THE VINE CULTIVAR Bolgar AND THE HYBRID COMBINATION Bolgar x Russalka Venelin Roychev¹, Dushko Nedelkovski^{2*}

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Abstract

The correlations between quantitative traits, which determine yield in the vine cultivar Bolgar and F₁ progeny of the hybrid combination Bolgar x Russalka 1, have been investigated through Path-analysis. It has been found that there are no traits, highly significant for the formation of yield from this cultivar, for which the correlation coefficients, direct and total indirect influences have positive values. Positive correlations have been reported between the two parent cultivars and F₁ progeny for the traits: shoot and fruiting shoot fertility coefficient, cluster width, total number of shoots, fruiting shoots and clusters. All studied fertility coefficients in the cultivar Bolgar exert positive direct influences, determined by moderate correlations, on the seedlings from F₁ progeny. The correlations of the other traits and the influence of separate parent cultivars have positive or negative values, which can be used in the selection of valuable elite forms.

Key words: quantitative traits, yield, seeded and seedless vine cultivar, F₁ progeny, correlations, direct and indirect influences, Path-analysis

POTENTIAL AND POSSIBILITIES OF REBO - NEW GRAPEVINE VARIETY (*Vitis vinifera* L.) IN GROWING CONDITIONS IN REPUBLIC OF MACEDONIA Dushko Nedelkovski^{1*}, Klime Beleski¹, Goran Milanov¹, Venelin Roychev², Violeta Dimovska³

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Abstract

Rebo (Rigotti 107-3) is a vine variety that originates from Trentino, north Italy. It was selected by the researcher Rebo Rigotti by crossing the varieties Merlot x Terloredo at the agriculture and forest experimental station in S. Michele all' Adige. According to the literature the idea of the breeder was to produce new variety that would be similar to Merlot but more resistant to cold climate conditions. Our idea to plant Rebo in North Macedonia was to grow this variety on sites with higher altitude locations that are difficult for growing Merlot. The vineyard for this study is located in the north part of Macedonia on the mountain German near the town of Kriva Palanka, area typical for growing frost resistant varieties. In this research paper we analyzed the mechanical structure of the grape cluster and berries, the quantity of sugar and titratable acids in the grapes. In the wine we analyzed the quantity of total phenols, total anthocyanins, wine colour (Cl;H), total flavanols.

Key words: Rebo, Rigotti 107-3, cold resistance

AGRO-BIOLOGICAL AND TECHNOLOGICAL CHARACTERISTICS OF RKATSITELI WINE GRAPE VARIETY, GROWN IN TIKVEŠ VINEYARDS Kire Panovski^{1*}, Violeta Dimovska¹, Fidanka Ilieva¹, Darko Mindev¹

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Abstract

Research is being performed to the Rkatsiteli wine grape variety. The vineyards are sited on the Smilica-Tikveš vineyards. Plantation is started in 1996 with standard plantation material, 2.4 m planting distance between rows, and 1.2 m distance between vines in a row. The training system is Guyot two arms, with 20 eyelets leaving the vine. Some optimal agro-technical and ampelo-technical measures are applied. During the research period the following items were included: phenophases on development, fruiting of buds, weight of cluster (g), chemical composition of grape must (sugar, total acid, pH), and chemical analysis of wine. On the basis of obtained results we can conclude that the variety Rkatsiteli belongs to the group of native varieties (coefficient of fertility 1.10) with 235 g average weight of cluster. The must grape contains 223 g/L sugar and 6.4 g/L total acids. The wine is a medium content of alcohol (12.33% vol) and low content of reducing sugar (1.7 g/L), which is due to selective grape harvesting and the way of vinification (winemaking).

Key words: Rkatsiteli, grape, wine, chemical composition

VINEYARD IRRIGATION SYSTEMS CONTROLLED ONLINE THROUGH GMS MODULE

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Abstract

In this paper we show how solar energy is used by farmers in the Republic of North Macedonia for irrigation and remote management using a GSM module. Over the last three decades, a number of advanced process controls have been installed in production plants. The need for upgrading these systems over an Internet network provides opportunities for design and analysis of remote-controlled systems with immense stability and reliability. In the last two decades, web-based systems in real time play an important role in the production of a quality product in our case raw grapes. This paper is a solution that allows us to obtain quality and remote-controlled equipment for low-cost equipment with the purpose of activating and disabling the pumps powered by solar energy and serving to irrigate vineyards. Use existing available technologies that are free to use and in combination with the new solutions from this paper, a managed system is run that will work seamlessly with mechanisms through which all errors will be annulled. Several systems that offer cheap solutions that will meet the requirements of the growers are considered in the Republic of North Macedonia.

Key words: grape production, remote management, irrigation systems

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ISBN 978-608-244-619-6