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2ND EUROPEAN SYMPOSIUM ON PHYTOCHEMICALS IN MEDICINE AND FOOD
3RD - 6TH JUNE 2024, SARAJEVO, BOSNIA AND HERZEGOVINA

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The abstracts underwent a streamlined submission process, wherein authors retained full responsibility for both the content and the language therein.

2nd EUROPEAN SYMPOSIUM ON Phytochemicals in Medicine and Food

AGENDA: DAY 1 (3rd June) - VENUE: HOTEL HOLIDAY

12.00 – 18.00 Registration/Poster set-up/Registration for the field trip and payment

14:00 – 14:15 Conference opening

Erna Karalija & Anja Haverić

Jianbo Xiao: Introduce IADNS

14:15 – 16:00 Bioactive compounds and human health

CHAIRS: Mohamed A. Farag, Jianbo Xiao

14:15 – 14:45 PL1: Cholesterol-lowering nutraceuticals and functional foods in prevention of heart diseases

Zhen-Yu Chen - *Food & Nutritional Sciences Programme, School of Life Sciences, The Chinese University of Hong Kong, Shatin, NT, Hong Kong, China*

14:45 – 15:15 PL2: The effects of dietary bioactive compounds on breast cancer

Maurizio Battino, *Polytechnic University of Marche, Italy*

15:15 – 15:40 IL1: the anti-psoriatic potential of natural compounds: focus on phenylethanoids

Milen I. Georgiev, *Bulgarian Academy of Sciences, Bulgaria*

15:40 – 16:00 OL1: Marine green algae-derived oligosaccharides and their potential pharmaceutical applications

Chao Zhao, *College of Marine Sciences, Fujian Agricultural and Forestry University*

16:00 – 16:30 Coffee break/Poster viewing

16:30 – 18:25 Bioactive compounds and human health

CHAIRS: Zhen-Yu Chen, Saida Ibragić

16:30 – 17:00 PL3: Plant extracts and their bioactive compounds against gastrointestinal discomfort

Maria Daglia, *University of Naples Federico II, Italy*

17:00 – 17:25 IL2: Strategies for promoting the bioaccessibility/bioavailability of polyphenols in plant-based foods

Esra Çapanoğlu*, Istanbul Technical University, Turkey*

17:25 – 17:45 OL2: The role of phytochemicals in the prevention of DNA damage

Nurşen Başaran, *Başkent University, Faculty of Pharmacy, Department of Pharmaceutical Toxicology, Ankara, Türkiye*

17:45 – 18:05 OL3: A flavonoid-rich extract of *Citrus bergamia* juice induces terminal differentiation in an *in vitro* model of acute myeloid leukaemia

Caterina Russo, *University of Messina, Italy*

18:05 – 18:25 OL4: Strategies to manipulate emission of volatile organic compounds

Pan Liao, *Department of Biology, Hong Kong Baptist University, Hong Kong, China*

19:00 – 20:00 Welcome cocktail and snacks (Hotel Holiday)

2nd EUROPEAN SYMPOSIUM ON
Phytochemicals in Medicine and Food

AGENDA: DAY 2 (04th June) - VENUE: HOTEL HOLIDAY

9:30– 16:00 Bioactive compounds and human health
CHAIRS: Maria Daglia, Chao Zhao

09:30 – 09:55 IL3: Antioxidant and antiproliferative activity of plant bioactive compounds during *in vitro* simulated digestion in the presence of food matrix
***Jelena Samardžić*,** Institute of Molecular Genetics and Genetic Engineering, University of Belgrade, Serbia

09:55 – 10:15 OL5: Beneficial effects of antioxidant phytochemicals in diabetes mellitus
Ahmet Başaran, *Başkent University, Faculty of Pharmacy, Ankara, Türkiye*

10:15 – 10:35 OL6: MAPKs and NF-κB inhibition are involved in the neuroprotective effects of a cinnamon/curcumin/turmeric spice blend in an in vitro model of Alzheimer's disease"
***Alessandro Maugeri*,** *University of Messina, Italy*

10:35 – 10:55 OL7: role of STP-60a in delaying senescence and signalling pathways regulating longevity in the nematode hidradenitis elegans
Weihong Lu *- School of Medicine and Health, Harbin Institute of Technology, Harbin; National and Local Joint Engineering Laboratory for Synthesis, Transformation and Separation of Extreme Environmental Nutrients, Harbin, China*

10:55 – 11:30 Coffee break/Poster viewing

11:30 -13:10 Farm to fork
CHAIRS: Maurizio Battino, *Jelena Popović-Djordjević*

11:30 -12:00 PL4: Seed priming as a sustainable approach for climate-smart crops
Vasileios Fotopoulos, *Cyprus University of Technology, Cyprus*

12:00 - 12:25 IL4: A bite for the healthy Planet - a bottom line for a climate-friendly society!
Aleksandra Nikolić, *Faculty of Agriculture and Food Science, University of Sarajevo*

12:25 – 12:50 IL 5: *A*roma profile and sensory characteristics of vermouth
Jelena Popović-Djordjević, *University of Belgrade, Faculty of Agriculture, Serbia*

12:50 – 13:10 OL8: Wiley's Food Science Journals and the Open Access Landscape
***Yanli Gao*,** *Senior Publisher, Wiley*

13:10 – 14:30 – Lunch

14:30 -16:50 Farm to fork & Analytical methods and biotechnology in phytomedicine
CHAIRS: Milen I. Georgiev, Aleksandra Nikolić

14:30- 14:55 OL9: Celery soluble dietary fibre antagonize flavonoids ameliorative effect on dextran-sodium-sulfate-induced colitis in mice
Hui Wang, *Guangdong Ocean University, China*

AGENDA: DAY 2 (04th June) - VENUE: HOTEL HOLIDAY - CONTINUATION

14:55 – 15:20 IL7: *Threats and opportunities of cannabis*
Petr Tarkowski, *Centre of the Region Haná for Biotechnological and Agricultural Research, Department of Genetic Resources for Vegetables, Medicinal and Special Plants, Crop Research Institute, Olomouc, Czech Republic/ Czech Advanced Technology and Research Institute, Palacky University, Czech Republic*

15:20 – 15:40 IL8: An overview of hyphenated mass spectrometry techniques implemented in crop quality assessment
Sanja Ćavar Zeljković, *Centre of the Region Haná for Biotechnological and Agricultural Research, Department of Genetic Resources for Vegetables, Medicinal and Special Plants, Crop Research Institute, Olomouc, Czech Republic/ Czech Advanced Technology and Research Institute, Palacky University, Czech Republic*

15:40-16:00 **OL10: Exploring the Mechanisms of Action of Active Constituents in Schisandrae Fructus for the Management of Diabetic Cardiomyopathy**
Dr. Jihang Chen*, School of Medicine, The Chinese University of Hong Kong, Shenzhen, China*

16:00 -16:30 –GROUP PHOTO/Poster viewing – voting

16:30 – 18:00 Workshop Metabolomics
Advanced MS-based metabolomics applications in medicine & pharmacy
Mohamed A. Farag, Cairo University, Department of Pharmacognosy

20:00 GALA DINER (Registration needed – ask at registration desk)

2nd EUROPEAN SYMPOSIUM ON
Phytochemicals in Medicine and Food

05.06. DAY 3
VENUE: Faculty of Science

11:00 -12:30 Natural resources of bioactive compounds (Erna Karalija)

11:00 -11:25 IL10*: New insights into ginkgo biflavonoids a century after their initial discovery*
***Dunja Šamec**, University North, Croatia*

11:25 – 11:50 IL11: Unveiling nature's allies: invasive plants as sources of phytopharmaceuticals
Danijela Pohulja*, *Institute of Agriculture and Tourism, Poreč, Croatia

Short talks - Competition
CHAIR: Esra Çapanoğl

11:50 – 121:00 SL1: *Marija Nazlić -, University of Split, Croatia*
12:00 – 12:10 SL2: *Dženeta Fazlić - University of Sarajevo, Bosnia and Herzegovina*
12:10 – 12:20 SL3: *Elena Rafailovska - Ss. Cyril and Methodius University; R. North Macedonia*
12:20 – 12:30 SL4: *Iva, Jurčević Šangut, University North, Croatia*
12:30 – 12:40 SL5: *Ivana Vrca - University of Split, Croatia*
12:40 – 12:50 SL6*: Miriam Negussu – university of Florence, Italy*

12:50 -14:00 Natural resources of bioactive compounds
CHAIRS: Dunja Šamec; Sanja Ćavar Zeljković

12:50 -13:15 OL10: *Polygonatum sibiricum* saponin-lactic acid bacteria combination attenuate hyperglycemia in T2DM mice by modulating amino acid metabolism
***Yihong Bao -** College of life science, Northeast Forestry University, Harbin; Key Laboratory of Forest Food Resources Utilization of Heilongjiang Province, Harbin, China*

13:15 – 13: 40 - OL11: Formation of nitrogenous flavonoid derivatives by reacting with amino acids in DMEM medium
***Jianbo Xiao**, University of Vigo, Spain*

13:40 – 14:00 – Closing remarks – Announcement of winners for Poster and short talk competition

14:00 – 15:30 – Networking and light lunch

15:30 – Walking tour (Starting from the venue -Faculty of Science) (please register at registration desk)

06.06. DAY 4 – FIELD TRIP
VENUE: Natural Museum of Sarajevo (across the street from hotel Holiday)

8:00 -8:15 Gathering of participants

Mostar visit (UNESCO heritage – old bridge)

Buna Spring visit (the biggest freshwater spring in Europe)

Return to Sarajevo in late evening (approx. 20.00h)

POSTERS

Poster presentation

PP01 **GADZOVSKA SIMIC SONJA** (*Institute of Biology, Faculty of Natural Sciences and Mathematics, University "Ss. Cyril and Methodius" in Skopje, 1000 Skopje, Republic of North Macedonia):* PRODUCTION OF PHENOLIC COMPOUNDS AND ANTIOXIDANT ACTIVITY IN *HYPERICUM PERFORATUM* L. HAIRY ROOT CULTURES ELICITED WITH JASMONIC ACID

PP02 **GADZOVSKA SIMIC SONJA** (*Institute of Biology, Faculty of Natural Sciences and Mathematics, University "Ss. Cyril and Methodius" in Skopje, 1000 Skopje, Republic of North Macedonia):* NEUROPROTECTIVE ACTIVITY OF PHENOLIC COMPOUNDS FROM *Hypericum perforatum* L. TRANSGENIC SHOOT CULTURES: AN *IN VITRO* AND *IN SILICO* APPROACH

PP03 **GADZOVSKA SIMIC SONJA** (*Institute of Biology, Faculty of Natural Sciences and Mathematics, University "Ss. Cyril and Methodius" in Skopje, 1000 Skopje, Republic of North Macedonia):* MICROPROPAGATION OF *Cannabis sativa* L. CULTIVAR BUBBA KUSH x OG KUSH AND PHYTOCANNABINOIDS PRODUCTION

PP04 **ŠAPČANIN AIDA** (*Faculty of Pharmacy, University of Sarajevo,Zmaja od Bosne 8, 71000 Sarajevo, Bosnia and Herzegovina*): ANTIOXIDANT ACTIVITY OF BLACK TRUFFLE FROM BOSNIA SPECIES

PP05 **ŠAPČANIN AIDA** (*Faculty of Pharmacy, University of Sarajevo,Zmaja od Bosne 8, 71000 Sarajevo, Bosnia and Herzegovina*): THE CONTENT OF SOME ESSENTIAL METALS IN WILD *ORIGANUM VULGARE* L.

PP06 **PAVOKOVIĆ DUBRAVKO** (*University of Zagreb, Faculty of Science, Biology, Horvatovac 102a, 10000 Zagreb, Croatia*): THE EFFECT OF HEAT ON THE ACTIVITY OF SEVERAL PROTEINS ASSOCIATED WITH STRESS IN THE BROCCOLI PLANT

PP07 **IBRAGIC SAIDA** (*University of Sarajevo, Faculty of Science, Zmaja od Bosne, 71000 Sarajevo, Bosnia and Herzegovina*): PHENOLIC COMPOSITION AND ENZYME INHIBITORY ACTIVITIES OF SELECTED MEDICINAL PLANT EXTRACTS

PP08 **IBRAGIC SAIDA** (*University of Sarajevo, Faculty of Science, Zmaja od Bosne, 71000 Sarajevo, Bosnia and Herzegovina*): PHENOLIC PROFILING AND ENZYME INHIBITORY POTENTIAL OF LEAF EXTRACTS USED IN TRADITIONAL MEDICINE OF BOSNIA AND HERZEGOVINA

PP09 **IBRAGIC SAIDA** (*University of Sarajevo, Faculty of Science, Zmaja od Bosne, 71000 Sarajevo, Bosnia and Herzegovina*): VARIATIONS IN CHEMICAL COMPOSITION OF ESSENTIAL OILS AMONG DIFFERENT EPHEDRA SPECIES

PP10 **POLITEO OLIVERA** (*Faculty of Chemistry and Technology, University of Split, R. Boskovica 35, Split, Croatia*): CHEMICAL COMPOSITION OF VOLATILE COMPOUNDS FROM GOLDEN SAMPHYRE

PP11 **OSTOJIĆ JELENA** (*Faculty of Science, University of Sarajevo, Zmaja od Bosne 33-35, Sarajevo, Bosnia and Herzegovina*): *CRATAEGUS MONOGYNA* EXTRACTS: A TREASURE TROVE OF ANTIOXIDANTS

PP12 **RAMIĆ EMINA** (*University of Sarajevo-Faculty of Pharmacy, Zmaja od Bosne 8, Sarajevo, Bosnia and Herzegovina*): DETERMINATION OF Co, Fe, Ni AND Zn CONTENT IN ROOT AND LEAF OF *TARAXACUM OFFICINALE*

PP13 **RAMIĆ EMINA** (*Faculty of Pharmacy, University of Sarajevo,Zmaja od Bosne 8, 71000 Sarajevo, Bosnia and Herzegovina*): BIOACTIVE COMPOUNDS FROM *MORCHELLA ESCULENTA PERS.* - THE HEALTH BENEFITS

PP14 **MARKELIĆ MILICA** (*University of Belgrade – Faculty of Biology, Studentski trg 16, Belgrade, Serbia*): PROTECTIVE EFFECTS OF SULFORAPHANE AGAINST INJURY OF ENDOCRINE PANCREAS IN DIABETIC MICE INCLUDE ANTIFERROPTOTIC ACTION

PP15 **VILOTIĆ ALEKSANDRA** (*Institute for the Application of Nuclear Energy INEP, University of Belgrade, Banatska 31b, 11080 Belgrade, Serbia*): CAFFEIC ACID DOWNREGULATES *HIF1A* AND VEGF RECEPTORS MODULATING ENDOTHELIAL-LIKE PROPERTIES OF HUMAN TROPHOBLAST CELLS

PP16 **KAJTAZ ESMERA** (*University of Sarajevo - Faculty of Pharmacy, Zmaja od Bosne 8, Sarajevo, Bosnia and Herzegovina*): EXAMINATION OF THE ANTIOXIDANT ACTIVITY OF SAMPLES OF *LAVANDULA* SPP.

PP17 **ŽERO SABINA** (*University of Sarajevo-Faculty of Science, Zmaja od Bosne 33-35, Sarajevo, Bosnia and Herzegovina*): THE CONTENT OF SELECTED METALS IN TEAS FROM SARAJEVO, BIH

PP18 **ŽERO SABINA** (*University of Sarajevo-Faculty of Science, Zmaja od Bosne 33-35, Sarajevo, Bosnia and Herzegovina*): DETERMINATION OF HEAVY METAL LEVELS IN DIFFERENT CINNAMON SAMPLES

PP19 **KLEPO LEJLA** (*Faculty of Science, University of Sarajevo, Zmaja od Bosne 33-35, Sarajevo, Bosnia and Herzegovina*): DETERMINATION OF ANTIOXIDANT ACTIVITY OF *FRAXINUS* EXTRACTS: A COMPARATIVE STUDY

PP20 **ŠUNJKA DRAGANA** (*Faculty of Agriculture, University of Novi Sad, Trg Dositeja Obradovića 8, Novi Sad, Serbia*): BENEFITS OF RESVERATROL FOR HUMAN AND PLANT HEALTH

PP21 **LAZIĆ SANJA** (*Faculty of Agriculture, University of Novi Sad, Trg Dositeja Obradovića 8, Novi Sad, Serbia*): RESVERATROL IN GRAPES: PRE-ANALYTICAL PROCEDURES

PP22 **IMAMOVIĆ MIRSAD** (*University of Sarajevo - Faculty of Pharmacy, Zmaja od Bosne 8, 71 000 Sarajevo, Bosnia and Herzegovina*): THE INFLUENCE OF THE CHLORINE POSITION IN ACETYL-11-KETO-β-BOSWELLIC ACID ON THE INHIBITION OF 5-LIPOXYGENASE AND DRUGLIKENESS PROPERTIES

PP23 **IMAMOVIĆ MIRSAD** (*University of Sarajevo - Faculty of Pharmacy, Zmaja od Bosne 8, 71 000 Sarajevo, Bosnia and Herzegovina*): OPTIMIZATION OF BOSWELLIC ACID DERIVATIVES AS ANTI-INFLAMMATORY AGENTS

PP24 **IMAMOVIĆ MIRSAD** (*University of Sarajevo - Faculty of Pharmacy, Zmaja od Bosne 8, 71 000 Sarajevo, Bosnia and Herzegovina*): WINE EVALUATION : MAN vs. MACHINE LEARNING AND APPLICATION OF MOLECULAR DESCRIPTORS FOR WINE EVALUATION - A META-ANALYSIS

PP25 **HUIFAN LIU** (*Zhongkai University of Agriculture and Engineering, Guangzhou, Guangdong, China*): CHARACTERIZATION AND RELATIONSHIP ANALYSIS OF ANTIOXIDANT AND ANTI-INFLAMMATORY PEPTIDES IN POMELO FRUITLET ALBUMIN

PP26 **WANG FANG** (*College of Food Science and Engineering/Collaborative Innovation Center for Modern Grain Circulation and Safety, Nanjing University of Finance and Economics, Nanjing 210046, China*): WHEAT GERM-DERIVED PEPTIDE ALLEVIATES DEXTRAN SULFATE SODIUM INDUCED COLITIS IN MICE

PP27 **ZHAI KEFENG** (*College of Biological and Food Engineering, Suzhou University, Suzhou 234000, China; School of Biological and Food Engineering, Engineering Research Center for Development and High Value Utilization of Genuine Medicinal Materials in North Anhui Province, Suzhou University, Suzhou, Anhui 234000, China*): EXPLORING THE ANTI-SKIN INFLAMMATION SUBSTANCES AND MECHANISM OF *PAEONIA LACTIFLORA* PALL. FLOWER VIA NETWORK PHARMACOLOGY-HPLC INTEGRATION

PP28 **PARIĆ ADISA** (*Laboratory for physiology and molecular biology, Department of Biology, Faculty of Science, University of Sarajevo*): BIOACTIVE PROPERTIES OF SELECTED *DIANTHUS* SPECIES

PP29 **WANG HUI** (*Guangdong Provincial Key Laboratory of Aquatic Product Processing and Safety, College of Food Science and Technology, Guangdong Ocean University, Zhanjiang, China; State Key Laboratory of Food Science and Technology, China-Canada Joint Lab of Food Science and Technology (Nanchang), Key Laboratory of Bioactive Polysaccharides of Jiangxi Province, Nanchang University, 235 Nanjing East Road, Nanchang 330047, China*): CELERY SOLUBLE DIETARY FIBER ANTAGONIZE FLAVONOIDS AMELIORATIVE EFFECT ON DEXTRAN-SODIUM-SULFATE-INDUCED COLITIS IN MICE

PP30 **SALOPEK-SONDI BRANKA** (*Ruđer Bošković Institute, Bijenička cesta 54, Zagreb, Croatia*): WHAT ARE HEALTHY PHYTOCHEMICALS IN TRADITIONAL LEAFY KALE (*BRASSICA OLERACEA* L. VAR. *ACEPHALA* DC.) AND WILD CABBAGE (*BRASSICA INCANA* TEN.)

PP31 **ZHU YONG** (*School of Medicine, The Chinese University of Hong Kong, Shenzhen, Guangdong 518172, PR China*): AN INTEGRATED "ISOLATION - DELIVERY" COUPLING PROCESS OF ALKALOIDS IN COPTIS CHINENSIS FRANCH. BASED ON AEROGEL NANOMATERIAL

PP32 **LUKIĆ NATAŠA** (*Faculty of Forestry, University of Banja Luka, Bulevar vojvode P. Bojovića 1a, 78000 Banja Luka, Republic of Srpska, Bosnia and Herzegovina*): ANTIOXIDANT CAPACITY AND HEAVY METALS IN SELECTED MEDICAL PLANTS

PP33 **DESPOTOVIĆ MARTA** (*Department for Nutrition and Metabolism, Institute for Medical Research, University of Belgrade, Belgrade, Serbia*): NATURE'S PHARMACY: PHYTOCHEMICALS AND PROBIOTICS AS THE GUARDIANS OF GUT WELLNESS AND IMMUNOLOGICAL HEALTH

Poster competition

PC01 **MUJEZIN AJDIN** (*Veterinary Faculty, University of Sarajevo, Zmaja od Bosne 90, Sarajevo, Bosnia and Herzegovina):* PHYTOCHEMICAL CHARACTERIZATION AND ANTIOXIDANT CAPACITY OF *CALENDULA OFFICINALIS* L.

PC02 **TRPCHEVSKA VESNA** (*Institute of Biology, Faculty of Natural Sciences and Mathematics "Ss. Cyril and Methodius University", 1000, Skopje, R. North Macedonia*): CANNABIDIOL OIL ATTENUATES OXIDATIVE STRESS IN THE BRAIN OF STZ-INDUCED DIABETIC RATS

PC03 **STEFKOV GJOSHE** (*Faculty of Pharmacy, "Ss. Cyril and Methodius University", Mother Tereza 47, 1000 Skopje, R.N. Macedonia*): DOSE-DEPENDENT EFFECTS OF CANNABIDIOL OIL TRETMENT OVER CARBOHYDRATE METABOLISM IN STZ-INDUCED DIABETIC RATS

PC04 **DAUTEFENDIĆ ANESA** (*Laboratory for physiology and molecular plant biology, Faculty of Science, University of Sarajevo, Zmaja od Bosne 35, 71000 Sarajevo, Bosnia and Herzegovina*): PHYTOTHERAPEUTIC POTENTIAL OF HERBAL PREPARATIONS IN THE TREATMENT OF GASTROINTESTINAL DISORDERS

PC05 **PIPLAŠ ADNAN** (*Laboratory for physiology and molecular plant biology, Faculty of Science, University of Sarajevo, Zmaja od Bosne 35, 71000 Sarajevo, Bosnia and Herzegovina*): TRANSGENERATIONAL MEMORY DETERMINES THE TOLERANCE TO ADVERSE TYPES OF STRESS

PC06 **DELIĆ MINELA, HADŽIABDIĆ AJLA** (*Laboratory for physiology and molecular plant biology, Faculty of Science, University of Sarajevo, Zmaja od Bosne 35, 71000 Sarajevo, Bosnia and Herzegovina*): FOOD AT RISK: NICKEL EXPOSURE AFFECTS GROWTH AND FRUIT DEVELOPMENT IN TOMATO

PC07 **WU QUANYONG** (*State Key Laboratory of Food Science and Technology,China-Canada Joint Laboratory of Food Scienceand Technology (Nanchang), Key Laboratory of BioactivePolysaccharides of Jiangxi Province, Nanchang University,Nanchang 330047, China*): IMPACT OF PECTIN WITH VARIOUS ESTERIFICATION DEGREES ON THE PROFILES OF GUT MICROBIOTA AND SERUM METABOLITES

PC08 **STANČIĆ ANA** (*Institute for Biological Research "Siniša Stanković", National Institute of Republic of Serbia, Bulevar despota Stefana 142, Belgrade, Serbia*): ANTI-FERROPTOTIC ACTION OF SULFORAPHANE IN SKELETAL MUSCLE OF DIABETIC MICE

PC09 **PRIJIĆ SAJRA** (*Laboratory for physiology and molecular plant biology, Faculty of Science, University of Sarajevo, Zmaja od Bosne 35, 71000 Sarajevo, Bosnia and Herzegovina*): INCREASE OF SALT STRESS TOLERANCE IN CHICKPEA BY SEED PRIMING

PC10 **VALJEVAC MIRZA** (*University of Sarajevo - Faculty of Agriculture and Food Sciences, Zmaja od Bosne 8, 71 000 Sarajevo, Bosnia and Herzegovina*): INFLUENCE OF DIFFERENT SUBSTRATES ON FRUITING BODIES YIELD AND ANTIOXIDANT PROPERTIES OF OYSTER MUSHROOM

PC11 **TODOROVIĆ HELENA** (*Tamiš Research and Development Institute, Novoseljanski put 33, 26000 Pančevo, Serbia; University of Belgrade, Faculty of Agriculture, Department of Food Technology and Biochemistry, Nemanjina 6, 11080 Belgrade, Serbia*): ANTIOXIDANT POTENTIAL OF GREEN SYNTHESIZED AGNPs, ESSENTIAL OIL, AND EXTRACTS OF *ORIGANUM VULGARE* L. LEAVES

PC12 **OMANOVIĆ RASIM** (*University of Sarajevo, Faculty of Science, Zmaja od Bosne 33-35, Sarajevo, Bosnia and Herzegovina; International Society of Engineering Science and Technology, Nottingham, United Kingdom*): COMPREHENSIVE CORRELATION STUDY OF HEAVY METALS CONTENT IN SOIL-GRASS-MILK CHAIN

PC13 **OTAŠEVIĆ VESNA** (*Institute for Biological Research "Siniša Stanković", National Institute of Republic of Serbia, Bulevar despota Stefana 142, Belgrade, Serbia*): SULFORAPHANE ATTENUATES HMGB1-MEDIATED ACTIVATION OF INFLAMMATORY PATHWAYS IN THE LIVER OF DIABETIC MICE AND SUPPRESSES FERROPTOSIS

PC14 **ABAZOVIĆ SEMIR** (*Biotechnical faculty, Marjanovića bb, Bihać, Bosnia and Herzegovina*): UNDERSTANDING THE MECHANISMS OF ACTION OF ANTIDIABETIC PLANT COMPOUNDS: A COMPREHENSIVE OVERVIEW

PC15 **TOPIĆ ARMINA** (*Department of Biology, Faculty of Science, University of Sarajevo, Zmaja od Bosne 33-35, 71000 Sarajevo, Bosnia and Herzegovina*): *PSEUDOMONAS AERUGINOSA* IMPROVED PHYTOREMEDIATION EFFICIENCY OF *OCIMUM BASILICUM* L. IN LEAD (PB) CONTAMINATED SOIL

PC16 **TOPIĆ ARMINA** (*Department of Biology, Faculty of Science, University of Sarajevo, Zmaja od Bosne 33-35, 71000 Sarajevo, Bosnia and Herzegovina*): PHYTOREMEDIATION OF LEAD CONTAMINATED SOIL USING *OCIMUM BASILICUM* L. IN ASSOCIATION WITH *BACILLUS SUBTILIS*

PC17 **PIRKOVIĆ ANDREA** (*Institute for the Application of Nuclear Energy, Banatska 31b, Belgrade-Zemun, Serbia*): THE EFFECT OF STANDARDIZED *ARONIA MELANOCARPA* L. EXTRACT SUPPLEMENTATION ON SALIVARY CARCINOEMBRYONIC ANTIGEN LEVELS IN PATIENTS WITH ORAL LICHEN PLANUS – PILOT STUDY

PC18 **BARCIELA PAULA** (*Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, España*): EXPLORING PHYTOCHEMICAL DIVERSITY AND BIOLOGICAL ACTIVITIES OF *HYPERICUM JAPONICUM* AND *HYPERICUM SAMPSONII*: POTENTIAL FOR NATURAL PRODUCT-BASED APPLICATIONS

PC19 **PEREZ-VAZQUEZ ANA** (*Universidade de Vigo, Nutrition and Bromatology Group, Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, España*): UNVEILING THE POTENTIAL OF *Euphorbia* SPECIES AS SUSTAINABLE SOURCES OF BIOACTIVE COMPOUNDS FOR THE FOOD AND PHARMACEUTICAL INDUSTRIES

PC20 **DURMIŠEVIĆ IRMA** (*University of Sarajevo - Institute for Genetic Engineering and Biotechnology, Zmaja od Bosne 8, Sarajevo, Bosnia and Herzegovina*): CYTOTOXIC AND APOPTOSIS-INDUCING POTENTIAL OF POLYMETHOXYLATED FLAVONES ENRICHED FRACTIONS FROM *ARTEMISIA ANNUA* L. IN HEK293T CELLS

PC21 **NAZLIĆ MARIJA** (*Department of Biology, Faculty of Science, University of Split, Ruđera Boškovića 33, 21000 Split, Croatia*): NATURAL RESOURCES OF *VERONICA ANAGALLIS-AQUATICA* L. - VOLATILE COMPOUNDS ISOLATED FROM WILD AND CULTIVATED SPECIES

PC22 **HASANOVIĆ MUJO** (*University of Sarajevo - Institute for Genetic Engineering and Biotechnology, Zmaja od Bosne 8, Sarajevo, Bosnia and Herzegovina*): CHARACTERIZATION OF SERPENTINE BACTERIA: BIOFILM PRODUCTION AND HEAVY METAL TOLERANCE

PC23 **ŠOLA IVANA** (*Department of Biology, Faculty of Science, University of Zagreb, Zagreb, Croatia*): PHYTOCHEMICAL ADAPTATIONS OF YOUNG BROCCOLI TO HOT AND COLD WATER STRESS

PC24 **PANDUREVIĆ MAJA** (*Faculty of Science, University of Sarajevo, Zmaja od Bosne 33-35, 71000 Sarajevo, Bosnia and Herzegovina*): BIOACTIVE PROPERTIES OF *INULA HIRTA* (L.) SPECIES

PC25 **SUBAŠIĆ MIREL** (*University of Sarajevo, Faculty of Forestry, Zagrebačka 20, 71000 Sarajevo, Bosnia and Herzegovina*): BOOSTING CROP SAFETY: HOW INTERCROPPING WITH *SILENE SENDTNERI* REDUCES HEAVY METAL UPTAKE IN *ZEA MAYS* L.

PC26 **RAFAILOVSKA ELENA** (*Institute of Biology, Faculty of Natural Sciences and Mathematics "Ss. Cyril and Methodius University", 1000 Skopje, R. North Macedonia*): HAIRY ROOT EXTRACTS FROM *Hypericum perforatum* L. REVEALED INSULINOTROPIC EFFECTS AND REGULATE HEPATIC CARBOHYDRATE METABOLISM IN DIABETIC RATS

PC27 **FAZLIĆ DŽENETA** (*Faculty of Agriculture and Food Sciences, University of Sarajevo, Zmaja od Bosne br. 8, Bosnia and Herzegovina*): COMPARATIVE STUDY OF THE MINERAL COMPOSITION AND ANTIOXIDANT PROPERTIES OF SELECTED CULTIVATED MUSHROOMS

PC28 **JURČEVIĆ ŠANGUT IVA** (*Department of Food Technology, University North, Trg dr. Žarka Dolinara 1, Koprivnica, Croatia*): UNLOCKING THE BIOACTIVE POTENTIAL OF DIMERIC FLAVONOIDS: COMPARISON OF 3'-8''-DIMERS VERSUS MONOMERIC SUBUNITS

PLENARY LECTURE

SEED PRIMING AS A SUSTAINABLE APPROACH FOR CLIMATE-SMART CROPS

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Global agricultural production is suffering substantial losses due to climate change-related weather events such as drought and salinity, leading to tissue damage and, ultimately, major yield losses. The development of sustainable, 'green' technologies is therefore becoming of utmost important, also due to the need for reduced agrochemical use. Close examination of plant-to-plant communication in nature has revealed the development of unique strategies from plants for responding to abiotic stress, with one of the most interesting being through priming for improved defense responses. The process of priming involves prior exposure to a biotic or abiotic stress factor making a plant more tolerant to future exposure. Priming can also be achieved by applying natural or synthetic compounds which act as signaling transducers, 'activating' the plant's defense system. The current presentation gives an up-to-date description of main research activities carried out at the Cyprus University of Technology with the employment of chemical compounds, microorganisms and advanced nanomaterials and polymers applied as priming agents for stress protection and improved growth, focusing at seed level. This technology offers an attractive alternative to established approaches such as conventional breeding and genetic modification with key advantages, representing a characteristic example of integrative plant physiology where multiple disciplines such as materials science, agriculture and analytical chemistry join forces to develop exciting new tools in modern agriculture.

Keywords: plant priming; abiotic stress; nanomaterials; polymer coatings

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PLENARY LECTURE

THE EFFECTS OF DIETARY BIOACTIVE COMPOUNDS ON BREAST CANCER

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Despite the improvement of the therapeutic approaches for cancer treatment that have been developed over the past 50 years, tumors remain a major cause of mortality globally. A lot of epidemiological studies suggested that many types of cancer, including breast cancer, can be prevented by changing our lifestyle and diet mainly through the increased consumption of plant-based foods. In the last years, our research group has deeply evaluated the anti-tumor effects of natural compounds present in different food matrices both on in vitro and in vivo models. For example, we found that in different types of breast cancer cells dietary bioactive compounds are able to decrease, in a dose-dependent manner, cell viability, migration, metastatization, mitochondrial respiration, glycolysis as well as to arrest cell cycle and increase cellular apoptosis and intracellular ROS. We also highlighted the capacity of these compounds in modulating several molecular pathways and genes involved in many cellular processes such as apoptosis, cell cycle, metastasization, migration, invasion and colony formation.

Keywords: natural compounds; anti tumor effect; apoptosis; food matrices

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PLENARY LECTURE

PLANTS EXTRACTS AND THEIR BIOACTIVE COMPOUNDS AGAINST GASTROINTESTINAL DISCOMFORT

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Gastrointestinal disorders are digestive tract issues that affect a large portion of the global population. Using the Rome IV criteria, various gastrointestinal illnesses without an organic origin can be classified. Functional dyspepsia (FD), irritable bowel syndrome (IBS), functional abdominal discomfort (FAD), defecation disorders, gastrointestinal motility disorders, and other non-specific functional gastrointestinal disorders are the categories into which gastrointestinal disorders can be subdivided. The most frequently used pharmacological treatments for IBS include antispasmodics, pro-motility or laxatives, serotonin modulators, and antidiarrheal medicines. Proton pump inhibitors (PPIs), prokinetics, antiacids, and alginates are used for FD, while tricyclic antidepressants (TCAs) and antispasmodics are used for FAD. Pharmaceutical therapies, however, may have adverse effects. Preventive intervention with dietary supplements can help to avoid drug contraindications. There are several helpful plant extracts for treating these conditions, such as *Malva sylvestris* L, an annual herbaceous plant whose leaves, flowers, and aerial parts are used as laxative agents due to the presence of mucilages that form a gel exerting an osmotic laxative effect; *Castanea sativa* Mill, which, on the contrary, have astringent properties due to its content of tannins, which exert complex biochemical processes involving their interaction with proteins and mucous membranes of biological tissues; *Citrus sinensis* L. Osbeck (orange) and other citrus fruits like *Citrus paradisi* M. (grapefruit) and *Citrus reticulata* B. (mandarin), which can be beneficial in relieving constipation due to their content of food fibers; *Ceratonia siliqua* L. (carob pulp), which is rich in soluble and insoluble fibers; *Avena sativa* L. which is a rich source of soluble and insoluble fibers that can help prevent and treat constipation, improve stool consistency and promote a healthy gut microbiota. In conclusion, a large amount of evidence suggests the efficacy of vegetable extracts in maintaining gastrointestinal health and reducing some symptoms of gastrointestinal discomfort. Thus, developing new food supplements based on vegetable extracts active in the gastrointestinal system represents an approach to treating functional gastrointestinal disorders.

Keywords: gastrointestinal disorders, vegetables extracts, food supplements

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PLENARY LECTURE

CHOLESTEROL-LOWERING NUTRACEUTICALS AND FUNCTIONAL FOODS IN PREVENTION OF HEART DISEASES

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Cardiovascular heart disease (CVD) involves atherosclerosis – the accumulation of cholesterol and other lipids along the inside wall of arteries. It is known that elevated concentrations of blood total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) are the major risk factors for atherosclerosis, whereas high concentrations of blood high-density lipoprotein cholesterol (HDL-C) and a low ratio of TC to HDL-C are protective against CVD. Hypercholesterolemia patients with TC >240mg/dl (6.2mM) have a high risk of CVD. There are about 20-30% people who have a slight to moderately increased risk of CVD because their blood TC concentration is between 200-240mg/dl (5.2-6.2 mM). In general, a nutritionally balanced diet with reduction in saturated fat and cholesterol intake has traditionally been the first goal of dietary therapy in lowering the risk for CVD. This may reduce blood TC only by 5-10%. In recent years, many phytochemicals have attracted much interest due to their potentiality as functional foods/nutraceuticals to treat the hypercholesterolemia, especially for patients, whose TC concentration is marginally high and does not warrant the prescription of cholesterol-lowering medications. The purpose of this presentation is to brief the literature and our research about the production, application, efficacy and mechanisms of popular cholesterol-lowering nutraceuticals and functional foods. (The Research Grants Council of Hong Kong is thanked for supporting the author's research).

Keywords: cholesterol, hypercholesterolemia, heart disease, functional foods, nutraceuticals

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INVITED LECTURE

NEW INSIGHTS INTO GINKGO BIFLAVONOIDS A CENTURY AFTER THEIR INITIAL DISCOVERY

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In the early 20th century, the first dimeric flavonoid, ginkgetin, was isolated from the yellow leaves of the ginkgo (*Ginkgo biloba* L.) tree. Today, researchers have identified nearly 600 different forms of dimeric flavonoids or biflavonoids, though they have received considerably less attention than their monomeric counterparts. Ginkgo, where the first biflavonoid was discovered, serve as a rich source of various biflavonoids and represent a model organism for our project investigating the role of these compounds in plants. To date, we have developed a robust method for the simultaneous determination and quantification of the five most abundant biflavonoids- amentoflavone, bilobetin, ginkgetin, isoginkgetin and sciadopitysin. We have also conducted comprehensive profiling of these compounds across various tissues and throughout different growing stages. Our research suggests that the localization and increased accumulation of biflavonoids may be indicative of their roles within plants, a topic that will be discussed during the presentation.

Keywords: biflavonoids, ginkgo, ginkgetin

Acknowledgments: This work has been supported by Croatian Science Foundation project "Biflavonoids role in plants: *Ginkgo biloba* L. as a model system" under project no. UIP-2019-04-1018.

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INVITED LECTURE

UNVEILING NATURE'S ALLIES: INVASIVE PLANTS AS SOURCES OF PHYTOPHARMACEUTICALS

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Climate change has facilitated the rapid spread of invasive plant species, presenting a huge challenge in maintaining ecological balance within “emerging” ecosystems. Is the key to ecosystem balance and biodiversity conservation in the use of invasive species? Can invasive species be a source of valuable bioactive phytochemicals? How to make the best use of invasive species as providers of new ecosystem services? The research project "NATURe as an ALLY: Alien invasive plants as phytopharmaceuticals – NATURALLY" (IP-2020-02-6899), funded by the Croatian Science Foundation, seeks to address these inquiries. The investigation of four invasive alien plant species (*Ailanthus altissima* (Mill.) Swingle, *Robinia pseudoacacia* L., *Helianthus tuberosus* L., and *Solidago canadensis* L.) in the Istria region (Croatia) aims to elucidate their potential as sources of phytopharmaceuticals. This lecture will unveil the results of phytochemical research conducted on leaf and flower extracts of these species, encompassing LC-MS phytochemical screening, spectrophotometric analysis of phenolic content, and evaluation of biological activity. The research aims to contribute to the sustainable management of invasive species.

Keywords: biological activity, phenolics, plant extracts

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INVITED LECTURE

THE ANTI-PSORIATIC POTENTIAL OF NATURAL COMPOUNDS: FOCUS ON PHENYLETHANOIDS

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Psoriasis is a chronic inflammatory immune-mediated disease with skin and joint manifestations with no clear cause at present. The disease has an increasing prevalence, hence appeared to be the second largest contributor to skin-related impairment and hence affecting ca. 2-3% of the world population. A decade ago, psoriasis was recognized as a serious noncommunicable disease by the WHO. It manifests itself with characteristic skin lesions covered with silvery dry scales appearing in preferential places, such as elbows, knees and scalp and is associated with multiple comorbidities and significant negative effect on patients' quality of life. Plants and plant-derived molecules have gained considerable interest as a possible alternatives of current psoriasis treatments due to their multi-target benefits and fewer side effects compared to synthetic drugs. We explored the effect of biotechnologically-produced extracts and their bioactive principles in psoriasis (in vivo mice model) psoriasis-like inflammation (interferon-γ/interleukin-17A/IL-22-stimulated HaCaT cells). Changes in key inflammatory signaling pathways, related to psoriasis development were detected by reverse transcription polymerase chain reaction and western blotting. Treatment with extracts and selected pure compounds improved psoriasis-related inflammation *via* suppression of the PI3K/AKT signaling in IFN-γ/IL-17A/IL-22-stimulated HaCaT cells. Overall, phenylethanoid glycosides appeared to have a therapeutic potential against psoriasis, by regulating keratinocyte differentiation, through inhibition of the PI3K/AKT signaling pathway.

Keywords: psoriasis treatment; inflamation; phenylethanoid glycosides

Acknowledgments: This research received funding from the Bulgarian National Science Fund (contract number КП-06-Н51/14).

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INVITED LECTURE

AROMA PROFILE AND SENSORY CHARACTERISTICS OF VERMOUTH

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The quality and type of Vermouth, "aromatized fortified wine", depend on the quality and nature of the base wine and on the quality and quantity of added herbs. The aim of this work was to obtain Vermouth wine, by aromatizing Smederevka white wine, and to evaluate its aromatic profile and sensory characteristics. The wine was produced from grapes of autochthonous variety Smederevka (*Vitis vinifera* L.) grown in the Southern Serbia. For obtaining Vermouth wine, the macerate was prepared by the addition of dried and finely ground parts and extract of twelve aromatic plants in 1L of 40% ethanol. Seeds of anise (*Pimpinella anisum* L), cumin (*Carum Carvi*), fennel (*Fructus Foenicili*) and coriander (*Coriandrum sativum* L.), yarrow (*Achillea millefolium*) flower, extract of vanilla (*Vanilla planifolia*), cinnamon bark (*Cinnamomum verum* J. Presl), common centaury (*Centaurium erythraea*) and mint (*Mentha piperita*) leaves, clove flower sticks (*Syzygium aromaticum*), and nutmeg (*Myristica fragrans*) and blueberry (*Vaccinium myrtillus* L.) fruits were used. Extraction of volatile compounds from Vermouth was performed by Headspace-Solid Phase Microextraction (HS-SPME) whereas identification was done by GC/MS and GC/FID. The intensity of the sensory attributes was assessed according to a 100-point scale. Analyses were done in triplicate, while Smederevka wine was used as a control. The terpenes were most abundant volatile compounds identified in Vermouth (13), followed by esters (10), and higher alcohols (4). Despite the fact that higher alcohols were present in the highest concentration (total content was 100 mg/L), they did not contribute to the wine aroma because their concentrations were below sensory perception threshold. To further assess impact of quantified compounds on the overall aroma profile of the analyzed Vermouth, odor activity values (OAVs) were computed as the ratio of the volatile component concentration to its odor threshold value (ODT). A total of 12 volatile compounds were quantified and identified as crucial odorants (OAVs above 1.0). In sensory evaluation Vermouth was rated with 52 points. Compared to the control, higher grades were obtained especially for olfactory perceptions (fineness and intensity) and for gustatory perceptions (purity and structure). The addition of aromatic plant extract during Vermouth production resulted in a specific volatile profile, primarily attributed to markedly high concentrations of terpenes. The sensory characteristics of the Vermouth were improved, particularly in terms of the finesse and intensity of the wine structure.

Keywords: Smederevka autochthonous grape variety, aromatic plants, terpenes, esters

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INVITED LECTURE

„A BITE FOR THE HEALTHY PLANET“ - A BOTTOM LINE FOR A CLIMATE-FRIENDLY SOCIETY!

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Previous research calls for an urgent and immediate transformation of the current food sector due to its contribution to the most pressing global challenges such as climate change (driven by natural resources depletion, biodiversity loss, emission of greenhouse gases, waste), poverty, and inequality (i.e hunger, malnutrition, obesity, and noncommunicable diseases). The deep transformation of the global food sector is impossible without changing current dietary patterns relying on energy(oil)-intensive, long, global supply chains and permanently increased consumption of highly processed food, meat, and dairy products. It requires a change of behavior underlying the importance of consumers' responsibility, ethics, and pro-environmental concerns to shape and adopt a climate-friendly lifestyle. So, the need to open up space for intensive social dialogue raising public understanding and awareness through information campaigns and appeals to environmental concerns, is evident. This research aims to shed light on BH consumers' attitudes, values, and beliefs regarding relationships between nature and humans, which are behind food-related habits and routines, as a step ahead in opening up a new space for social dialog and collaboration to facilitate dietary pattern change. The developed research instrument combines the most widely used method to test environmental attitudes and values (Dominant Social Paradigm vs New Ecological Paradigm) with food-related lifestyle measures. Data was obtained through an online consumer survey from September to October 2023, with collected 217 valid responses. The research results suggest that although BiH consumers share nature-centric values and respect nature, a lack of social dialogue and collaboration decreases their ability to recognize new areas for engagement and alter consumption patterns to benefit the environment. Therefore policy tools and instruments should be tailor-made, and context-sensitive to promote social dialog targeting the needs of different types of households, individuals, or groups.

Keywords: climate-friendly dietary patterns, food system, New Ecological Paradigm, consumer responsibility, emerging economies

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INVITED LECTURE

THREATS AND OPPORTUNITIES OF CANNABIS

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Cannabis is a plant containing a mixture of chemical substances of unique composition, and therefore it has a vast array of applications. Hemp fiber and shives are used in the paper, construction and textile industries. Hemp seeds and products have high nutritional value for humans. They contain significant amounts of essential amino acids and represent a source of ω-3 and ω-6 essential fatty acids. In addition, cannabis flowers contain a broad spectrum of secondary metabolites (phytocannabinoids, terpenoids, and phenylpropanoids), which possess beneficial properties against various disorders. The presentation summarizes our contribution to cannabis research from multiple perspectives including analytical chemistry, pharmacology, and food production. Moreover, prospects, challenges, threats and opportunities of this unique plant and its products will be discussed.

Keywords: cannabis; secondary metabolites; cannabinoids; terpenoids

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INVITED LECTURE

ANTIOXIDANT AND ANTIPROLIFERATIVE ACTIVITY OF PLANT BIOACTIVE COMPOUNDS DURING *IN VITRO* SIMULATED DIGESTION IN THE PRESENCE OF FOOD MATRIX

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One of the key factors that can hinder the beneficial effects of bioactive compounds found in food is their bioavailability, which is contingent upon their digestive stability, release from the food matrix, and efficiency in passing through the epithelial barrier. Our study investigated the impact of *in vitro* digestion and the food matrix on polyphenols from chokeberry fruits and organosulfur compounds from ramsons. Our results indicate that despite the significant transformation of chokeberry phenolics during digestion in the presence of the food matrix, they retain their potency as antioxidants and antiproliferative agents. Research on ramsons (*Allium ursinum*) suggests that its consumption may provide health benefits, particularly regarding potential anticancer properties. The safety characteristics of *Lactobacillus fermentum* strains associated with *A. ursinum*, including the absence of gelatinase and hemolytic activity, susceptibility to clinically relevant antibiotics, and beneficial properties such as survival in the simulated gastrointestinal environment, colonization of the intestinal mucosa, and immunomodulatory effects, indicate their potential use as probiotics for human consumption. This study represents the first comprehensive analysis of ramsons' antioxidant and antiproliferative properties, followed by an investigation into its microbiota and the health-promoting effects of lactic acid bacteria (LAB).

Keywords: bioactive compounds; bioavailability; *in vitro* digestion; food matrix; lactic acid bacteria

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INVITED LECTURE

AN OVERVIEW OF HYPHENATED MASS SPECTROMETRY TECHNIQUES IMPLEMENTED IN CROP QUALITY ASSESSMENT

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The quality and safety of crops, including medicinal plants and vegetables, is of paramount importance, necessitating a thorough understanding of their complex phytochemical composition. The diverse range of single plant species available on the market, influenced by environmental and genetic factors, underscores the critical need for such knowledge, crucial not only from nutritional but also medical perspectives. Among all techniques used for identification of natural compounds, the mass spectrometry and its hyphenated techniques emerges as a pivotal platform for chemical profiling, metabolomics and quality control of plant-based foods.This overview presents a concise exploration of mass spectrometry techniques employed in quantifying various classes of low-molecular-weight natural products. These include plant hormones, found in minute concentrations in plant tissues, to amino acids, polyamines, small organic acids, sugars, vitamins, cannabinoids, terpenoids, phenolic acids, and fatty acids, a major and/or highly important constituents of certain plant-based products. The discussion encompasses the advantages and limitations of each hyphenated method, coupled with specific mass spectrometry techniques like electron ionization or electrospray triple quadrupole mass spectrometry, spanning from sample preparation to data processing.

Keywords: mass spectrometry, gas chromatography, liquid chromatography, plant science, crop quality

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INVITED LECTURE – SYNOPSIS OF WORKSHOP

ADVANCED-BASED METABOLOMICS APPLICATIONS IN MEDICINE & PHARMACY

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The metabolomics workshop line-up will provide insights into the latest developments and spectroscopic strategies in the field of Mass spectrometry-based metabolomics. Applications include the field of food and drug analysis. An orientation on the different platforms in metabolomics MS, and bioinformatics tools for analysis of MS datasets shall be offered highlighting hurdles in modeling different datasets. Stress shall be given towards model validations and how to avoid technology abuse in seeking an answer for a biological question. Examples shall be presented from Dr. Mohamed Farag's research about quality control analysis of food and herbal drugs, identification of active agents, and disease diagnosis.

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Oral presentation

BENEFICIAL EFFECTS OF ANTIOXIDANT PHYTOCHEMICALS IN DIABETES MELLITUS

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Diabetes mellitus, a chronic metabolic disease, characterized by elevated blood levels of glucose and insufficiency in production and action of insulin, affects a significant proportion of the population worldwide. It is associated with a reduced quality of life and increased risk factors for mortality and morbidity. Numerous studies have shown that diabetes mellitus is associated with increased formation of free radicals and decrease in antioxidant potential. In diabetes treatment, the current drugs have higher costs, limited efficacy, and tolerability and/or significant side effects. As a result of these factors, patients have often used alternative forms of therapy such as herbal products. Since in the patients with diabetes mellitus, the levels of antioxidant parameters are found to decrease, hence in many studies phytochemicals which can exert antioxidant and free radical scavenging activities, are suggested to improve the insulin sensitivity. There has been a growing interest in replacing synthetic diabetic drugs with natural antioxidants from plant materials. Studies have shown that plants contain a large variety of substances that possess antioxidant activity. According to an estimation published by the World Health Organization (WHO), approximately 80% of diabetic patients presently rely on herbal medicine for their successive treatments. However, the studies about the antidiabetic activity of plants and plant derived compounds are limited. Limonene is a major component of oils obtained from Citrus plants, orange, lemon and grapefruit. Cinnamic acid is a phenolic acid that exist in many fruits, vegetables, and beverages including blueberry, kiwi, cherry, plum, apple, pear, chicory, artichoke, potato, cider, and coffee. Ursolic acid is a well-known pentacyclic triterpene which is commonly found in *Olea europaea*, *Origanum vulgare*, *Rosmarinus officinalis*, *Salvia* and *Thymus* plants. The relationship between diabetes mellitus and preventive roles of various phytochemicals such as limonene, cinnamic and ursolic acid on diabetes via their antioxidant properties will be discussed.

Keywords: Diabetes mellitus, phytochemicals, limonene, cinnamic acid, ursolic acid

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Oral presentation

MARINE GREEN ALGAE-DERIVED OLIGOSACCHARIDES AND THEIR POTENTIAL PHARMACEUTICAL APPLICATIONS

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Oligosaccharides offer beneficial effects on immune system and gut health, such as immunomodulatory activity, anticancer activity, and complement activation. Functional oligosaccharides are widely found in plants, algae, bacteria, and higher fungi. The consumption of functional oligosaccharides can reduce the risk of lifestyle-related diseases, such as cardiovascular disease, cancer, obesity and type 2 diabetes. Marine macroalgae possess tremendous nutritional value and have been well-known to cure and prevent the chronic metabolic diseases. An increased interest in various bioactive natural products from marine macroalgae, as a potential source of effective agents, has been observed in recent years. Especially, green algae have attracted attentions for their important functional properties and potential biological applications. The effects of marine green algal oligosaccharides may delay the development of chronic metabolic diseases such as diabetes, and alter the metabolic abnormalities through various mechanisms of actions. Marine green algal oligosaccharides used to prevent and manage diabetes. The excellent performance was based on their chemical structures and glycosidic linkages. Our research is focus on structures, accessible sources, physiological and chemical characteristics, and potential health benefits of green algal functional oligosaccharides. Moreover, the project aims to to carry out research on new key gene mining and regulation mechanism of marine green algal functional oligosaccharides to dietary interventions for glucose metabolism. Our group engages in the nutritional evaluation research of functional components from marine algae and has achieved a series of original results: to firstly report the largest gram scale production of fucosylated oligosaccharide lacto-N-fucopentaose I, to firstly discovered the COL1A1 as one potential new biomarker and therapeutic target for type 2 diabetes, to reveal the new mode of regulation of algal oligosaccharides on glycometabolism network based on microRNAs, and to elucidate systematically molecular mechanisms of marine algal oligosaccharides to regulate glucose metabolism via mediating intestinal flora. These results make the important breakthrough in the theoretical basis of algal food nutrition and successfully realize them transformation and application.

Keywords: Green alga, Oligosaccharides, Anti-diabetic, Anti-tumor, Anti-virus

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Oral presentation

CELERY SOLUBLE DIETARY FIBER ANTAGONIZE FLAVONOIDS AMELIORATIVE EFFECT ON DEXTRAN-SODIUM-SULFATE-INDUCED COLITIS IN MICE

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Dietary fiber and flavonoids are promising drugs reported in the treatment of inflammatory bowel disease (IBD). However, it is unclear the interaction between dietary fiber and flavonoids as typical in a whole food scenario. The therapeutic effect of celery, kale, and red chicory powders on colitis mice using non-group feeding cages was investigated. Further, the efficacy of whole celery, celery soluble dietary fiber (CSDF), celery insoluble dietary fiber (CIDF), celery flavonoids (CF), CSDF+CF and CIDF+CF in IBD mice model was assessed to dissect protective effect to attribute to which component(s) in such complex matrix. Administration of kale and red chicory significantly restored body weight, DAI score, and colon length in colonic mice, and celery showed the weakest effects. Administration of either CSDF or CF markedly improved the histological damage, increased colonic mucus expression, and reduced colonic MPO/iNOS activities, and IL-6/IL-1β levels. However, CSDF+CF showed weaker improvement than CF or SDF in most physical and biochemical signs. Furthermore, CSDF and CF decreased intestinal *g_Escherichia-Shihella* and *g_Clostridium_sensu_stricto_1* induced by DSS administration. Interestingly, celery flavonoid promoted *g_Akkermansia* proliferation both *in vivo* and *in vitro*, and which can be inhibited by CSDF. This study revealed for the first time that CSDF can suppress the protective effect of CF on intestinal health by inhibiting *g_Akkermansia*, and clarified that the decreased efficacy of celery whole food on colitis was mediated by an antagonism between CSDF and CF. Moreover, this study presents for the first time that interaction between soluble dietary fiber and flavonoids *in vivo* can ameliorate the efficacy of dietary fiber or flavonoids when administered alone suggestive for an antagonistic effect.

Keywords: Celery dietary fiber, Celery flavonoids, Colitis, Gut microbiota

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Oral presentation

CITRUS JAPONICA L. ESSENTIAL OIL- A RICH SOURCE OF NUTRITIONALLY VALUABLE COMPONENTS, ITS *IN VITRO* DIGESTION AND BIOLOGICAL ACTIVITY

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Plants are known for the various biological activities they exhibit and for their specific chemical identity that enables them to synthesize metabolites such as phenolic compounds, flavonoids, saponins, terpenes, coumarins and alkaloids. Kumquat (*Citrus japonica* L.) is a small, elliptically shaped fruit, belongs to the smallest citrus fruits (family Rutaceae). Popular mainly for their raw fruits, kumquats have been used for their medicinal and therapeutic effects. What is interesting about kumquat is that it is a citrus whose pulp is eaten together with the peel, which is sweet and edible with a typical aroma due to the presence of flavonoids and terpenoids. Kumquat essential oil (KEO) extracted from mature kumquat has significant potential value in the cosmetic, phytopharmaceutical and food industries due to its desirable fragrance and diverse biological activities. However, compared to other plant essential oils, there are relatively few studies on the biological activity of KEO and limited data on its health benefits. Developing a mechanistic understanding of the impact of food structure and composition on human health increasingly involves simulating digestion in the upper gastrointestinal tract. Static *in vitro* digestion models provide results that are highly correlated with *in vivo* studies. In static *in vitro* digestion models, the oral, gastric and intestinal phases are simulated to determine the stability and bioaccessibility of the desired (bioactive) components after digestion. Therefore, the aim of this research is isolation of KEO by microwave-assisted extraction, examination of the chemical profile using GC-MS technique, and its *in vitro* gastrointestinal stability. In the continuation of the research, its biological activity (cytotoxic and antioxidant activities) also will be tested. Cytotoxic activity will be tested against a cervical cancer cell line (HeLa), human colon cancer cell line (HCT116), human osteosarcoma cell line (U2OS), and healthy cell line (RPE1). Antioxidant activity will be examined with two methods: DPPH (2,2-diphenyl-1-picrylhydrazyl) and ORAC (oxygen radical absorbance capacity). The results showed that the cytotoxic activity of KEO on all three tested cancer cell lines is IC_{50} 1-2 mg/mL.

Keywords: *Citrus japonica*, microwave-assisted extraction, essential oil, chemical profile, *in vitro* digestion, biological activity

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Oral presentation

ROLE OF STP-60A IN DELAYING SENESCENCE AND SIGNALING PATHWAYS REGULATING LONGEVITY IN THE NEMATODE HIDRADENITIS ELEGANS

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Obesity accelerates the aging process, triggers age-related diseases earlier, or aggravates the disease degree. It is of great significance to explore the possibility of delaying natural aging and resisting premature aging caused by obesity. *Caenorhabditis elegans* (*C. elegans*) has become the preferred model for research on aging and obesity due to its short life cycle, rapid reproduction and high genetic homology with human beings. The polysaccharide fragment with the best anti-aging activity in Guangxi sweet tea crude polysaccharide was found to be STP-60a in the previous experiment. The effects of STP-60a on delaying the senescence of *C. elegans* and the signal pathways regulating the longevity of *C. elegans* were explored. STP-60a significantly prolonged the longest life span and average life span of normal diet nematodes, reduced the accumulation of lipofuscin, and improved many physiological indicators (exercise ability, pharyngeal pump rate, stress resistence). STP-60a increased the activity of SOD, CAT and GSH-Px, decreased the content of ROS and MDA, and affected the redox system of nematodes. Using qRT-PCR and transgenic nematodes to study the key pathway, the results showed that STP-60a prolonged the life span of normal diet nematodes mainly through insulin, mitochondrial respiratory chain and autophagy pathway. STP-60a significantly increased the expression of three transcription factors (DAF-16, SKN-1 and HSF-1) and their target genes (sod-3, ctl-2, prdx-3, gst-4, gst-7, hsp-12.6, hsp-16.1, hsp-16.2) downstream of insulin signaling pathway in normal diet nematodes, and enhanced the accumulation of DAF-16 and SKN-1 in the nucleus. The deletion mutation of daf-16, skn-1 and hsf-1 prevented STP-60a from prolonging the life span of nematodes. At the same time, STP-60a could improve the mitochondrial function of normal diet nematodes, increase the activity of mitochondrial respiratory chain complex I and complex II, regulate the expression of mitochondrial respiratory chain genes (mev-1, clk-1, isp-1), and induce mitochondrial unfolded protein reaction. In addition, STP-60a activated the autophagy system of nematodes in the form of insulin and mitochondrial pathway dependence, upregulated the expression of autophagy related genes (unc-51, lgg-1, bec-1, vps-34), enhanced the autophagy level, and ultimately prolonged the life span of normal diet nematodes.

Keywords: STP-60a, delaying senescence, sweet tea polysaccharide

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Oral presentation

POLYGONATUM SIBIRICUM SAPONIN-LACTIC ACID BACTERIA COMBINATION ATTENUATE HYPERGLYCEMIA IN T2DM MICE BY MODULATING AMINO ACID METABOLISM

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Some researches have shown that the combination of plant extracts and probiotics may be a better way to treat type 2 diabetes mellitus (T2DM) than a single intervention. However, there are still relatively few relevant reports in this aspect. Therefore, this study aims to investigate whether the treatment of *polygonatum sibiricum* saponin (PSS) and probiotics combination can better manage T2DM. Firstly, the properties of nine probiotics were evaluated by principal component and heatmap analysis. And the hypoglycemic properties of compound probiotics were compared with single strains. The results showed the inhibition (%) of α-amylase was higher when *L. casei* was used synergistically with *L. bulgaricus* compared with single strains as well as other strain combinations. And it was also found that the inhibition (%) of α-amylase was higher as 70.35% after PSS and the compound probiotic were compounded as a ratio of 2:1. Futhermore, the anti-diabetes mechanism of the combination was studied from the perspectives of glucose metabolism, microbiome and metabolome. The results showed that PSS+lactic acid bacteria (LAB) could better improve fasting blood glucose level, insulin sensitivity, lipid metabolism disorder, and liver function. Protein analysis showed that PSS+LAB treatment significantly increased the expression of p-PI3K/PI3K, p-AKT/AKT, GLUT2, IRS2, and GSK-3β in the liver of T2DM mice, while inhibiting the expression of FOXO1. This combination positively regulated the composition and abundance of the gut microbiota. Metabolomic analysis showed that the combination treatment exhibited more changes in gut microbiota metabolites compared to PSS treatment alone. The alteration of gut microbiota by LAB+PSS led to significant changes in alanine, aspartate and glucose metabolism pathways. This study may provide a theoretical basis for the combined application of plant extracts and probiotics for the management of T2DM.

Keywords: probiotics, screening, *Polygonatum sibiricum*, saponin, hypoglycemic

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Oral presentation

EXPLORING THE MECHANISMS OF ACTION OF ACTIVE CONSTITUENTS IN *SCHISANDRAE FRUCTUS* FOR THE MANAGEMENT OF DIABETIC CARDIOMYOPATHY

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Diabetes mellitus is a prevalent chronic metabolic disorder with a high incidence rate. It is estimated that by the year 2030, the global prevalence of diabetes mellitus will rise to 578 million individuals. Prolonged elevated blood glucose levels can detrimentally impact various organs in patients, leading to a range of diabetic complications. Diabetic cardiomyopathy remains a major cause of death, accounting for approximately 50-80% of diabetes-related fatalities. *Schisandra chinensis*, a member of Schisandraceae family, is a common woody plant native to China, Korea, and Japan. As both a medicinal herb and a culinary ingredient, its dried and mature fruits, known as Schisandrae fructus, exhibit five distinct flavors: sour, sweet, bitter, spicy, and salty. Consequently, a variety of food and health products derived from *Schisandra chinensis*, such as Schisandra wine and Schisandra tea, have established mature market systems. Therefore, elucidating the mechanisms of action of the main components of *Schisandra chinensis* holds significant economic and social value. Through different in vivo and in vitro models, we have observed that the alleviation of diabetic cardiomyopathy by Schisandrin A and Schisandrin B relies on a comprehensive network of multi-organ cooperation. This network demonstrates protective abilities not only towards the heart and pancreas but also exhibits certain clearance capabilities in major lipid and glycogen-storing organs such as the liver and kidney. Moreover, through transcriptomics analysis, we have discovered that Schisandrin A and Schisandrin B exhibit distinct mechanisms of action in the two main subtypes of diabetes. In type 1 diabetes, they exert strong regulatory effects on the complement system, inhibiting key members of this pathway such as C3, C3a, and C5a. However, in type 2 diabetes, the focus shifts to mitochondrial oxidative phosphorylation. We aim to further explore the respective main targets within the frameworks of type 1 and type 2 diabetic cardiomyopathy. Although a member of the heat shock protein family, Grp94, has been previously identified as one of the main targets previously, a comprehensive understanding of the multi-organ cooperative network of Schisandrin A and Schisandrin B undoubtedly requires support from additional targets.

Keywords: Diabetic cardiomyopathy, Schisandrae fructus, Mechanisms elucidation

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Oral presentation

FORMATION OF NITROGENOUS FLAVONOID DERIVATIVES BY REACTING WITH AMINO ACIDS IN DMEM MEDIUM

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A class of nitrogenous derivatives of flavonoids was detected using *in vitro* cell culture medium and *in vivo* mice produced without enzymatic catalysis have been consistently overlooked in literature. In this study, 39 flavonoids were incubated in Dulbecco's modified eagle's medium (DMEM) at 37 ºC for 2 h to explore the reaction mechanism behind nitrogenous derivatives from flavonoids. Baicalein, scutellarein, DMY, GC, EGC, and EGCG were found to produce corresponding nitrogenous derivatives in both DMEM and mixed amino acid solution. The nitrogen source of these 6 flavonoid nitrogenous derivatives was revealed to be amino acid. The reaction site with amines in these flavonoid nitrogenous derivatives was identified as OH of the pyrogallol moiety in flavonoids via LC-MS/MS and NMR. This pyrogallol group was a key motif being first oxidized into quinone, further, to react with Strecker degradation of amino acids to yield N-flavonoids and corresponding aldehydes. Reaction optimization revealed that a slightly alkaline environment accelerates flavonoid nitrogenous derivatives formation by promoting the formation of flavonoid quinone. These results provide the first mechanistic evidence for the *in vitro* generation of flavonoid nitrogenous derivatives yet to be tested using *in vivo* assay.

Keywords: Nitrogenous flavonoids, dihydromyricetin, pyrogallol, amino acids, Strecker degradation

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Oral presentation

THE ROLE OF PHYTOCHEMICALS IN THE PREVENTION OF DNA DAMAGE

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For the last decades, people seem to be more conscious about the uses of herbal medicines or plant derived products. Phytochemicals especially phenolic compounds, derived from natural plants have been used commonly for the prevention and/or treatment of different diseases due to the belief of their safety. They have been regarded as possible antioxidants. But on the other hand, it is suggested that various phenolic antioxidants can display pro-oxidant properties at high doses. The side effects of phytochemicals have not already been known sufficiently and there are too many contradictory results. Due to these uncertain outcomes, people must be vigilant about using these products. Further detailed *in-vitro* and/or *in-vivo* animal studies are necessary to understand the health beneficial or hazardous effects of plant derived compounds. It is known that most of the phytochemicals show their action through the generation of reactive oxygen species. During the treatment of some oxidative stress-related diseases, use of antioxidant phytochemicals may be beneficial. However, patients must be careful due to the possibility of pro-oxidant properties of phytochemicals used in inappropriate doses. Cells must maintain the balance between the levels of free radicals and antioxidants. When the levels of free radicals exceed that of antioxidants during oxidative stress, biomolecules such as lipids, proteins, and DNA in particular can be damaged. This damage could cause numerous chronic disorders including cancer. In this talk, the role of some phytochemicals (epigallocatechin gallate, carvacrol, galangin, limonene, lycopene, naringin, puerarin, terpinene, thymol and ursolic acid) on the prevention of DNA damage will be discussed. These phytochemicals are ubiquitous in many plants and are frequently consumed in human diet such as green or black tea (epigallocatechin), thyme or oregano (carvacrol and thymol), citrus plants (limonene and naringin) and tomatoes (lycopene).

Keywords: Phytochemicals, DNA damage, oxidant, pro-oxidant

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Oral presentation

STRATEGIES TO MANIPULATE EMISSION OF VOLATILE ORGANIC COMPOUNDS

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Emissions of volatile organic compounds (VOCs) from plants are critical for processes such as pollination and seed dispersal. They also serve as a defense mechanism against parasites, pathogens, and herbivores and contribute to the pleasant smells of fruits, vegetables, flowers, and leaves. These compounds are primarily made up of phenylpropanoids/benzenoids, terpenoids, fatty acid derivatives, and amino acid derivatives. There has been considerable advancement in understanding the biosynthesis of VOCs over the past decades, but the specifics of how these compounds exit the cells and enter the environment remain less clear. Historically, it was believed that VOCs diffused passively out of cells. However, recent research involving petunia flowers has shed light on an active biological process involving an ABC transporter that aids in the emission of volatiles. In our study utilizing *Petunia hybrida*, which emits a high volume of volatiles derived from phenylalanine (Phe), we aimed to elucidate the mechanism of VOC release and the potential involvement of the cuticle and non-specific lipid transfer proteins in this process. Employing reverse-genetic and chemical methodologies, we identified a cell-wall localized non-specific lipid transfer protein (nsLTP), PhnsLTP3, that plays a part in transporting VOCs through the cell wall to the cuticle. Inhibiting PhnsLTP3 led to a decrease in VOC emissions and altered the distribution of VOCs, resulting in fewer of them reaching the cuticle, without affecting the total VOC content. Our findings also reveal that while the cuticle significantly hinders the movement of VOCs, it acts as a pivotal sink and concentrator for these compounds. Intracellular VOC accumulation can trigger a feedback mechanism that reduces their biosynthesis by downregulating the supply of the Phe precursor, a protective measure against the toxicity of these hydrophobic substances. This research offers new avenues for the metabolic engineering of VOCs to enhance desired fragrances or diminish the release of unwanted odors from plants.

Keywords: Volatiles, *Petunia hybrida*, LTPs, VOCs, biotechnology

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Oral presentation

MAPKS AND NF-KB INHIBITION ARE INVOLVED IN THE NEUROPROTECTIVE EFFECTS OF CINNAMON/CURCUMIN/TURMERIC SPICE BLEND IN AN *IN VITRO* MODEL OF ALZHEIMER'S DISEASE

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Alzheimer's disease (AD) is a neurodegenerative disorder whose exact aetiology remains elusive, challenging the entire scientific community. However, it is acknowledged that AD is characterized by an increased deposition in the brain of β-amyloid (Aβ) protein, which triggers pro-inflammatory events in the surrounding nervous tissue. The aim of this study was to investigate the neuroprotective effects of a spice blend composed of an extract of cinnamon bark and two different turmeric root extracts (CCSB) in Aβ-exposed THP-1 cells, employed as a model of neuroinflammation. In abiotic ORAC assays, CCSB exhibited up to 3-fold greater reactive oxygen species (ROS) quenching ability than the standard Trolox. In THP-1 cells, CCSB also demonstrated antioxidant potential by reducing ROS, induced by the amyloid fragment by up to 39.7%. Furthermore, CCSB diminished the Aβ-stimulated secretion of the pro-inflammatory cytokines IL-1β and IL-6 by up to 24.9% and 43.4%, respectively, and their gene expression by up to 25.2% and 43.1%, respectively. The mechanism underlying this effect seems to involve the mitogen activated protein kinases (MAPKs) ERK, JNK and p38, whose phosphorylation was reduced by up to 51.5%, 73.7%, and 58.2%, respectively. In addition, phosphorylation of p65, one of the five components forming NF-κB, was reduced by up to 86.1%. Our data indicate that CCSB can counteract the neuroinflammation induced by Aβ-stimulation of THP-1 cells, thus targeting the events characterizing the early stages of AD.

Keywords: Alzheimer's disease; neuroinflammation; curcumin; cinnamon; turmeric

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Oral presentation

A FLAVONOID-RICH EXTRACT OF *CITRUS BERGAMIA* JUICE INDUCES TERMINAL DIFFERENTIATION IN AN *IN VITRO* MODEL OF ACUTE MYELOID LEUKEMIA

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Acute myeloid leukaemia (AML) is the haematological disease with the lowest survival rate, due to its genetic and clinical heterogeneity. Gene aberrations render myeloid cells undifferentiated and able to proliferate in uncontrolled manner. In particular, the over-expression of SIRT2, an enzyme belonging to the histone deacetylases family, has been suggested as a key mechanism of AML pathogenesis, since it was shown to decrease the rate of differentiation and, thus, to promote the proliferation of AML cells. Although the use of synthetic differentiating agents represents a strategy for the treatment of some subtypes of AML, their severe side effects prompted to search for potential candidates in the plant kingdom. Among these, *Citrus* × *bergamia* (bergamot) has showed to possess relevant pharmacological properties, including anticancer ones. Therefore, the aim of this study was to evaluate the ability of a flavonoid-rich extract of bergamot juice (BJe) to exert antileukemic effects via the induction of terminal differentiation in THP-1 cells, an *in vitro* model of AML, shedding light on the potential involvement of SIRT2 enzyme. In our study, BJe induced anti-proliferative effects, blocking cell cycle in S-phase and triggering apoptosis in THP-1 cells. These effects might be related to the activation of differentiating processes. Indeed, BJe induced differentiation of THP-1 cells, as shown by changes in cell adhesion and increased expression of cell surface markers such as CD11b, CD14, and CD68. One of the mechanisms responsible for cellular differentiation induced by BJe in leukemic THP-1 cells might be the inhibition of SIRT2. This because BJe was able to inhibit SIRT2 activity of the isolated enzyme and in THP-1 cells, where it caused the increase of acetylated p53 levels, a well-known SIRT2 substrate, and also the reduction of SIRT2 gene expression. Our results show the anti-leukemic effects of BJe, achieved by a SIRT2-mediated induction of differentiation, which could represent a novel viable strategy in AML management.

Keywords: Acute myeloid leukemia; Bergamot juice extract; differentiation; SIRT2; nutraceuticals

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Oral presentation

THE HEREDITY OF DROUGHT: PROBING PHYSIOLOGICAL AND MOLECULAR MARKERS OF STRESS MEMORY IN MYLES CHICKPEA CULTIVAR

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Drought stress poses a significant challenge to crop productivity, with chickpea (*Cicer arietinum* L.) being particularly susceptible to water scarcity. Understanding the long-term effects of drought stress on plant morphology across generations is crucial for devising resilient agricultural strategies. This study investigates the response of chickpea plants to drought stress and explores stress memory effects on morphology in the subsequent generation, comparing offspring from stressed plants with those from control conditions. Chickpea plants subjected to drought stress exhibited characteristic adaptive responses, including reduced plant height, decreased leaf area, and altered root architecture, indicative of stress avoidance strategies. Furthermore, analysis of the subsequent generation revealed intriguing stress memory effects on plant morphology. Offspring derived from stressed plants displayed phenotypic plasticity, with significant alterations in morphological traits compared to progeny from control conditions. Notably, these changes included enhanced root system development, increased leaf thickness, and altered shoot architecture, suggesting transgenerational inheritance of stress memory. In this study, we will complement these findings by employing a combination of molecular transcriptomic and methylome analyses. By integrating molecular approaches with morphological observations, we aim to unravel the underlying mechanisms driving the observed phenotypic changes. This comprehensive analysis will provide valuable insights into the molecular pathways involved in stress response and transgenerational inheritance in chickpea plants under drought conditions.

Keywords: drought stress; chickpea (*Cicer arietinum* L.); dorphological traits; transgenerational inheritance; stress memory

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Oral presentation

STRATEGIES FOR PROMOTING THE BIOACCESSIBILITY/BIOAVAILABILITY OF BIOACTIVE COMPOUNDS IN PLANT-BASED FOODS

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Bioactive compounds, including terpenoids, polyphenols, alkaloids and other nitrogen-containing constituents, exert various beneficial health effects, including antioxidant, anti-inflammatory, anti-diabetic, anti-carcinogenic properties. However, due to their low water solubility, chemical instability, food matrix effects, and interactions with other nutrients, many bioactive compounds have low bioavailability and thus bioactivity. The bioactive compounds need to be released from the food matrix during digestion in a form that the body can absorb. However, the absorption of numerous bioactive compounds is hindered by various physicochemical and physiological processes that take place in the gastrointestinal tract following their consumption. Several innovative technologies and approaches have recently been developed to improve the bioaccessibility and bioavailability of bioactive compounds. In this work, various methods used to improve the bioavailability of bioactive compounds such as polyphenols and carotenoids are discussed. Different methods including fermentation, natural deep eutectic solvents, encapsulation technologies, and excipient emulsion systems are covered. The mechanisms of action of these novel approaches and their potential to be used in food production are also explored.

Keywords: bioactive compounds; absorption; bioavailability; food production

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Oral presentation

SPEEDWELLS – SMALL PLANTS WITH ANTIOXIDANT ACTIVITY

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Testing the antioxidant activity is often one of the first steps in assessing the positive effect of selected extracts, given that the formation of ROS (reactive oxygen species) is a consequence of every normal metabolism, and their accumulation causes diseases. Antioxidant activity is most often tested on different types of food and medicinal herbs that we also use as food supplements. Plants of the genus *Veronica* (speedwells) belong to the group of plants that have been used in traditional medicine for a long time and are used still to this day. Numerous studies about biological activity of their extracts, mostly phenolic extracts, have shown that these are plants with great potential. They are cosmopolitan and ecologically diverse species spread on a variety of habitats from aquatic, marshy and forest to rock, rock cracks, fields, and ruderal habitats, so they produce a large number of specialized metabolites to overcome this variety of condition that they live in. In Croatia, there are 40 species of the genus *Veronica*. In this study we will give a review of the so far results of the antioxidant activity from the project "Croatian *Veronica* species: Phytotaxonomy and Biological Activity" for volatile compounds extracted and identified from different *Veronica* species. The antioxidant activity of all extracts (essential oils and hydrosols) was investigated using two methods, ORAC (oxygen radical absorbance capacity) and DPPH (2,2-diphenyl-1-picrylhydrazyl). Also, the mentioned extracts were obtained by two techniques, classic Clevenger distillation and microwave distillation. Antioxidant activity was tested on all these extracts of volatile compounds. These results for volatile compounds will also be compared with the so far results for different phenolic extracts (methanolic, ethanolic and water).

Keywords: *Veronica; antioxidant activity; specialized metabolites; DPPH; ORAC*

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Poster presentation *PP01*

PRODUCTION OF PHENOLIC COMPOUNDS AND ANTIOXIDANT ACTIVITY IN *HYPERICUM PERFORATUM* L. HAIRY ROOT CULTURES ELICITED WITH JASMONIC ACID

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This study aimed to investigate the effect of different concentrations of jasmonic acid (JA: 10, 50, and 100 μM) on the growth, production of total phenolics (TP) and flavonoids (TF), as well antioxidant capacity (DPPH and CUPRAC) in hairy root (HR) cultures of *Hypercum perforatum* L. during the period of post-elicitation (day 1, 4, 7, 14, 21 and 28). Exogenous application of 10 and 50 μM JA significantly increased fresh HR biomass (up to 1.5-fold) compared to control HR during the late post-elicitation period. In contrast, the application of 100 μM JA markedly reduced HR biomass in elicited HR (from 2.5- to 5.1-fold) during the entire post-elicitation period. All tested JA concentrations significantly increased TP production (from 1.2- to 3.7-fold) in elicited HR compared to control cultures during the intermediate post-elicitation period. At the end of post-elicitation, only HR elicited with 10 μM JA showed significantly higher TP contents (1.5-fold) compared to control HR. In comparison to control cultures, the application of 100 μM JA continuously enhanced TF production (from 1.9- to 3.8-fold) during the entire post-elicitation period, while 10 and 50 μM JA showed a 1.8-fold increased TF contents at day 28. Concerning the antioxidant activity, only 100 μM JA significantly enhanced DPPH values (up to 1.3-fold) compared to control HR during the intermediate post-elicitation period. Slightly increased DPPH activity was also observed in HR elicited with 10 μM JA (1.2-fold) in comparison to control cultures at the end of post-elicitation. From day 4 to day 21, HR elicited with 50 and 100 μM JA exhibited significantly higher CUPRAC values (up to 2.6-fold) compared to control HR. At the end of post-elicitation, HR elicited with 10 and 50 μM JA demonstrated significantly increased CUPRAC values (1.6- and 1.3-fold, respectively) in comparison to control cultures. The antioxidant capacity assays displayed a significantly positive correlation with TP and TF contents suggesting that phenolic and flavonoid compounds greatly contributed to the antioxidant activity of HR. Therefore, it could be assumed that JA-mediated enhancement of phenolic contents has a potential role in the antioxidant defense strategy of *H. perforatum* HR cultures.

Keywords: *Antioxidant activity, Elicitation, Hairy roots, Hypericum perforatum, Phenolic compounds*

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Poster presentation *PP02*

NEUROPROTECTIVE ACTIVITY OF PHENOLIC COMPOUNDS FROM *HYPERICUM PERFORATUM* L. TRANSGENIC SHOOT CULTURES: AN *IN VITRO* AND *IN SILICO* APPROACH

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Hypericum perforatum L. transgenic shoot clones (TS B, TS F, and TS H) along with non-transgenic shoots (NTS) were analyzed for their phenolic profile and in vitro inhibitory activity against acetylcholinesterase (AChE) and butyrylcholinesterase (BChE) as key enzymes related to neurodegenerative disorders. The TS clones were spontaneously regenerated from the corresponding hairy roots obtained by *Agrobacterium rhizogenes* A4-mediated transformation. In silico molecular modeling was performed using AutoDock 4.2 software to provide the interactions between selected phenolics and target enzymes. Chromatographic analyses revealed that shoot extracts represent an efficient source of phenolic acids, epicatechin and procyanidin derivatives, quercetin and kaempferol glycosides, anthocyanins, naphthodianthrones, acyl-phloroglucinols, and xanthones. Concerning the in vitro neuroprotective activities, all tested TS clones displayed significantly lower IC50 values for AChE inhibition (from 217.90 to 944.91 μg•mL-1) compared to NTS cultures (1107.23 μg•mL-1). In contrast, shoot extracts did not exhibit strong BChE inhibitory activity and the results were expressed as IC25 values. The IC25 values for BChE inhibition in TS clones were markedly higher (from 480.03 to 1257.49 μg•mL-1) in comparison to NTS (75.12 μg•mL-1). A molecular docking study was conducted on chlorogenic acid, epicatechin, quercitrin, hyperoside, cyanidin 3-O-rhamnoside, pseudohypericin, hyperforin, mangiferin, and cadensin G as dominant phenolic compounds in H. perforatum shoot extracts. According to docking results on AChE, pseudohypericin and cadensin G showed the best docking score with binding energies of -12.00 and -10.62 kcal•mol-1, respectively. Other phenolics showed moderate AChE inhibition with binding energies from -7.30 to -8.49 kcal•mol-1. Docking data on BChE showed that pseudohypericin and hyperforin exhibited the best affinities to the enzyme active pocket (binding energy -14.56 and -11.06 kcal•mol-1, respectively). Other tested ligands displayed intermediate affinities towards BChE with binding energies ranging from -5.84 to -8.94 kcal•mol-1. These results suggested that *H. perforatum* transformed shoots represent a promising source of cholinesterase inhibitory compounds that could be exploited for the preparation of novel phytoproducts for the treatment of neurodegenerative diseases.

Keywords: *Hypericum perforatum,* Molecular docking, Neuroprotective activity, Trasnsgenic shoots

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Poster presentation *PP03*

MICROPROPAGATION OF *CANNABIS SATIVA* L. CULTIVAR BUBBA KUSH X OG KUSH AND PHYTOCANNABINOIDS PRODUCTION

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This study has been made to develop an efficient protocol for micropropagation of *Cannabis sativa* L. cultivar Bubba Kush x OG Kush allowing us to examine cannabinoid production in various *in vitro* cultures. The role of plant growth regulators has been particularly studied. Three *in vitro* culture lines with different morphological characteristics were obtained during cannabis micropropagation and referred to calli, shoots, and plantlets according to their appearance. Callogenesis and shoot induction were examined on apical segments isolated from sterile germinated seedlings and cultivated on a solid MS/B5 medium supplemented with various concentrations (0.05, 0.1, 0.2, 0.5, 1.0, 1.5, and 2.0 mg•L-1) of cytokinin thidiazuron (TDZ). The regenerative potential of shoots was assessed on MS/B5 medium with different concentrations (0.1, 0.5, and 1.0 mg•L-1) of auxin indole-3-butyric acid (IBA). The main goal of this research was to summarize the influence of plant growth regulators on phytocannabinoid production in in vitro cultures of the cultivar Bubba Kush x OG Kush. The HPLC-DAD method for cannabinoid determination was applied from German Pharmacopoeia, DAB, 2018. Calli, shoots and plantlets possessed the capability for the production of five major cannabinoids: cannabidiolic acid (CBDA), cannabidiol (CBD), cannabinol (CBN), Δ9-tetrahydrocannabinol (Δ9-THC), and Δ9-tetrahydrocannabinol acid (Δ9-THCA). In callus cultures cultivated on medium supplemented with 1.0 mg•L-1 TDZ, the highest values for CBDA and Δ9-THCA (4.6±0.05 µg•g-1 DE and 5.5±0.16 µg•g-1 DE, respectively), as well for CBD and Δ9-THC (1.4±0.08 µg•g-1 DE and 3.9±0.16 µg•g-1 DE, respectively) were determined. The lowest used concentration of TDZ (0.05 mg•L-1) in shoot cultures enhanced the production of the neutral cannabinoids: CBD (0.82±0.08 mg•g-1 DE), and Δ9-THC (49.2±1.6 mg•g-1 DE), while shoots showed the greatest capacity for accumulation of cannabinoid acids CBDA (0.7±0.04 mg•g-1 DE) and Δ9-THCA (35.3±1.9 mg•g-1 DE) on media supplemented with 0.1 mg•L-1 TDZ. Regenerated plantlets accumulated the highest values for cannabinoids accumulation such as CBDA (0.7±0.03 mg•g-1 DE), Δ9-THCA (145.5±7.6 mg•g-1 DE), CBD (1.2±0.1 mg•g-1 DE) and Δ9-THC (80.1±1.1 mg•g-1 DE) when cultivated on basal media in comparison to those grown in the presence of auxin IBA. Cannabis in vitro cultures represent promising systems for phytocannabinoid production.

Keywords: *Cannabis; in vitro* culture; cannabinoids

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Poster presentation *PP04*

ANTIOXIDANT ACTIVITY OF BLACK TRUFFLE FROM BOSNIA SPECIES

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Truffles represent a significant source of natural biocomponents that can probably be used as potential therapeutics. For the first time, the study estimated the antioxidant activity against various free radicals in black truffles (Tuber aestivum) collected in the area of northern Bosnia. The antioxidant activity of the liophylised samples of black truffle was determined by using the DPPH, NO scavenging and FRAP methods. The total phenols content and total flavonoids content were determined too. The obtained values for antioxidant activity against DPPH *, NO * radicals and reducing power were: 20,16 ± 1,20 µg TE/ mg dw, 452,61 ± 23,54 µg TE/ mg dw and 15,23 ± 0,19 µg TE/ mg dw, respectively . Total phenols content of investigated black truffle was 33,20 ± 1,35 mg GAE/g dw and total flavonoids content was 2,26 ± 0,15 mg QE/ g dw. The total phenols content, flavonoids content and obtained values of antioxidant activity against different radicals, in the collected Bosnian black truffle indicate a significant health potential of this mushroom species. Further investigations to complete chemical composition of Bosnian black truffle are in progress.

Keywords: black truffle, antioxidant activity, bioactive compounds

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Poster presentation *PP05*

THE CONTENT OF SOME ESSENTIAL METALS IN WILD *ORIGANUM VULGARE* L.

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Since ancient times, in Bosnia and Herzegovina, various plants have been used in traditional medicine for the treatment of various illnesses. They often contain highly active pharmacological components including essential and trace metals. Essential metals have various physiological and biochemical functions in organism and affects to normal human health. This work was aimed to determine the content of some essential metals such as Cu, Cr, Mn, Fe, and Zn in samples of the leaves of wild *Origanum vulgare* L. Samples of wild oregano were collected from meadows in Bugojno, Bosnia and Herzegovina (BH). Wet digestion was used to dissolve the samples, and content of essential metals were analysed by Atomic Absorption Spectrometry (AAS). Metals were present in the samples in different concentrations as follows: Cu 4.75 mg kg^{-1}; Cr 0.0295 mg kg^{-1}; Mn 26.79 mg kg^{-1}; Fe 130.65 mg kg^{-1}; Zn 42.88 mg kg^{-1}. Therefore, leaves of wild *Origanum vulgare* L. can be used in different forms in daily consumption due to the higher content of Fe, Mn, and Zn and their beneficial effects on the normal functioning of the organism without any consequences for human health.

Keywords: *Origanum vulgare* L., essential metals, health benefit

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Poster presentation *PP06*

THE EFFECT OF HEAT ON THE ACTIVITY OF SEVERAL PROTEINS ASSOCIATED WITH STRESS IN THE BROCCOLI PLANT

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This research was done to determine the relationship between metabolism and the activity of some enzymes in the reaction of young broccoli plants to stressors – high temperature, drought and flood. This results might show effect of bioactive compounds. Plants were obtained from ISP GmbH, Quedlinburg and grown on Stender (GmbH) Blue substrate in a phytotron. The control was grown for 18 hours at 23 °C - day and 6 hours at 18 °C - night, and water every other day. On drought 38 °C - day and 33 °C - night and water every seventh day. For flooding, the plants were watered every day with excess water and in the same system as the control. Methods used in the experiment included isolation and measurement of products of primary and secondary metabolism (HPLC and spectrometry), as well as protein isolation and measurement of peroxidase enzyme activity. Proteins from the samples were separated by 12% SDS-PAGE gel electrophoresis, and visualized using Coomassie stain CBB (G-250). Separated proteins were transferred to the membrane and detected and visualized with antibodies for HSP70 (mitochondrion) and Lhcb6 (chloroplast). The amount of proline, dissolved sugars and chlorophyll was higher at high temperature, compared to lower temperature. The activity of the peroxidase enzyme was increased in flood stress and elevated temperature, and decreased in drought. The amounts of HSP70 and Lhcb6 proteins were increased during drought and elevated temperature, and the amount of HSP70 and Lhcb6 decreased during flooding. Young plants showed changes in metabolism after all experiments, and the results show, in agreement, that broccoli is more sensitive to flooding and higher temperatures

Keywords: metabolites, *Brassica oleracea*, HSP, proteins

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Poster presentation *PP07*

PHENOLIC COMPOSITION AND ENZYME INHIBITORY ACTIVITIES OF SELECTED MEDICINAL PLANT EXTRACTS

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After screening 60 plant extracts used in the traditional medicine of Bosnia and Herzegovina, six plant species (*Sambucus nigra, Thymus serpyllum, Filipendula vulgaris, Crataegus rhipidophylla, Epilobium angustifolium* and *Helichrysum italicum*) with a high content of total phenols and flavonoids and antioxidant activity were selected for further research. The aim was to perform a qualitative and quantitative analysis of phenolic constituents, test the enzyme inhibitory potential of the plant extracts and to determine the binding affinity of most abundant phenolic constituents with selected enzymes. The qualitative and quantitative composition of phenolic acids and flavonoids was analysed by the HPLC-DAD method. The inhibition of acetylcholinesterase (AChE) and butyrylcholinesterase (BChE) was assessed by modified Ellman's method, while the binding of selected phenolic compounds to cholinesterase were modeled by the molecular docking method. Among the investigated phenolic acids, the following were detected: chlorogenic acid, gallic acid, protocatechuic acid, ferulic acid and rosmarinic acid. Chlorogenic acid was most abundant reaching 14.02 mg/g in *S. nigra* flowers. Catechin, rutin and quercetin were identified in the majority of extracts. Rutin was most abundant, with the highest concentration found in *S. nigra* flowers (9.39 mg/g). The herbal extracts were thus found to be rich in chlorogenic acid, gallic acid, rutin and quercetin - compounds that contribute to their overall high antioxidant activity and strong enzyme inhibition. All plant extracts showed inhibitory activity against AChE and BChE. Inhibitory concentration, IC50 for AChE inhibition activity ranged from 0.09 mg/mL for *T. serpyllum* to 8.31 mg/mL for *H. italicum* extract, while BChE inhibition activity ranged from 5.35 mg/mL for *T. serpyllum* to 11.01 mg/mL for *E. angustifolim*. According to molecular docking calculations, theoretically, rutin showed the best binding position with AChE and BChE.

Keywords: plant extract, phenolic acids, flavonoids, HPLC-DAD, enzyme inhibition activity, molecular docking

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Poster presentation *PP08*

PHENOLIC PROFILING AND ENZYME INHIBITORY POTENTIAL OF LEAF EXTRACTS USED IN TRADITIONAL MEDICINE OF BOSNIA AND HERZEGOVINA

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The aim of this paper was to characterise the phytochemical profile and bioactivities of four leaf extracts of plants used in traditional medicine of Bosnia and Herzegovina. In a preliminary study, the selected plant species (*Vaccinium myrtillus, Symphytum officinale, Corylus avellana, Rubus fruticosus*) showed to be rich in phenolics, have a strong antioxidant and antimicrobial activity. The objective was to conduct a qualitative and quantitative analysis of phenolic constituents, evaluate the plant extracts' ability to inhibit enzymes, and determine the enzyme binding affinity of the most prevalent phenolic constituents. Using HPLC-DAD the plant extracts were analysed for the presence of 7 phenolic acids and 6 flavonoids in a gradient mode at 270 nm. Furthermore, the structure-affinity relationship of binding between certain phenolic acids and enzymes was assessed, as was the extracts' inhibitory efficacy against acetylcholinesterase (AChE) and butyrylcholinesterase (BChE), using Ellman's spectrophotometric approach. The highest concentration of phenolic acids was found in S. officinale extract with 27.43 mg/g p-coumaric acid and 23.03 mg/g rosmarinic acid. The highest concentration of cholorogenic acid was found in C. avellana. Gallic acid, ferulic and vanillic acid were present in some of the extracts in the range from 0.1 - 0.63 mg/g. Protocatechuic acid was not detected in any of the extracts. Among the flavonoids only catechin, rutin and quercetin were detected. The herbal extracts were thus found to be rich in p-coumaric acid, rosmarinic, chlorogenic and gallic acid, catechin and rutin. The leaf extract of V. myrtillus exhibited the strongest AChE and BChE inhibitory activity (with IC50 0.08 mg/mL and 8.42 mg/mL, respectively). The AChE inhibitory potential of extracts decreased in the following order: *V. myrtillus*, > *S. officinale*, > *R. fruticosus* > *C. avellana*. Computational outcomes showed that hydrogen bonding was one of the key binding forces for binding interaction. By docking, gallic acid has six H-bonds with BChE and five H-bonds with AChE

Keywords: leaf extract; HPLC-DAD; cholinesterase, computation study

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Poster presentation *PP09*

VARIATIONS IN CHEMICAL COMPOSITION OF ESSENTIAL OILS AMONG DIFFERENT EPHEDRA SPECIES

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Ephedra herb is best known for its historical use in traditional medicine, particularly for its stimulant and bronchodilatory properties. Today, this plant is considered a source of bioactive natural products with potential pharmaceutical, cosmetic, nutritional or agro-industrial uses. There are numerous studies on the phytocomposition of Ephedra herb extracts, although reports on the composition and bioactivity of essential oils are limited. In this study, we conducted a comparative GC-MS analysis of essential oils of seven *Ephedra* species (*E. distachya, E. chilensis, E. sinica, E. ciliata, E. foeminea, E. equisetina*, and *E. major*) with different geographical origin and aimed at establishing possible compositional variations among them. A diverse array of volatile compounds was identified in the analysed species. *Ephedra sinica, E. ciliata* and *E. equisetina* were among the investigated species particularly rich in organic volatile compounds. Fatty acids excluded, some of the components found to have a high relative content include α-terpineol, tetramethyl pyrazine (ligustrazine) and p-menth-1-en-9-ol, α-muurolol, coumarin, (E)-isoeugenol and 3,4-dihydrocoumarin. The majority of species contained p-vinyl guaiacol reaching the relative content of 11.52% in *E. major*. The results confirm and expand existing literature findings and present the chemical profile of the essential oils of *E. chilensis* and *E. ciliata* for the first time. Our findings underscore the chemical diversity present within *Ephedra* species and highlight the potential for further exploration of their medicinal properties. Understanding the chemical compositions of these plants is crucial for unlocking their therapeutic potential and directing future pharmacological research and drug development efforts..

Keywords: *Ephedra* herb, essential oil, GC-MS, volatile organic compounds

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Poster presentation *PP10*

CHEMICAL COMPOSITION OF VOLATILE COMPOUNDS FROM GOLDEN SAMPHYRE

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A large part of the Earth's land surface is covered by areas characterized by an increased salt content. These include areas along sea coasts, salt marshes, land deserts and the shores of land lakes. Under conditions of high soil salinity, only a special group of plants can survive on such soils, which have adaptive mechanisms to adapt to life under these extreme conditions and are known as halophytes. The mechanisms by which these plants adapt to increased salinity vary. Insufficient adaptation leads to osmotic and oxidative stress and increased expression of enzymes and phytohormones involved in stress responses. The adaptation responses of halophytes involve a complex network of biochemical mechanisms and a variety of bioactive molecules. Halophytic medicinal plants have long been used to treat various infectious diseases due to their rich phytochemical composition. In the Mediterranean region, rural communities use halophytes both as food and as a source of health-promoting. The specificity of saline habitats leads to a high specificity of the qualitative and quantitative composition of secondary metabolites, which makes halophytes the subject of modern research showing that these plant species can be considered a rich source of various biologically active compounds. In Croatia, halophytes grow not only by the sea, but also on the coast in the spray zone and in some places further away from the sea, where there is a pronounced salinity due to strong winds, so that the soil is salty. The aim of this study was to determine the chemical composition of the essential oils and hydrolates of the air-dried aerial plant material of golden samphire, *Inula crithmoides* L. The essential oil was isolated by hydrodistillation, while the hydrolate was obtained after removal of the essential oil. Headspace solid phase microextraction (HS-SPME) was used to isolate the volatile components from the hydrolate. Chemical analysis of the essential oil and hydrolate were performed by gas chromatography/mass spectrometry (GC/MS). The main components of the essential oil were p-cymene, 8,9-dehydrothymol methyl ether and p-cymene-7-ol, while the main components of the hydrolate were 8,9-dehydrothymol methyl ether, 8,9-dehydrothymol and 8,9-dehydro-4-hydroxythymol dimethyl ether.

Keywords: halophyte, golden samphire, essential oil, hydrolate, GC-MS

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Poster presentation *PP11*

CRATAEGUS MONOGYNA EXTRACTS: A TREASURE TROVE OF ANTIOXIDANTS

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Monogyna (*Crataegus monogyna*), commonly known as hawthorn, has long been revered for its potential health benefits. *Crataegus* plants are rich in phenolic compounds, such as flavonoids, phenolic acids, and proanthocyanins, which have been reported to possess various biological activities, including antioxidant, anti-inflammatory, cardioprotective, antidiabetic, and antimicrobial effects. In this study, we conducted a comprehensive assessment of the antioxidant potential of *C. monogyna*, focusing on its ability to combat oxidative stress and support overall well-being. Through a series of experiments and analyses, we unveiled the remarkable antioxidant properties of *C. monogyna*, which make it a promising candidate for promoting health and preventing various chronic diseases. *C. monogyna* extracts were prepared by two extraction methods, ultrasound extraction and Soxhlet extraction. We used seven different spectrophotometric methods to determine the antioxidant ability of *C. monogyna* extracts, and we also used the Briggs Rauscher method. Spectrophotometric methods for determination of antioxidative activity (AA) were the FRAP method, the Hydrogen peroxide scavenging method, the DMPD method, the Ferrozine method, the Fe(III) ion reduction method, the Mo(VI) reduction method, and the Hydroxyl radical scavenging method. The higher yield is demonstrated by the Soxhlet-extracted sample of *C. monogyna* (18.20%), while the ultrasonic extraction of the same samples reveals that the yield is significantly lower (9.71%). The sample obtained by Soxhlet extraction determined by the Ferrozine method exhibits a very high percentage of AA (80.33%), while the ultrasound extract showed a value of 54.10% of AA. Among the extracts obtained by ultrasonic and Soxhlet extraction, it was noticed that ultrasonic extracts exhibited better AA for the majority of methods. Our findings show that plants of the genus *Crataegus* possess antioxidative activity which is attributed to flavonoids, alkaloids, tannins, saponins, as well as phenolic acids. Flavonoids act as potent metal chelators, scavengers of free radicals, as well as strong antioxidants. This plant may play the significant role in improving human health and underscore the need for further exploration of its applications in nutraceuticals and natural medicine.

Keywords: *Crataegus monogyna*, Antioxidant Activity, Ultrasound Extraction, Soxhlet Extraction

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Poster presentation *PP12*

DETERMINATION OF Co, Fe, Ni AND Zn CONTENT IN ROOT AND LEAF OF *TARAXACUM OFFICINALE*

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Taraxacum officinale, or Dandelion, is a plant that can be found in various ecosystems. Traditionally, Taraxacum officinale is picked up by people in Bosnia and Herzegovina and eaten as salad or used for preparing homemade dandelion honey; moreover, it is used as a medicinal plant, and it has been frequently used in environmental studies. The aim of this study was to assess the safety of using *Taraxacum officinale* in traditional medicine and as food by determining the Fe, Co, Ni, and Zn content in the leaves and roots of *Taraxacum officinale*. Sampling was performed at seven urban locations in the municipality of Visoko in Bosnia and Herzegovina. Root and leaf samples were washed with distilled water and air-dried. The method of wet acid digestion was used. Flame Atomic Absorption Spectrometry (FAAS) was used to perform the metal analysis. Metal content in leaf samples was in the following range: Co (0.41 µg/g - 2.05 µg/g), Fe (75.4 µg/g - 278 µg/g), Ni (4.39 µg/ g - 6.19 µg/g), and Zn (13.88 µg/g - 36 µg/g). Metal content in root samples was in the following range: Co (<LOD - 0.3 µg/g), Fe (208 µg/g - 747 µg/g), Ni (from 1.29 µg/g - 4.69 µg/g), and Zn (16.55 µg/g - 42.99 µg/g). Metal content in leaf and root was in the same range as other similar studies. As usual, caution should be used when consuming or using as traditional medicine spontaneously growing *Taraxacum officinale*, especially from the urban areas.

Keywords: rural locations, dandelion, metals, food, traditional medicine, FAAS

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Poster presentation *PP13*

BIOACTIVE COMPOUNDS FROM *MORCHELLA ESCULENTA PERS*. - THE HEALTH BENEFITS

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Morchella esculenta Pers**.** is top delicacy mushroom from the Morchellaceae family. Every year, large quantities of this mushroom species are harvested and bought for the needs of the foreign market. Unfortunately, it can rarely be found for sale in our markets or shopping centers. It grows from early spring to early summer. Aim of this study was determination of the total phenols content and total flavonoids content and the content of selected essential metals in the samples of *Morchella esculenta* Pers. from area of Visoko and Kakanj, Bosnia and Herzegovina. The obtained values for total phenols content of investigated *Morchella esculenta* Pers**.** was 63,20 ± 1,35 mg GAE/g dw and total flavonoids content was 7,26 ± 0,15 mg QE/ g dw. The lowest and highest element content determined in elemental analysis studies of this mushroom samples were obtained as 14.6-135 for Fe, 35.8-128 for Zn, 72.33-95 for Cu, 0.67-2.14 for Ni, 0.05-5.27 for Co and 3.71-97.5 for Cr. The metal composition of this species reveals high levels of biogenic elements. The total phenols content, flavonoids content and obtained values of essential elements, in the collected Bosnian *Morchella esculenta* Pers**.** indicate a significant health potential of this mushroom species. Completeing of chemical composition of *Morchella esculenta* Pers**.** is in progress.

Keywords: *Morchella esculenta* Pers.; essential elements; bioactive compounds

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Poster presentation *PP14*

PROTECTIVE EFFECTS OF SULFORAPHANE AGAINST INJURY OF ENDOCRINE PANCREAS IN DIABETIC MICE INCLUDE ANTIFERROPTOTIC ACTION

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Sulforaphane (SFN) is a natural sulphur-containing compound with various beneficial biological effects that is found in cruciferous vegetables. Among others, these effects include the activation of Nrf2, a transcription factor that plays an important role in the prevention of ferroptosis, a cell death characterized by the accumulation of labile iron, glutathione (GSH) depletion and lipid peroxidation. Recently, we have demonstrated the antiferroptotic hepatoprotective effect of SFN in diabetic mice. Since ferroptosis has also been confirmed by us and others as one of the causes of β-cell destruction in diabetes, we aimed to investigate the potential of SFN treatment in preventing/eliminating injury of pancreatic islets during diabetes development in vivo. For this purpose, male C57BL/6 mice were divided into four groups (n=8): Control (Crtl), SFN-treated (SFN, 2.5 mg/kg), diabetic (DM, treated with 40 mg/kg streptozotocin from day 1-5) and diabetic SFN-treated (DM+SFN) group. All animals received an intraperitoneal injection of SFN or vehicle for 42 days and were sacrificed on day 43. Pancreata were isolated and prepared for histologic analysis and determination of GSH content. Glycemia was measured once a week during the experiment. Consistent with the improved glycemia, we observed histologic evidence of improvement in the endocrine pancreas of the DM+SFN animals: pancreatic GSH content was restored, average islet size and insulin immunopositivity returned to control values, and there was less insulitis than in the DM group. Lipid peroxidation, which was greatly increased in the DM islets as shown by 4-HNE immunopositivity, also decreased in the DM+SFN animals, while Nrf2 increased. As a sign of improved islet regeneration, PDX-1 immunoexpression strongly increased in this group. To investigate whether SFN as a natural H2S donor affects the endogenous production of this gasotransmitter in islet cells, immunoexpression of cystathionine-β-synthase (CBS) and cystathionine gamma-lyase (CSE) was also analyzed. The results showed that SFN increased CBS expression in islets under diabetogenic insults. In summary, we have shown that SFN prevents diabetogenic islet damage by activating antiferroptotic signaling pathways. Moreover, our results indicate the importance of the H2S/CBS signaling pathway in protecting islet cells from DM insult, indicating this pathway as a potential antidiabetic target.

Keywords: sulforaphane, diabetes, ferroptosis, endocrine pancreas

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Poster presentation *PP15*

CAFFEIC ACID DOWNREGULATES *HIF1A* AND VEGF RECEPTORS MODULATING ENDOTHELIAL-LIKE PROPERTIES OF HUMAN TROPHOBLAST CELLS

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Caffeic acid (CA) is a polyphenolic compound widely present in fruits, vegetables, spices and beverages used in everyday diet. Numerous research indicated beneficial effects of CA on human health including its antioxidant, anti-inflammatory and anticancer activities. Nevertheless, data about the effects of CA in pregnancy, especially on early pregnancy events, are limited. Remodeling of uterine spiral arteries together with trophoblast endovascular differentiation are critical processes for establishing and maintaining a healthy pregnancy. The aim of this study is to investigate how CA affects trophoblast endothelial-like properties assessed with tube formation assay on Matrigel, an *in vitro* angiogenesis assay. Human trophoblast HTR-8/SVneo cell line was used in the experiments. Further, we evaluated the expression of molecular regulators of angiogenesis in HTR-8/SVneo cells after CA treatment by quantitative PCR. Our results showed that preincubation with 10 μM or 100 μM CA for 24 h concentration-dependently inhibited tube formation of HTR-8/SVneo cells as scored by decrease of both tube length and branching points' number of HTR-8/SVneo tubule network. Furthermore, CA downregulated expression of *HIF1A*, gene encoding for the α subunit of transcription factor HIF-1, a major regulator of angiogenesis. HIF-1 activates transcription of different genes which promote angiogenesis such as *VEGFA*. Although CA didn't affect *VEGFA* mRNA levels in treated HTR-8/SVneo cells, it significantly downregulated expression of both *FLT1* and *KDR*, genes encoding for VEGF receptor (VEGFR) 1 and VEGFR2 respectively, potentially affecting VEGF-A angiogenesis-promoting signaling pathway. Although further research is needed, our results indicate that CA could affect processes important for early pregnancy.

Keywords: Caffeic acid; trophoblast; endovascular differentiation; HIF1A; VEGF receptors

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Poster presentation *PP16*

EXAMINATION OF THE ANTIOXIDANT ACTIVITY OF SAMPLES OF *LAVANDULA* SPP.

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Lavender (*Lavandula officinalis*) is a low, perennial shrub that grows in countries around the western Mediterranean. It originates from sunny rocky areas and is primarily cultivated for its essential oils. Various studies have shown that certain types of medicinal plants, such as *Lavandula angustifolia* Miller, containing linalool and linalyl acetate ester, have a mild sedative effect and are used in aromatherapy and phytotherapy to relieve stress. The aim of this study is to determine the antioxidant activity of *Lavandula* spp. essential oil. Samples of plant material were collected from the following areas: Gubavica (municipality of Mostar), and essential oil was obtained by hydrodistillation of the plant material; Šehovina (city of Mostar) for the sample macerated in ethyl acetate; collected aqueous residue after hydrodistillation; commercial essential oil. The determination of the antioxidant activity of the samples was carried out using the following methods: DPPH, ABTS, and TPTZ. Hydrodistilled essential oil, as well as commercial oil, showed weaker antioxidant activity, which was confirmed by all the methods used. Weaker antioxidant activity was also observed in the analysis of the ethyl acetate sample. Monitoring the reaction progress for the aforementioned samples, it was found impossible to calculate the IC50 value. The water sample showed the highest antioxidant activity according to all methods used, confirmed by the IC50 value according to the DPPH method, which was 0.032 ± 0.006 mg/mL, while for the ABTS method, the IC50 value was 0.135 ± 0.003 mg/mL. Also, according to the TPTZ method, the water sample exhibited the best antioxidant activity. By determining the chemical composition and antioxidant activity of all samples, as well as reviewing the obtained results, it was concluded that the essential oils (hydrodistilled and commercial) and the ethyl acetate sample did not show good antioxidant activity, while the water sample displayed significant antioxidant activity according to all applied methods, as expected due to the presence of phenolic components attributed to significant antioxidant properties.

Keywords: *Lavandula officinalis*, antioxidant activity, DPPH, ABTS, TPTZ

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Poster presentation *PP17*

THE CONTENT OF SELECTED METALS IN TEAS FROM SARAJEVO, BIH

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Tea is one of the most popular and consumed beverages in the world, whose beneficial effect on human health is particularly emphasized by researchers. One of the parameters that is very often determined in teas is the metal content. It is necessary to monitor metal presence in food because some metals are essential while others are toxic; moreover, it is important to point out that both the lack and elevated concentrations of essential elements can have a negative impact on human health. In this work, the content of Co, Cd, Cu, Fe, Mn, Ni, Pb and Zn in 13 air dried tea samples was investigated by using atomic absorption spectrometry - flame technique (FAAS). The collected samples are commercially available on the Sarajevo market or are collected in the wider area of the Sarajevo basin. Samples were prepared by using acid digestion. The metal content in the tea samples ranged from: (0.85-12.92) mg/kg for Cu, <LOD-523 mg/kg for Mn, <LOD-512 mg/kg for Fe, <LOD-1.68 mg/kg for Co, <LOD-3.11 mg/kg for Ni. Cd was determined only in one tea sample (0.42 mg/kg). The content of Zn ranged from <LOD to 98.16 mg/kg in all investigated teas, while Pb concentrations in all teas were below the limit of detection (<LOD) of FAAS. It can be concluded that teas samples are a significant source of heavy metals since the obtained results suggest that all but one metal are present in the researched samples.

Keywords: tea, metals, FAAS, Sarajevo

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Poster presentation *PP18*

DETERMINATION OF HEAVY METAL LEVELS IN DIFFERENT CINNAMON SAMPLES

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Spices are used both in the food industry during processing and in households for the purpose of achieving certain sensorial properties of food. In addition to giving food a certain taste or smell, many spices show positive effects on the state of the organism. Cinnamon is one of the oldest and most widely used spices. Besides its pronounced smell and pleasant taste, recent research shows that cinnamon is an antioxidant, that it improves digestion, helps people with type II diabetes, and has a beneficial effect on cancerous diseases, autoimmune diseases and various viruses. Spices are significant sources of heavy metals which are present in different concentrations. Despite their positive effects, spices can have a high content of heavy metals, originating from the environment, during production, processing and storage. In this paper, the content of Ca, Cd, Cu, Fe, Mg, Mn, Ni, Pb and Zn in 14 samples of cinnamon (powder or stick) was determined by using flame atomic absorption spectrometry (FAAS). All samples are purchased from the Sarajevo market and prepared by acid digestion. Metal content in cinnamon samples ranged from: 2.26-11.36 μg/g for Cu, 39.63-252 μg/g for Mn, 20.17-443 μg/g for Fe, 0.66-0.72 μg/g for Ni, 0.96-50.67 μg/g for Zn, 1297-2677 μg/g for Ca and 52.49-103 μg/g for Mg. Cd and Pb concentrations were below the detection limit of the used method. Based on the obtained results, it can be concluded that cinnamon samples are a significant source of metals. However, consumers should be careful with excessive consumption of cinnamon as this research did not include its organic components nor other elements, which is certainly recommended for further research.

Keywords: cinnamon, metal, FAAS, Sarajevo

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Poster presentation *PP19*

DETERMINATION OF ANTIOXIDANT ACTIVITY OF *FRAXINUS* EXTRACTS: A COMPARATIVE STUDY

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Fraxinus, commonly known as ash trees, has gained significant attention in recent years due to its potential therapeutic properties, particularly its antioxidant activity. This study presents a novel approach utilizing the Briggs-Rauscher method to evaluate the antioxidant activity of *Fraxinus* extracts. The extraction process involved Soxhlet extraction and ultrasound extraction to obtain extracts from *Fraxinus*. Two species of *Fraxinus* were used as samples. The extracts were then subjected to the Briggs-Rauscher antioxidant assay, which measures the inhibition of the oscillating reaction between hydrogen peroxide, potassium iodate, malonic acid, sulfuric acid, manganese(II) sulfate, and starch in the presence of an antioxidant. Preliminary results indicate that *Fraxinus* extracts possess substantial antioxidant activity, with differences observed based on the type of extraction and the plant part extracted. Utilizing *Fraxinus angustifolia* Vahl. ultrasonic bark extract revealed higher antioxidant activity compared to *Fraxinus pennsylvanica* Marsh., with leaves demonstrating superior antioxidant activity. According to the type of extraction, a sample of *Fraxinus angustifolia* Vahl. bark extract prepared via ultrasound, compared to Soxhlet extraction, showed higher antioxidant activity. These findings underscore the potential of Fraxinus extracts as a promising natural source of antioxidants, highlighting the importance of solvent selection and plant part extraction in maximizing antioxidant activity. Further investigations are warranted to elucidate the specific antioxidant compounds responsible for the observed effects and their potential applications in the pharmaceutical and nutraceutical industries.

Keywords: *Fraxinus angustifolia* Vahl., *Fraxinus pennsylvanica* Marsh., Antioxidant Activity, Ultrasound Extraction, Soxhlet Extraction

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Poster presentation *PP20*

BENEFITS OF RESVERATROL FOR HUMAN AND PLANT HEALTH

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Resveratrol (3,4′,5-trihydroxy-1,2-diphenylethylene) is a phytochemical belonging to the stilbene class. In nature, resveratrol occurs as a trans-isomer, with greater biological activity, and in greater quantity, compared to its transformation product, cis-isomer. It is naturally detected in more than 70 plant species, including blueberries, raspberries, mulberries, and peanuts, while in the human diet, grapes rank as the main source of this compound. Resveratrol is synthesized in all parts of the grapevine, however, it is most prevalent in grapes and less in the leaves, shoots, and buds. The highest concentration of resveratrol in berries can be isolated from the skin, and seed. When it comes to its benefits for human health, resveratrol does not stop attracting attention. It has been established to possess antioxidant, cardioprotective, and anticarcinogenic effects in numerous studies. Furthermore, due to its presence in red wine, resveratrol is considered the cause of the French paradox - a relatively low risk of coronary disease, despite a diet saturated with fats. Although naturally present in grapevine, resveratrol synthesis in plants is induced by stress, as a part of their defense mechanism. Stress triggers can be various biotic and abiotic factors. Resveratrol production is mainly induced by infection of phytopathogenic microorganisms, and in the initial stage of infection, it is present in a considerably larger amount. Thus, inhibition of the pathogens' growth and prevention of infection progress, until climate conditions become unfavorable for their further development and reproduction, are the main purpose of resveratrol. Therefore, it is considered that resveratrol is directly linked to the grapevines' resistance to some of the most economically important plant pathogens, which makes it one of the carriers of the induced mechanisms of grapevine defense. One of the ways to increase the amount of this compound in grapes is to reduce the use of fungicides in vine protection, relying on natural resistance. Precisely, this resistance to diseases and pests enables the growing of certain grapevine varieties according to the principles of organic production, as a prerequisite for a higher content of resveratrol.

Keywords: resveratrol, grapes, health, plants, plant protection

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Poster presentation *PP21*

RESVERATROL IN GRAPES: PRE-ANALYTICAL PROCEDURES

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Many secondary plant metabolites have significant beneficial effects on human, animal, and plant health. The grapevine (*Vitis vinifera* L.), is an important source of these compounds in the human diet, which is the reason why all positive effects of its consumption have been studied during the past few decades. One of the mentioned compounds is resveratrol. Since its discovery in 1939, its importance has been determined, especially in the prevention and treatment of many cardiovascular conditions, after which anti-inflammatory, anti-cancer, neuroprotective, immunomodulatory effects, and many others were established. Much research has been conducted on this chemical, revealing its benefits and drawbacks. To investigate novel avenues for resveratrol further exploitation, the initial and most important step involves its isolation from botanical sources, after which its content is determined by different chromatographic techniques. The extraction is preceded by sample preparation so the biomolecules stay preserved. During resveratrol extraction from grapes, the quantity of water in the berries must be taken into account. Conversely, drying grape samples can be achieved through various methods, but it can lead to pathogen development, or resveratrol degradation due to inadequate drying temperature. For decades, many techniques have been utilized for resveratrol extraction, which can be classified as conventional or unconventional. The first class of extraction methods includes Soxhlet extraction, solid-phase extraction, maceration, and liquid-liquid extraction, which extensively rely on solvent and time consumption, as well as human engagement. The group of unconventional extraction methods involves enzyme-assisted extraction, QuEChERS extraction, ultrasonication-assisted extraction, and supercritical fluid, which were developed to compensate for the shortcomings of conventional methods and improve the process of resveratrol extraction from the grape matrix. Practically, low-cost approaches with undemanding equipment should be prioritized. To ensure environmental sustainability, it is important to reasonably employ solvent consumption, choose less harmful options, and minimize human engagement while keeping extraction time short. Isolation of resveratrol is successfully finalized when a high extraction yield is achieved, while its verification could be ensured through subsequent chromatographic analysis of gained extracts employing contemporary techniques such as high-performance liquid chromatography, gas chromatography, ultra-high-pressure liquid chromatography, tandem mass liquid chromatography, etc.

Keywords: resveratrol, extraction, grapes

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Poster presentation *PP22*

THE INFLUENCE OF THE CHLORINE POSITION IN ACETYL-11-KETO-B-BOSWELLIC ACID ON THE INHIBITION OF 5-LIPOXYGENASE AND DRUGLIKENESS PROPERTIES

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Lipoxygenases are a family of enzymes that catalyze the enzymatic peroxidation of polyunsaturated fatty acids (PUFA). Products of this process are lipid peroxides, mediators of many pathological conditions, including inflammation, cancer and neurodegenerative diseases. 5-lipoxygenase is found in vasculature, in endothelial cells, as well as throughout the central nervous system, in both neurons and glia. Arachidonic acid, one of the most important PUFA in mammalian cells, is a substrate for 5-lipoxygenase. Boswellic acids are distinguished as 5-lipoxygenase inhibitors and are present in the resin of Boswellia serrata. From the 45 designed and by molecular docking tested boswellic acid derivatives, five chlorine substituted derivatives with the lowest binding energy values toward 5-lipoxygenase were chosen for further investigation. The designed derivatives were obtained by introducing chlorine atoms at different positions of the basic structure of acetyl-11-keto-β-boswellic acid (AKBA). Using the online platform Ochem.eu. additional druglikeness characteristics (log P, PSA, ...) were calculated for these derivates as well. Values of the binding energy for tested compounds obtained by YASARA 23.9.29 software ranged from -9.76 to -9.37 kcal/mol. Besides these values, dissociation constants were also predicted, and the results ranged from 0.070 to 0.137 mM. Druglikeness values for lipohilicity ranged from 5.5 to 6.1, which exceeded recommended log P for druglikeness parameters, partially because of the chlorine introduction. Another reason for high log P values was the original steroidal structure of boswellic acids, however, since boswellic acids are distinguished as 5-lipoxygenase inhibitors, the high logP values were not limiting factor. Introduction of chlorine substituents at different positions enhanced the binding affinity of boswellic acid derivatives towards 5-lipoxygenase compared to that of the basic structure of acetyl-11-keto-β-boswellic acid, making these derivatives interesting alternatives for inhibiting 5-lipoxygenase.

Keywords: sulforaphane, diabetes, ferroptosis, endocrine pancreas

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Poster presentation *PP23*

OPTIMIZATION OF BOSWELLIC ACID DERIVATIVES AS ANTI-INFLAMMATORY AGENTS

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Inflammation is a part of a non-specific immune response that occurs as a reaction to any type of physical injury characterized by redness, swelling, pain, heat and loss of function. Lipoxygenases are a family of enzymes that catalyze the enzymatic peroxidation of polyunsaturated fatty acids. Products of this process are lipid peroxides, mediators of many pathological conditions, including inflammation, cancer and neurodegenerative diseases. Boswellic acids are distinguished as 5-lipoxygenase inhibitors; namely keto boswellic and acetyl keto boswellic acid. These compounds are present in the resin of Boswellia species. Using YASARA 23.9.29 molecular docking software, 45 designed boswellic acid derivatives were tested and five best derivatives with alkoxy groups with the lowest binding energy to 5-lipoxygenase were selected for further studies. Besides binding energy values, dissociation constants were also calculated. For the selected derivatives, other druglikeness properties (log P, PSA, ...) were calculated using the online platform Ochem.eu. Binding energy values ranged from -9.91 to -9.37 kcal/mol, while dissociation constants ranged from 0.054 to 0.136 mM. These values indicated higher affinity of designed compounds toward the 5-lipoxygenase enzyme compared to the basic structure of acetyl-11-keto-β-boswellic acid. Lipohilicity values ranged from 4.3 to 5.3, which were somewhat higher log P values than what is usually recommended from druglikeness parameters, however, having in mind the complex and steroidal structure of boswellic acids, these results were expected. Introduction of alkoxy substituents enhanced the binding affinity of acetyl-11-keto-β-boswellic acid derivatives towards 5-lipoxygenase, making these derivatives promising anti-inflammatory agents.

Keywords: 5-lipoxygenase, acetyl-11-keto-β-boswellic acid, alkoxy substituents, molecular docking, druglikeness properties

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Poster presentation *PP24*

WINE EVALUATION : MAN VS. MACHINE LEARNING AND APPLICATION OF MOLECULAR DESCRIPTORS FOR WINE EVALUATION - A META-ANALYSIS

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The evaluation of wine by professional wine tasters carries a great responsibility and a significant impact on the financial position of the wine on the market; The olfactory part in the evaluation of wine carries a majority part of the overall evaluation, which is subconsciously emotionally correlated when evaluated by a human, which affects the objectivity of evaluation, especially when tasting a wine whose olfactory impression is similar to some wine already tasted, on the special occasion; The fact that there are only a few thousand top professional wine tasters on the planet, and their training is long-term and challenging, where the demand for top wines is growing globally, leads to a multi-decade tendency for, at least partially, artificial evaluation of wine and artificial obtaining of the Olfactory Profile of wine, with the need of objectification of that process, in which calculation methods through Molecular Descriptors (MD), linked to specific Machine Learning Models (MLM) - would play a key role. The conducted meta-analysis indicates that olfactory assessment via MLM /MD is currently only partially sufficient, even as a supportive form of olfactory assessment, based on an incomplete and possibly expandable matrix of artificial assessment, and due to the impossibility of clearly predicting the "direction" and the scope of wine maturation, the appearance of "silent" periods in that process, as well as the eventual appearance of unobserved wine defects, and other factors; In this sense, new directions for the creation of dedicated MDs are proposed, based on oscillation-vibrational correlated algorithms of potential olfactory-relevant substances in the must and on the analytical part of the grape's vinification Profile - through which one can get, at least partially, olfactory-predictive profile of the wine, especially in sense of possible Archiving; Wider MLM - which would include the pedological-agro-meteorological, anti-parasite protective and vinification-technological annual Grape Profiles - would for the most part round off the possibility of reaching the required level of olfactory profiling, for at least a partial MLM /MD olfactory-objectified and standardized evaluation of wine, approximately equal to human.

Keywords: Olfactory evaluation of wine; Olfactory profile of wine; Machine Learning, Molecular Descriptors

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Poster presentation *PP25*

CHARACTERIZATION AND RELATIONSHIP ANALYSIS OF ANTIOXIDANT AND ANTI-INFLAMMATORY PEPTIDES IN POMELO FRUITLET ALBUMIN

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Several macromolecules from the pomelo fruitlet (PF) have demonstrated functional potential in previous research. In this study, pomelo fruitlet albumin (PFA) was extracted from PF, its anti-inflammatory and anti oxidant properties were assessed using enzyme-linked immunosorbent assays, and its capacity to clear free radicals was measured. Meanwhile, we hypothesize that the amino acid sequence may affect the anti- inflammatory and antioxidant properties, and the two may rely on common significant sites within the amino acid sequence. Therefore, we analyzed the amino acid sequence using a quantitative structure–activity rela tionship model to explore the connection between the antioxidant and anti-inflammatory capacities of PFA. Both capacities were closely associated with six sites within the amino acid sequence. Collectively, this study illus trates that PFA exhibits both anti-inflammatory and antioxidant capacities, with six specific sites identified as significantly affecting both activities.

Keywords: Pomelo fruitlet albumin; Antioxidant; Anti-inflammatory; QSAR Site prediction

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Poster presentation *PP26*

WHEAT GERM-DERIVED PEPTIDE ALLEVIATES DEXTRAN SULFATE SODIUM INDUCED COLITIS IN MICE

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This study explores the protective properties and potential mechanisms of wheat-germ-derived peptide APEPEPAF (APE) against ulcerative colitis. Colitis mice induced by dextran sulfate sodium (DSS) were used as the animal model. The results showed that the APE peptide could alleviate colitis symptoms including weight loss, colon shortening, and histopathological changes. This peptide attenuated the generation of inflammatory cytokines by inhibiting the phosphorylation of protein kinase PKCζ (Thr410) and NF-κB transcriptional activity in DSS-induced mice, suggesting that APE ameliorates colitis inflammation by regulating the PKCζ/NF-κB signaling pathway. APE also preserved the barrier function of the colon by dose-dependently promoting the expression of tight junction proteins (claudin-1, zonula occluded-1, and occludin). In addition, APE significantly decreased the abundance of Bacteroides and increased the abundance of Dubosiella and Lachnospiraceae_UCG-006 to improve the intestinal flora imbalance in DSS-induced colitis mice. Therefore, wheat germ peptide APE can be used as a novel agent and dietary supplement to treat ulcerative colitis.

Keywords: wheat germ, peptide, colitis, PKCζ, NF-κB

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Poster presentation *PP27*

EXPLORING THE ANTI-SKIN INFLAMMATION SUBSTANCES AND MECHANISM OF *PAEONIA LACTIFLORA* PALL. FLOWER VIA NETWORK PHARMACOLOGY-HPLC INTEGRATION

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Paeonia lactiflora Pall. is a perennial herb in the family Paeoniaceae, genus Paeonia, and has a long history of medicinal use in China as a traditional Chinese medicine. The flowers of *Paeonia lactiflora* Pall. are important organs in the growth process of *Paeonia lactiflora* Pall. and have a variety of biological activities. Skin is considered the largest organ of the body and constitutes a physical barrier protecting it from injury, infection, water, and electrolyte loss, as well as being an important player of the immune system. Inflammation partakes in physiological mechanisms mediating skin healing and repair post-injury, whilst it is a central feature in several dermatoses and underpins cancer development. Therefore, it is important to study the research of natural medicines for the prevention and treatment of skin inflammation. *Paeonia lactiflora* Pall. flower has several bioactive components that are known to have antioxidant activity, however, the complex components in *Paeonia lactiflora* Pall. flower extracts have been less studied. Therefore, we investigated the composition of compounds in *Paeonia lactiflora* Pall. flower extracts and studied their role in interfering with skin inflammation. We investigated the role of *Paeonia lactiflora* Pall. flower extract in inflammation in RAW 264.7. The results showed that *Paeonia lactiflora* Pall. flower extract inhibited the activation of the MAPK signaling pathway by affecting the expression of inflammatory factors in RAW 264.7. The results indicate that *Paeonia lactiflora* Pall. flower has the potential for development in skin inflammation.

Keywords: HPLC; Skin inflammation; Network Pharmacology; MAPK signaling pathway

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Poster presentation *PP28*

BIOACTIVE PROPERTIES OF SELECTED *DIANTHUS* SPECIES

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The present study aimed to evaluate bioactive potential and activities of the methanolic extracts of four selected *Dianthus* species growing in Bosnia and Herzegovina (*Dianthus sylvestris, Dianthus giganteus, Dianthus deltoides, Dianthus petraeus*). Aerial parts of investigated *Dianthus* species were collected at the full flowering stage and used for the analysis. The total phenolic contents and total flavonoid of plant extracts were determined by Folin–Ciocalteau reagent and aluminum chloride calorimetric assay, respectively. DPPH methods was employed to determine the antioxidant potential. The flower methanolic *Dianthus deltoides* extract showed the highest values of total phenolic content (65,78 mgGAE/gDW) followed by flower methanolic *Diantus sylvestris* extract (61,76 mgGAE/gDW). A similar trend was observed with the content of total flavonoids, where the methanol extracts of the flower had a higher content compared to the vegetative part (stem and leaf). All examined extracts of all four species of the genus *Dianthus* showed strong antioxidant properties with a statistically lower antioxidant capacity of the extract of the vegetative part of the species *D. deltoides*. However, for the same species, the lowest IC50 value was recorded for the flower extract (0.18 mg/ml), i.e. the strongest antioxidant effect. *D. deltoides* and *D. sylvestris* extracts showed significant differences between the IC50 values of the flower extract and the extract of the vegetative part of the plant.

Keywords: *Dianthus,* bioactive potential, natural resources

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Poster presentation *PP29*

CELERY SOLUBLE DIETARY FIBER ANTAGONIZE FLAVONOIDS AMELIORATIVE EFFECT ON DEXTRAN-SODIUM-SULFATE-INDUCED COLITIS IN MICE

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Dietary fiber and flavonoids are promising drugs reported in the treatment of inflammatory bowel disease (IBD). However, it is unclear the interaction between dietary fiber and flavonoids as typical in a whole food scenario. The therapeutic effect of celery, kale, and red chicory powders on colitis mice using non-group feeding cages was investigated. Further, the efficacy of whole celery, celery soluble dietary fiber (CSDF), celery insoluble dietary fiber (CIDF), celery flavonoids (CF), CSDF+CF and CIDF+CF in IBD mice model was assessed to dissect protective effect to attribute to which component(s) in such complex matrix. Administration of kale and red chicory significantly restored body weight, DAI score, and colon length in colonic mice, and celery showed the weakest effects. Administration of either CSDF or CF markedly improved the histological damage, increased colonic mucus expression, and reduced colonic MPO/iNOS activities, and IL-6/IL-1β levels. However, CSDF+CF showed weaker improvement than CF or SDF in most physical and biochemical signs. Furthermore, CSDF and CF decreased intestinal *g_Escherichia-Shihella* and *g_Clostridium_sensu_stricto_1* induced by DSS administration. Interestingly, celery flavonoid promoted *g_Akkermansia* proliferation both *in vivo* and *in vitro*, and which can be inhibited by CSDF. This study revealed for the first time that CSDF can suppress the protective effect of CF on intestinal health by inhibiting *g_Akkermansia*, and clarified that the decreased efficacy of celery whole food on colitis was mediated by an antagonism between CSDF and CF. Moreover, this study presents for the first time that interaction between soluble dietary fiber and flavonoids *in vivo* can ameliorate the efficacy of dietary fiber or flavonoids when administered alone suggestive for an antagonistic effect.

Keywords: Celery dietary fiber, Celery flavonoids, Colitis, Gut microbiota

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Poster presentation *PP30*

WHAT ARE HEALTHY PHYTOCHEMICALS IN TRADITIONAL LEAFY KALE (*BRASSICA OLERACEA* L. VAR. *ACEPHALA* DC.) AND WILD CABBAGE (*BRASSICA INCANA* TEN.)

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Cabbage (genus *Brassica*, family Brassicaceae) comprises a number of species that are cultivated all over the world and are an important part of the human diet as fresh and preserved vegetables, vegetable oils and spices. The health benefits of a *Brassica*-based diet have been recognized since ancient times. Brassica plants have recently become an interesting topic of research as their bioactive phytochemicals (mainly glucosinolates and polyphenols) have been associated with various health benefits, e.g. anti-cancer, antioxidant, anti-inflammatory and cardioprotective activities. We are particularly interested in the traditional Croatian leaf cabbage (*Brassica oleracea* L. var. *acephala*) and its ancestor, the wild cabbage (*B. incana*), which inhabits the vertical cliffs and calcareous rocky slopes of the south-eastern Mediterranean. Both species are morphologically similar and have low growth requirements and a high tolerance to drought, high temperatures and salinity, which is positive in the era of climate change. The aim of this study was to investigate the primary and secondary metabolites of these two species and, in particular, to identify the phenolic compounds and the antioxidant and anticancer potential of the phenolic extracts. The phenolic groups and antioxidant activity were determined spectrophotometrically, selected phenolic compounds (ferulic acid, sinapic acid, salicylic acid, kaempferol and quercetin) were analyzed by LC-MS/MS, and the anticancer potential was investigated *in vitro* using HeLa cells. The extracts of both plant species are rich in phenolic compounds and showed significant antioxidant activity at similar levels. LC-MS/MS detected sinapic acid as the most abundant phenolic acid, followed by ferulic acid, while salicylic acid was present in lower concentrations. A comparative analysis showed that wild cabbage contained significantly more sinapic acid, while kale contained more kaempferol and quercetin. Both *Brassica* extracts showed an antiproliferative effect on HeLa cells at a concentration of 50 μg mL^{-1}, while they did not affect the proliferation of normal human skin fibroblasts. Wild cabbage extract also showed an antiproliferative effect on HeLa cells at a lower concentration of 10 μg mL^{-1} of the extracts. Clonogenic analysis also showed the inhibitory effect of the extracts on HeLa colony growth.

Keywords: *Brassica* sp.; phenolic compounds; antioxidative activity; antiproliferative activity;

HeLa cells

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Poster presentation *PP31*

AN INTEGRATED "ISOLATION - DELIVERY" COUPLING PROCESS OF ALKALOIDS IN COPTIS CHINENSIS FRANCH. BASED ON AEROGEL NANOMATERIAL

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Coptis chinensis Franch., one of the most famous Chinese medicines, has been used for thousands of years. Modern pharmacological studies revealed that alkaloids are the main chemical component and bioactivity source of *Coptis chinensis*, with excellent antibacterial, antitumour and hypoglycaemic, etc. However, the technical barrier of alkaloids isolation and purification and the functional deficiency of poor bioavailability have become the constraints for the development of the clinical application of *Coptis chinensis*. Therefore, it is urgent to develop an efficient isolation and delivery system to improve the stability and drug-like properties of alkaloids in *Coptis chinensis*. Based on this, we designed and synthesized the resorcinol-formaldehyde aerogel nanomaterial of high porosity, developed mesoporous structure and abundant surface group by 'sol-gel' process. And then the microenvironment (pore size from 7 nm to 2 μm) and chemical functionality (surface electrical properties from -30 mV to -43 mV) of aerogel were finely tuned. Subsequently, after selective adsorption and isolation of alkaloids in *Coptis chinensis* by resorcinol-formaldehyde aerogel, the alkaloids-loaded aerogel was directly used as alkaloids sustained release formulation. Combining the mechanisms of 'selective isolation of alkaloids based on electrostatic interaction and size sieve effect' and 'sustained release of alkaloids based on high tortuosity of pore structure and specific affinity', an integrated 'isolation - delivery' coupling process of alkaloids in *Coptis chinensis* based on resorcinol-formaldehyde aerogel was constructed. The results showed that the coupling process of 'isolation - delivery' of alkaloids could significantly increase the purity of alkaloids to approximately 90%. At the same time, the in vitro release time of alkaloids was up to 6 h, and the release efficiency was more than 80%. In conclusion, this study would creatively provide a new strategy and theoretical basis for the development of modern and innovative application of phytomedicine.

Keywords: Alkaloids in *Coptis chinensis* Franch.; Resorcinol-formaldehyde aerogel; 'Isolation - delivery' coupling process

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Poster presentation *PP32*

ANTIOXIDANT CAPACITY AND HEAVY METALS IN SELECTED MEDICAL PLANTS

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Traditional medicinal plants such as *Punica granatum* (Lythraceae), *Chaerophyllum coloratum* (Apiaceae), *Menyanthes trifoliata* (Menyanthaceae), *Teucrium montanum* (Lamiaceae), *Petteria ramentacea* (Fabaceae), and *Dictamnus albus* (Rutaceae) have long been utilized for their therapeutic potential in managing various ailments. This study aims to investigate their antioxidant capabilities, positioning them as potential natural sources of antioxidants. The antioxidant capacities of these selected plants were assessed through the ferric-reducing antioxidant power (FRAP) and CUPric reducing antioxidant capacity assays, Fe chelation, hydroxyl radicals' removal, alongside the quantification of total phenolic compounds. Additionally, the concentration of heavy metals (Cu and Fe) was determined using atomic absorption spectrophotometry to ensure safety. The findings indicate significant variability in antioxidant activities across the various plant species examined in this study, with certain plants exhibiting notable richness in natural antioxidants. Among these, *P. granatum* displayed the highest phenolic compound content, closely followed by *T. montanum* and *M. trifoliata*. Moreover, *P. granatum* and *T. montanum* exhibited superior Fe chelating ability and Cu reduction capacity, indicative of their potent antioxidative capabilities. Conversely, *D. albus* demonstrated comparatively lower antioxidative capacity, Fe chelating ability, Cu reduction capacity, and phenolic compound concentration. Moreover, investigating the correlation between the reduction of Fe and Cu and the concentration of phenolic compounds reveals a strong association, with a high intensity correlation coefficient (R=0.796 for Fe and R=0.774 for Cu). This underscores the significant role of phenolic compounds as antioxidants. Crucially, heavy metal concentrations (Fe (<100 mg kg^{-1}) and Cu (<15 mg kg^{-1})) in all plants fell within permissible limits, ensuring their safety for medicinal use. In conclusion, the investigated medicinal plants showcase promising antioxidant potential, with *P. granatum* and *T. montanum* emerging as particularly robust candidates. These findings underscore their significance as natural sources of antioxidants for potential therapeutic applications.

Keywords: antioxidant capacity, heavy metals, medical plants, natural products, phenolic compounds

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Poster presentation *PP33*

NATURE'S PHARMACY: PHYTOCHEMICALS AND PROBIOTICS AS THE GUARDIANS OF GUT WELLNESS AND IMMUNOLOGICAL HEALTH

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Recent studies have highlighted the significant role of dietary phytochemicals and probiotics in promoting a healthy gut microbiota and modulating immune responses. The human gut microbiota plays a pivotal role in health and disease. Diet is a key modulator of gut microbiota composition and function, which then influences immune and other systems. Phytochemicals, contribute to the health benefits associated with a plant-based diet, include polyphenols, carotenoids, glucosinolates, saponins, phytosterols and other. Adittionaly, dietary fibers, which serve as prebiotics enhance antioxidant activity, anti-inflammatory effects, cancer prevention, cardiovascular health and immune support. Understanding mechanisms of how certain compounds in diet influence human physiology is crucial for elucidating the link between diet, gut health and the development of various chronic diseases. This study aims to comprehensively investigate the intricate interplay between dietary phytochemicals and probiotics in modulating the composition and functionality of the gut microbiota, thereby investigating their pivotal role as guardians of gut wellness and immunological health within the framework of human physiology and the pathogenesis of chronic diseases. This research endeavors to provide valuable insights into the potential therapeutic strategies and ultimately prevent the onset or progression of chronic diseases associated with dysbiosis and immune dysregulation. A systematic review was conducted utilizing PubMed, Scopus and Web of Science databases. Eligible studies included dietary intervention trials, observational cohorts and cross-sectional analyses. Data extraction covered study design, demographics, interventions, microbiota analyses, immunological assays and statistical methods, while quality assessment ensured reliability. Plant-based diet abundant in fruits, vegetables, whole, non-gluten grains, nuts, seeds and legumes ensures a broad intake of these beneficial phytochemicals. Polyphenols have been shown to exhibit prebiotic-like effects and promote the growth of beneficial gut bacteria. These bacteria produce metabolites that enhance gut barrier function and reduce inflammation. Dietary fibers are fermented by gut bacteria into short-chain fatty acids (SCFAs), which have immunomodulatory properties. One SCFA, butyrate has been shown to enhance the differentiation of regulatory T cells (Tregs) and inhibit the production of pro-inflammatory cytokines, thus contributing to an anti-inflammatory immune environment. Specific probiotic strains, such as *Lactobacillus rhamnosus* and *Bifidobacterium longum*, have been demonstrated to reduce Th17 cell populations, thereby ameliorating symptoms in autoimmune diseases. Furthermore, they lower the production of pro-inflammatory cytokines and enhancing anti-inflammatory responses. On the other side, diet based on animal products has been observed to alter the balance of gut bacteria, often favoring a pro-inflammatory microbial environment. Animal-based foods, particularly those high in saturated fats, heme iron and certain proteins, can promote a pro-inflammatory gut microbiota. The metabolites

produced from these compounds can damage the gut barrier, increase intestinal permeability and trigger systemic inflammation. Incorporating a diverse range of phytochemical-rich foods into the diet can provide numerous immune-boosting properties and help prevent chronic diseases. By promoting the growth of beneficial bacteria through the intake of these phytochemicals and dietary fibers, a diet rich in plant-based foods supports gut health and immune function. Understanding these mechanisms highlights the crucial role of dietary choices in maintaining gut health, reducing inflammation and preventing inflammation-related diseases. Thus, prioritizing a variety of fruits, vegetables, nuts, seeds, and whole grains can significantly contribute to overall well-being and long-term health.

Keywords: plant-based diet; vegan; phytochemicals; gut health; immune system

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Poster competition *PC01*

PHYTOCHEMICAL CHARACTERIZATION AND ANTIOXIDANT CAPACITY OF *CALENDULA OFFICINALIS* L.

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Since ancient times, *Calendula officinalis* L. (marigold) has been used for the prevention and treatment of various diseases. This herb is medicinal and originates from the Asteraceae family. It contains bioactive compounds that have many pharmacological activities. The objective of this study was to determine the content of total phenolic compounds, phenolic acids, flavonoids, coumarins, and anthocyanins, as well as the antioxidant capacity of *C. officinalis* L. extracts. Samples of this herb (flowers, leaves, and stems) were collected in Lukavica in 2020 and 2021, and in Hotonj in 2021. These samples were exposed to Soxhlet extraction (S.E.) and ultrasound-assisted extraction (U.E.) with 96% ethanol as a solvent. For determining the content of total phenolic compounds, gallic acid (GA) was used as a standard. Flowers (U.E.) collected in Lukavica 2020 have showed the highest content of total phenolic compounds (1.63 ± 0.02 mgEGA/gextract). The quantity of total phenolic acids was measured using caffeic acid (CA) as a standard. The flowers (S.E.) taken in Lukavica 2021 had the maximum level (317.20 ± 0.06 mgECA/gextract). Quercetin (Q) was used as a standard in determining the content of total flavonoids, with the highest content (17.32 ± 0.02 mgEQ/gextract) found in the leaves (U.E.) collected in Lukavica 2020. In determining the content of total coumarins, esculin hydrate (EH) was used as a standard. The highest content of total coumarins (813.71 ± 4.80 mgEEH/gextract) was found in the flowers (U.E.) collected in Lukavica 2020. By using the pH differential method, the amount of total anthocyanins was found. The results were reported as milligrammes of equivalent cyanidine-3-O-glucoside chloride (ECGCl) per gramme of extract. Toward this method, leaves (U.E.), which were collected in Lukavica 2021, showed the highest content of total anthocyanins (9.32 mgECGCl/gextract). Using caffeic acid (CA) as a reference, the DPPH (2,2-diphenyl-1-picrylhydrazyl) scavenging method was utilised to measure the antioxidant capacity. Using this approach, the maximum antioxidant capacity (11.43 ± 0.28 mgECA/gextract) was demonstrated by flowers (U.E.) harvested in Lukavica 2020. In conclusion, according to these results, *Calendula officinalis* L. has shown a high content of the previously mentioned bioactive compounds and good antioxidant capacity.

Keywords: *Calendula officinalis* L.; Phenolic compounds; Antioxidant capacity; DPPH method

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Poster competition *PC02*

CANNABIDIOL OIL ATTENUATES OXIDATIVE STRESS IN THE BRAIN OF STZ-INDUCED DIABETIC RATS

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Diabetes mellitus adversely affects brain function through various mechanisms, including glycotoxicity, vascular damage, blood-brain barrier (BBB) disruption, mitochondrial dysfunction, insulin resistance, synaptic insufficiency, and neuroinflammation. Among these, oxidative stress emerges as a pivotal player in the multifaceted impairment of brain function. This study investigates the ability of cannabidiol (CBD) to reduce oxidative stress in the brain of diabetic rats, taking into account its recognized neuroprotective and antioxidant effects. CBD oil extract, obtained through CO2 extraction from decarboxylated Cannabis flos and diluted with olive oil to 25% (w/w), was administered to streptozotocin (STZ)-induced diabetic rats (50mg/kg) over a 45-day treatment period. Biomarkers for oxidative stress and the activity of antioxidative enzymes in the brain were assessed. The administration of CBD oil in diabetic animals resulted in substantial increase in the activity of both glutathione peroxidase and glutathione reductase, accompanied by increase in glutathione content in the brain of diabetic rats. Moreover, CBD-treatment significantly increased the activity of catalase and superoxide dismutase as well as the ferric ion reducing antioxidant power-FRAP value, while decreasing malondialdehyde levels in the brain. The results suggest a promising role for CBD oil extract in ameliorating oxidative stress and supporting antioxidative mechanisms in the context of diabetes-induced brain dysfunction. This highlights the potential of CBD as a natural therapeutic agent, emphasizing its role in preserving brain health.

Keywords: cannabidiol, oxidative stress, STZ-diabetic rats

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Poster competition *PC03*

DOSE-DEPENDENT EFFECTS OF CANNABIDIOL OIL TRETMENT OVER CARBOHYDRATE METABOLISM IN STZ-INDUCED DIABETIC RATS

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Cannabidiol (CBD), the predominant non-psychotropic cannabinoid found in *Cannabis sativa* L., has attracted considerable attention due to its diverse biological activities and favorable safety profile. However, limited studies have explored the effects of CBD on carbohydrate metabolism and its effects on blood glucose concentration. Thus, this study investigates the effects of CBD oil on blood glucose, insulin concentration, and key enzymes related to carbohydrate metabolism in the liver of diabetic rats. CBD oil extract was obtained through CO_2 extraction from decarboxylated *Cannabis flos* and then diluted with olive oil (w/w). Diabetes was induced using streptozotocin-STZ (45 mg/kg body weight). The rats were divided into six groups, comprising a negative healthy control group, an untreated diabetic group, a metformin-treated group, and three CBD-treated groups with different doses. Following an overnight fast, the rats were administered CBD extracts at doses of 25, 50 and 100mg/kg b.w. respectively, for 8 days. Treating diabetic rats with CBD-25 mg/kg b.w. resulted in a decrease in glucose-6-phosphatase activity and an increase in glucose-6-phosphate content in the liver. However, it had no impact on blood glucose and insulin levels, as well as fructose-1-6-bisphosphatase, glycogen phosphorylase, hexokinase and glycogen content in the liver. Conversely, administering CBD at 50 mg/kg b.w. led to reduced activity of G6Pase, F16BPase and GP activity, accompanied by a decrease in both blood glucose and liver glucose. When compared to diabetic rats there was no effect on insulin and glycogen concentration. At a dose of 100 mg/kg b.w., CBD showed significant decrease in F16BPase and GP activity, along with a lower liver glucose concentration, as well as an increased HK activity and G6P content. Nonetheless, no effects were observed in blood glucose and insulin levels. The results obtained confirmed the glucose-lowering effect of CBD oil, with the most effective control observed in the group receiving 50 mg/kg. While CBD oil did not exhibit insulinotropic effects, it successfully normalized glycaemia by inhibiting gluconeogenesis and restoring decreased glycolysis in diabetic rats. These findings emphasize the potential therapeutic value of CBD regarding diabetes mellitus treatment.

Keywords: cannabidiol, carbohydrate metabolism, anti-diabetic effects, STZ-diabetic rats

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Poster competition *PC04*

PHYTOTHERAPEUTIC POTENTIAL OF HERBAL PREPARATIONS IN THE TREATMENT OF GASTROINTESTINAL DISORDERS

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Bioactive compounds of plants are primarily secondary metabolites that are constitutively part of the plant metabolome or synthesized as a response to different stimuli. Extracts isolated from medicinal plants exhibit various biological activities such as antimicrobial, anti-inflammatory, and antioxidant activities. Previous studies indicate that many plant species possess antimicrobial and antioxidant activities necessary for treating gastrointestinal disorders. This paper presents evaluates eleven different plants and mixes used in treatment of gastrointestinal discomfort. Evaluation of total phenolic content, total flavonoid content, sensitivity of bacterial strains to the action of plant extracts and the ability to quench stable DPPH (2,2-diphenyl-1-picrylhydrazyl) free radicals was evaluated. *Salmonella abony* was used for the analysis of antimicrobial value of plant extracts as main bacteria responsible for food poisoning. Plant extracts exhibited satisfactory levels of phenols and flavonoids as well as significant antioxidant activity. Through biochemical analyses, herbal preparations demonstrated significant potential in the treatment of gastrointestinal disorders. To develop preparations that achieve maximum effectiveness in antimicrobial action against *Salmonella* spp. and other bacteria, it is necessary to conduct more detailed and extensive research to precisely identify effective secondary metabolites and their safe and effective form for consumption.

Keywords: *Salmonella abony*, gastrointestinal discomfort, tea infusions

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Poster competition *PC05*

TRANSGENERATIONAL MEMORY DETERMINES THE TOLERANCE TO ADVERSE TYPES OF STRESS

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Transgenerational memory of previous stress influences a plant's ability to adapt to new stress and affects its survival rates. Presented research evaluated the effect of stress priming of plants in F0 generation using Cr(VI) to the response of plants to salt and Cd stress in F2 generation. In F1 generation plants were grown in optimal conditions ensuring that any differences observed in F2 are result of stress memory in F0. F2 seeds of control plants (non-stressed) and plants exposed to 2.5 Cr in F0 experiment were used for establishment of seedlings in jiffy. Once 4 leaves were formed, seedlings were moved to hydroponics with Hoagland, and when rosette was formed plants were stressed with 25 mM NaCl or 25 mM Cd till the fruiting of plants (10 weeks). Plant response was evaluated by measuring root length, plant length, fresh & dry weight, proline levels and antioxidant enzymatic activity. Under metal stress, both sets of seeds exhibited altered growth patterns, reduced chlorophyll content, and increased oxidative stress markers compared to control conditions. However, pre-stressed seeds demonstrated enhanced tolerance to metal stress, displaying mitigated growth inhibition and lower levels of oxidative damage. Similarly, salt stress induced significant growth retardation and physiological changes in *Arabidopsis thaliana*. Nonetheless, pre-stressed seeds displayed a primed response, characterized by improved growth parameters and lower accumulation of osmolytes compared to non-stressed counterparts. Overall, our findings highlight the distinct responses of *Arabidopsis thaliana* to metal and salt stress, elucidating the benefits of stress priming in enhancing stress tolerance. This study enhances the importance of plant priming as a potential strategy for improving plant resilience to environmental stresses, thereby contributing to sustainable agriculture and ecosystem resilience.

Keywords: plant memory, salt stress, *Arabidopsis thaliana*, metal stress

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Poster competition *PC06*

FOOD AT RISK: NICKEL EXPOSURE AFFECTS GROWTH AND FRUIT DEVELOPMENT IN TOMATO

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Heavy metals, also known as micronutrients, can be found in the environment, and although some of these heavy metals are essential for plant growth, their excessive accumulation often leads to heavy metal stress, especially in cultivated plants used in human diet. Tomato plant (*Solanum lycopersicum* L.) is one of the most cultivated plants in the World susceptible to heavy metal stress. Presented study evaluated response tomato exposed to nickel (Ni) stress in the form of chronic exposure to lower concentrations of nickel (10 mM Ni) and acute short-term exposure to high concentrations of nickel (50 mM Ni). Plants were grown in hydroponic system, and Ni exposure was applied when plants were 4 weeks old. Chronic exposure was administered till the end of experiment (4 months) while acute exposure lasted 3 weeks after which plants were moved to Hoagland solution. Growth and biochemical response to Ni stress in tomato plants were analysed after 4 months evaluating fresh and dry mass, chlorophyll content, root development, antioxidant enzymes and proline content. The results showed that the uptake of nickel (Ni) in tomato plants caused significant changes in the physiological and biochemical parameters. Different response of plants under chronic and acute exposure was noted with differences in antioxidant enzymatic activity and proline content. High enzymatic activity has been noted in roots under chronic exposure, while proline accumulation was noted for leaves. Such results indicate that antioxidant enzymes were mostly activated where plant was in direct contact with Ni while proline was mostly accumulated in areas of compartmentalisation and detoxification in the cells of above ground organs. Effects on flower and fruit development were also noted, with abortive flowers and senescing fruits suggesting long lasting whole plant effects (from genomic to metabolomic level) effects on the plant.

Keywords: *Solanum lycopersicum*, nickel (Ni), acute and chronic exposure, physiological and biochemical parameters

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Poster competition *PC07*

IMPACT OF PECTIN WITH VARIOUS ESTERIFICATION DEGREES ON THE PROFILES OF GUT MICROBIOTA AND SERUM METABOLITES

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Colitis is generally afected by multiple factors, including the dysbiosis of intestinal microbiota, and may afect organs outsidecolon through circulation. Pectin, which is an edible polysaccharide widely present in plant cell walls, has been proved in our previous study to possess preventive potentials against acute ulcerative colitis, especially when the esterifcation degree is less than 50%. This study aimed to clarify the underlying correlations of gut microbiome and serum metabolites with the preventive efects of pectin with diferent esterifcation degrees (H121, L13, and L102) against colitis in mice. MiSeq sequencing data showed that symbiotic bacteria especially benefcial Lactobacillus and *Bifdobacterium* were enriched by pectin intake. Fiber consumers such as *Prevotella* and *Bacteroides* actively responded to L13 pectin, particularly under high dosage (L13-H). In addition, the abnormal abundance of Akkermansia associated with colitis would not appear in mice who had been provided with any of the three pectins before dextran sulfate sodium (DSS) treatment. Furthermore, pre-treatment of H121 and L13 pectins could improve the serum glycerophospholipids such as phosphatidylcholine (PC) and phosphatidylethanolamine (PE). In contrast, lysophosphatidic acid (LPA) contributing to the glycerophospholipid metabolism pathway was enriched only in the L13-H group, which has been previously proved to be associated with the epithelial barrier and intestinal homeostasis. Positive relationships between the glycerophospholipids and the dominant candidates of intestinal bacteria such as *Lactobacillus* indicated the joint actions of intestinal microbes and serum metabolites as well as the underlying crosstalks among gut microbiome. Therefore, the results of this research suggested that the preventive efects of low-esterifed pectin on DSS-induced colitis were likely to be initiated by the enrichment of probiotics in the gut and serum glycerophospholipids..

Keywords: Pectin, Esterification degrees, Gut microbiota, Serum metabolites, Colitis

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Poster competition *PC08*

ANTI-FERROPTOTIC ACTION OF SULFORAPHANE IN SKELETAL MUSCLE OF DIABETIC MICE

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Sulforaphane (SFN) is a natural sulfur-rich compound found in cruciferous vegetables. SFN has been recognized as a powerful bioactive agent for reducing hyperglycemia and hyperlipidemia, improving insulin resistance, oxidative stress and inflammation in diabetic conditions. We aimed here to examine whether and how SFN affects diabetic-related skeletal muscle disorders associated with cell death signaling pathways. Precisely, the effect of SFN on ferroptosis, iron-dependent form of regulated cell death characterized by the accumulation of lipid peroxides, was examined. Male C57BL/6 mice were divided into four groups: control, diabetic (streptozotocin-induced; 40 mg/kg, from days 1 to 5), non-diabetic SFN-treated (SFN) and diabetic treated with SFN (DM + SFN). SFN was administrated i.p. in a dose of 2.5 mg/kg/day for 42 days. The results from histochemical analyses have shown the increased level of ferroptotic markers, seen as an accumulation of iron, as well 4-hydroxynonenal (4-HNE), an abundant end-product of lipid peroxidation, in skeletal muscle of diabetic animals. Along with this, there was decrease in antioxidant capacity, observed as lower immunohistochemical positivity for glutathione peroxidase 4 (GPX4), the main lipid peroxides-scavenging enzyme as well decrease in protein expression of cystine-glutamate antiporter system (xCT), the important determinant of intracellular synthesis of glutathione, GPX cofactor. Treatment of diabetic animals with SFN induced decreased accumulation of iron and 4-HNE and increased GPX4 immunopositivity and xCT protein level in skeletal muscle compared to the untreated diabetic animals. We can conclude that SFN has beneficial effects on the main core of ferroptosis signaling composed of xCT/GPX4/lipid peroxides axis and thus improves ferroptotic phenotype of skeletal muscle in diabetic conditions. This shed light on the new mechanism of SFN action over diabetes-related skeletal muscle dysfunction based on antiferroptotic action and nominates SFN as a promising phytoparmaceutical in the treatment of diabetes-related metabolic disorders.

Keywords: Sulforaphane, diabetes, skeletal muscle, ferroptosis

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Poster competition *PC09*

INCREASE OF SALT STRESS TOLERANCE IN CHICKPEA BY SEED PRIMING

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Salt stress is one of the main abiotic factors that limits the growth, development and productivity of plants. The aim of this research was to determine the role of seed priming in chickpea (*Cicer arietinum* L.) in osmotic stress tolerance and to identify mechanisms of tolerance. Chickpea seeds were primed using 1 mM proline. In order to analyse the effect of stress on the physiological and biochemical response of chickpea, biochemical parameters such as protein content, total proline and activity of the antioxidant enzymes POD, ASPOX were examined under 25mM NaCl salt stress. The analysis of the priming effect showed an improved level of salt tolerance through the activation of mechanisms for the synthesis of osmolytes and the activation of the antioxidant system. The results showed that salt stress increased the proline content. The POD activity significantly increased in the root tissue of primed plants, while activity was decreased in the leaf tissue. Seeds which were primed with 1 mM proline solution showed better performance than non-primed seeds.

Keywords: Antioxidant enzymes, Chickpea, Osmolyte synthesis, Salt stress, Seed priming

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Poster competition *PC10*

INFLUENCE OF DIFFERENT SUBSTRATES ON FRUITING BODIES YIELD AND ANTIOXIDANT PROPERTIES OF OYSTER MUSHROOM

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The present study was designed to evaluate the influence of different substrates on the yield and antioxidant properties of Oyster mushroom (Pleurotus ostreatus) cultivated in 'bag-logs'. The substrates used in this study were: (1) maize straw, (2) beech sawdust mixed with wheat bran in a ratio of 80:20, (3) maize straw mixed with spent coffee grounds in a ratio of 70:30 and (4) maize straw mixed with spent coffee grounds in a ratio of 50:50. The weight of every culture bag (20.32 × 30.48 cm) was approximately 1.5 kg. Total phenolic and flavonoid contents were determined by the Folin-Ciocalteu method and aluminum chloride method, respectively. Antioxidant activities of the mushroom extracts were analyzed by Ferric Reducing Antioxidant Power (FRAP) assay. The highest fruiting bodies yield of Oyster mushroom was obtained from substrate 4 (maize straw mixed with spent coffee grounds in a ratio of 50:50) (414 g/packet), while the least was from substrate 1 (maize straw) (368.6 g/packet). Significant differences ($P<0.05$) were found between the total phenolic and flavonoid contents of Oyster mushroom extracts grown on different substrates. The Oyster mushrooms growing in substrate 1 (maize straw) and 2 (beech sawdust mixed with wheat bran in a ratio of 80:20) had higher total phenolic and flavonoid contents than those growing in maize straw mixed with spent coffee grounds. Total phenolic contents ranged from 3.80 mg ± 0.61 in Oyster mushroom on substrate 4 (maize straw mixed with spent coffee grounds in a ratio of 50:50) to 4.85 mg ± 0.42 of gallic acid equivalents g-1 dry mass in Oyster mushroom on substrate 2 (beech sawdust mixed with wheat bran in a ratio of 80:20). Total flavonoid contents were very low in all analyzed Oyster mushroom extracts and ranged from 0.11 to 0.17 mg of catechin equivalents g-1 dry mass. Interestingly, there was no significant difference between the total antioxidant activities of Oyster mushroom grown on different substrates..

Keywords: bran, coffee grounds, mushrooms, sawdust, straw

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Poster competition *PC11*

ANTIOXIDANT POTENTIAL OF GREEN SYNTHESIZED AGNPs, ESSENTIAL OIL, AND EXTRACTS OF *ORIGANUM VULGARE* L. LEAVES

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The application of green nanotechnology in various industries has been so rapid and widespread due to its eco-friendly, cost-efficient, and involving nontoxic chemicals properties. Aromatic plant essential oils are now considered a suitable, non-toxic and environmental friendly tool to protect plants and their products against fungal attacks. However, there are limitations such as: volatility, poor water solubility and difficult dispersion limit their use in biological control of fungi. Among various nanoparticles, silver nanoparticles (AgNPs) have been well known for their strong biological activity such as antioxidant, antibacterial, anti-fungal, anti-viral, and others. The aim of this study was focused on the simple, rapid, green, and inexpensive synthesis and characterization of green AgNPs with methanol and water extracts of *Origanum vulgare* L. leaves. AgNPs were characterized by using UV-VIS spectrophotometer and scanning electron microscopy (SEM). Moreover, the total amount of polyphenols of extracts and green AgNPs and their antioxidant activities were evaluated. Gas chromatography-mass spectrometry (GC–MS) analysis was used for determination of bioactive compounds in the essential oil of *O. vulgare* L. leaves. UV-VIS and SEM analysis showed that spherical aqueous and methanolic AgNPs had 19.43 and 18.35 nm, respectively. Aqueous extract showed the highest total phenolic content (TPC, 50.28±1.00 mg gallic acid/g) and methanolic AgNPs exhibited the strongest activity as a DPPH scavenger with 89.68±0.25% and IC_{50}=19.63±0.34 µg/ml. Carvacrol (56.53%), thymol (21.18%), *p*-cymene (6.22%), and γ-terpinene (5.67%) were determined as the main constituents of essential oil. This study showed that extraction solvent, temperature, and time affected the content of polyphenolic compounds as well as their antioxidant activity. Plant essential oil and AgNPs synthesized from *O. vulgare* plant extract both had high antioxidant activities. However, due to stability and higher solubility of AgNPs in water, and easier diffusion the application of studied NPs can be more effective against different fungal diseases in comparison to essential oils.

Keywords: Oregano leaves extract; AgNPs; essential oil; antioxidant activity; carvacol

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Poster competition *PC12*

COMPREHENSIVE CORRELATION STUDY OF HEAVY METALS CONTENT IN SOIL-GRASS-MILK CHAIN

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The detrimental effects of increased amounts of heavy metals in food and the discovery of sources from which these metals come into food is an increasingly challenging task for analysts. As milk plays an important role as the only source of nutrients for young mammals, providing a complex mixture of lipids, proteins, carbohydrates, vitamins and minerals it is important to determine its quality based on the content of metals, via the soil-grass-milk chain. Many authors consider that the content of heavy metals in milk samples is associated with contaminated pastures, industrial influences and mining. Therefore, the main objective of this study was to determine the concentration of essential minerals (Ca, Na, K, Zn, Fe, Cu, Mn, Ni and Mg) and potentially toxic metals (Cd, Co, Cr and Pb) in milk, as well as their content in soil and grass in order to conduct the correlation study, from three diferrent locations. Iron and manganese were present in highest content (mg/g), while other metals were in µg/g, within all soil-grass samples. In general, the correlation for total content of Fe, Cu, Ni, Zn and K between soil - grass was evident, where among listed Cu, Zn and K are very important for plant growth. However, zinc occured as the main constituent in all milk samples, while the other metals followed the order: Ca>K>Fe>Mg>Mn, indicating weak or none correlation with soil-grass content. Moreover, milk samples did not contain Co, Cr, Ni and Pb despite their relatively high content in grass. By comparing the total content of Co, Cr, Cu, Ni, Pb and Zn in the soil with the values from the "Regulations on determination of permitted amounts of harmful and dangerous substances in the soil and their testing methods", published in the "Official Gazette of the Federation of Bosnia and Herzegovina", number 08-24-480-1/99, it can be stated that the tested soils are not contaminated with heavy metals

Keywords: heavy metals, FAAS, soil-grass-milk chain, correlation study

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Poster competition *PC13*

SULFORAPHANE ATTENUATES HMGB1-MEDIATED ACTIVATION OF INFLAMMATORY PATHWAYS IN THE LIVER OF DIABETIC MICE AND SUPPRESSES FERROPTOSIS

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The activation of inflammation is closely associated with ferroptosis and vice versa. Recently, we have demonstrated the involvement of ferroptosis, a newly defined form of iron-dependent cell death, in diabetes-induced liver pathology. We also found that sulforaphane (SFN), a natural isothiocyanate from cruciferous vegetables, prevents diabetes-induced hepatic ferroptosis by activating the Nrf2 signaling axis. Since ferroptosis and inflammation jointly fulfill physiological and pathological functions, in this study we investigated whether the anti-inflammatory effect of SFN is reflected in the modulation of high mobility group box 1 (HMGB1)-related activation of the inflammatory cascade in the liver of diabetic mice and how it is related to the extent of ferroptosis. HMGB1 is a damage-associated molecular pattern molecule that is released by ferroptotic cells, among others. Extracellular HMGB1 is a potent activator of well-characterized inflammation-related pathways, including JAK-STAT, NF-κB, and mitogen-activated protein kinase (MAPK), whose activities are associated with ferroptosis.For this purpose, male C57BL/6 mice in which diabetes was induced with streptozotocin (40 mg/kg/5 consecutive days) were treated with SFN (2.5 mg/kg/day from day 1 to 42). Blood glucose levels were measured once a week during the trial. On day 43, the liver was isolated and prepared for Western immunoblotting and ELISA tests. SFN was found to improve serum levels of glucose, ALT and triglycerides in diabetic mice and to enhance the diabetes-induced decrease in liver expression of GPX4, a hallmark of ferroptosis events. This improvement was partly due to the SFN-induced decrease in the increased expression of HMGB1 and its downstream pro-inflammatory activities related to the activation of MAPKs, NF-κB p65 and JAK1/STAT3 signaling pathways. SFN prevented diabetes-induced phosphorylation of p38 and extracellular signal-regulated kinases (ERKs), NF-κB 65 and STAT3 phosphorylation, and phosphorylation of protein kinase B (Akt), a key mediator of cell survival. The results obtained suggest that interfering with HMGB1 signaling pathways through SFN may enable effective intervention in diabetes by exerting therapeutic effects on inflammatory status and cell death such as ferroptosis.

Keywords: diabetes, sulforaphane, HMGB1, inflammation, ferroptosis

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Poster competition *PC14*

UNDERSTANDING THE MECHANISMS OF ACTION OF ANTIDIABETIC PLANT COMPOUNDS: A COMPREHENSIVE OVERVIEW

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The escalating prevalence of diabetes mellitus globally has sparked intensive research into alternative therapeutic approaches, among which antidiabetic phytochemicals derived from various plant sources have emerged as promising candidates. These natural compounds have garnered significant attention for their potential in managing diabetes mellitus due to their multifaceted modes of action. However, a comprehensive understanding of the diverse mechanisms through which antidiabetic phytochemicals exert their effects is imperative for harnessing their therapeutic potential effectively. This comprehensive review embarks on an in-depth exploration of the intricate molecular pathways targeted by antidiabetic phytochemicals. It commences with an overview of diabetes mellitus, elucidating the staggering burden it imposes on global health. Subsequently, the review delves into the multifaceted modes of action of antidiabetic phytochemicals, ranging from their modulation of insulin signalling pathways to their regulation of glucose metabolism and inflammatory processes. By synthesizing findings from a myriad of studies, both in vitro and in vivo, the review sheds light on the varied mechanisms employed by these natural compounds. Moreover, the review highlights the antioxidant properties of antidiabetic phytochemicals and their interactions with key enzymes implicated in glucose homeostasis. It also discusses emerging research investigating the genetic and epigenetic effects of these compounds as well as its effects on microbiome, offering insights into their potential long-term implications for diabetes management. By providing a comprehensive synthesis of current knowledge, this review offers valuable insights into the potential variations in the modes of action of antidiabetic phytochemicals. Such understanding not only enhances our comprehension of plant-based therapeutics but also lays the groundwork for the development of novel treatment strategies for diabetes mellitus, thereby addressing a pressing global health concern.

Keywords: diabetes mellitus, Antidiabetic phytochemicals, Mechanisms of action

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Poster competition *PC15*

PSEUDOMONAS AERUGINOSA IMPROVED PHYTOREMEDIATION EFFICIENCY OF *OCIMUM BASILICUM* L. IN LEAD (PB) CONTAMINATED SOIL

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Currently, the pollution of soils by heavy metals is a global problem and requires the development of proper remediation techniques. The lead (Pb) is one of the most common heavy metal contaminants in soils that poses adverse effects to the environment and human health. The effect of *Pseudomonas aeruginosa* on the phytoremediation potential of *Ocimum basilicum* L. on soil contaminated with lead (Pb) was investigated by pot experiments. The Pb concentration in the soil sample and plant organs (roots, stem and leaves) was analysed by atomic absorption spectrophotometer using SHIMADZU AA-7000 spectrometer. According to the measured values of Pb in the soil after the experiment and accumulated content in above ground part of the plant we calculated translocation and bioaccumulation factor. The Pb concentration was reported as mg/kg dry weight. The results of this study showed that all parts of the plant that grew in soil enriched with *P. aeruginosa* accumulated lead in higher concentrations compared to the treatment without the addition of microorganisms. Lead concentrations follow the order root > stem > leaf. In light of the above results, *P. aeruginosa* application improved the phytoremediation efficiency of *Ocimum basilicum* L. in soil contaminated with Pb and showed the stimulating effect on the remediation of lead.

Keywords: bioremediation, lead contamination, microorganisms, plants

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Poster competition *PC16*

PHYTOREMEDIATION OF LEAD CONTAMINATED SOIL USING *OCIMUM BASILICUM* L. IN ASSOCIATION WITH *BACILLUS SUBTILIS*

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Environmental contamination with heavy metals is one of the major problems caused by human activity. The plant–microorganism interaction is one approach for the remediation of heavy metals contaminated soils. The current research was conducted to study the effect of *Bacillus subtilis* on the phytoremediation potential of *Ocimum basilicum* L. in lead-contaminated soil. A pot experiment was conducted to investigate the influence of *Bacillus subtilis* addition on the phytoremediation potential of *Ocimum basilicum* in lead-contaminated soil. Quantities of Pb from soil and plant samples (roots, stems and leaves) were analyzed by atomic absorption spectrophotometer using a SHIMADZU AA-7000 spectrometer. Heavy metal translocation ability of *Ocimum basilicum* plants from roots to the shoot was evaluated using the translocation factor while metal translocation from soil to shoot was determined by the bioaccumulation factor. The Pb concentration was reported as mg/kg dry weight. The results obtained from this study showed that *Bacillus subtilis* inoculated plants accumulated lead in higher concentrations compared to the treatment without the addition of microorganisms. Lead concentrations in different tissues occurred in the following order: root > stem > leaf. Inoculation of *B. subtilis* improved the phytoextraction efficiency of *Ocimum basilicum* in lead-contaminated soil. This study suggested that the application of microorganisms could greatly enhance the rhizoremediation of plants for heavy metals.

Keywords: rhizoremediation, lead contamination, microbes, plants

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Poster competition *PC17*

THE EFFECT OF STANDARDIZED *ARONIA MELANOCARPA* L. EXTRACT SUPPLEMENTATION ON SALIVARY CARCINOEMBRYONIC ANTIGEN LEVELS IN PATIENTS WITH ORAL LICHEN PLANUS – PILOT STUDY

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Oral lichen planus (OLP) is a common affliction of the oral mucosa, affecting 0.5% to 2% of the population, primarily middle-aged women, with a 0.44% risk of malignant transformation. Its etiology involves immune dysregulation, microbial infections, endocrine imbalances, and microcirculatory disturbances. OLP pathogenesis is linked to oxidative stress, evidenced by elevated oxidative damage markers and diminished antioxidants. Accurate diagnosis, typically via biopsy and histopathological assessment, is crucial for effective treatment. Saliva, reflecting salivary gland health, offers promise for biomarker research and treatment monitoring. Previous studies identified carcinoembryonic antigen (CEA) as a potential biomarker for mucosal inflammation and treatment response. Traditional OLP therapies include topical corticosteroids, calcineurin inhibitors, retinoids, and phototherapy. Polyphenols, notably flavonoids, renowned for their anti-inflammatory and immunomodulatory properties, have gained attention in autoimmune disorder management. Siberian chokeberry (*Aronia melanocarpa* L.), rich in antioxidants, has shown anticancer and anti-inflammatory effects. A-LIXIR®400 PROTECT (Pharmanova Belgrade, Serbia, a standardized Aronia extract, is a solution for oral use rich in polyphenols and anthocyanins. In a study involving 13 healthy volunteers and 13 OLP patients before and after 28 days of A-LIXIR®400 PROTECT treatment, salivary protein concentrations were measured using a BCA protein assay kit, while salivary CEA levels were assessed via an immunoradiometric assay. Healthy subjects exhibited a median salivary protein concentration of 1.05 mg/mL.In contrast, OLP patients had significantly higher concentrations at 1.5 mg/mL, which decreased to 1.2 mg/mL post-treatment. Salivary CEA levels were notably elevated in OLP patients compared to healthy subjects (258 ng/mL vs. 612 ng/mL), with a reduction observed post-treatment (398 ng/mL). These findings suggest A-LIXIR®400 PROTECT may offer potential benefits for OLP patients, possibly reflected in decreased salivary protein concentrations and CEA levels. However, further randomized controlled trials with larger cohorts are imperative to comprehensively evaluate its clinical efficacy and safety.

Keywords: oral Lichen planus, antioxidants, saliva, carcinoembryonic antigen

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Poster competition *PC18*

EXPLORING PHYTOCHEMICAL DIVERSITY AND BIOLOGICAL ACTIVITIES OF *HYPERICUM JAPONICUM* AND *HYPERICUM SAMPSONII*: POTENTIAL FOR NATURAL PRODUCT-BASED APPLICATIONS

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This study represents the first comprehensive investigation into the phenolic profiles and biological properties of whole *Hypericum japonicum* and *Hypericum sampsonii*, two medicinal plant species within the genus *Hypericum*, revealing distinct chemical and bioactive properties of their extracts. Phenolic compounds, plant secondary metabolites widely recognized as bioactive, were extracted from the dried whole plant of each species and analysed by HPLC-DAD-MS/MS, and the bioactivities were assessed using in vitro methods. The predominant phenolic families differed between the two species, with flavonoids such as taxifolin-O-rhamnoside, isoquercitrin, and quercitrin being the major compounds found in *H. japonicum*. A total of 30 phenolic compounds were identified in this specie with a significantly higher total phenolic content (TPC = 184.51±0.2 mg/g extract dw) than *H. sampsonii* (TPC = 59.57±0.8 mg/g extract dw). In the latter species, 17 compounds were identified and quantified, being xanthones such as mangiferin, besides rutin, and hyperoside among the most prevalent compounds in *H. sampsonii* extract. Additionally, four different classes of previously unidentified anthocyanins were discovered in *H. sampsonii*, collectively amounting to 303.94±0.3 mg/g of extracted dw. The antioxidant activity assessed using the OxHLIA and TBARS methods yielded values of EC50 that were either equal to or superior to the positive control tested (Trolox). Additionally, the extracts exhibited promising antitumor effects, with particular significance attributed to the remarkable GI50 value of *H. japonicum* against the human gastric adenocarcinoma (AGS) cell line (69±2 μg/mL extract). While further research is warranted to generalize the cytotoxic activity, both extracts showed remarkable antimicrobial efficacy, with H. japonicum extract exhibiting minimum inhibitory concentration (MIC) values as low as 0.007 mg/mL against various clinical and food bacterial strains. Overall, the assessment of biological properties suggests that *H. japonicum* exhibits greater potential compared to *H. sampsonii*, likely due to its threefold higher TPC content. These findings suggest promising avenues for future research, including isolating key compounds and exploring these extracts as versatile functional foods and potent antioxidants across different sectors. Moreover, the possibility of developing pharmacological products based solely on concentrated herbal preparations or standardized extracts of *Hypericum* opens new horizons in natural product-based therapeutics.8,9-dehydrothymol methyl ether, 8,9-dehydrothymol and 8,9-dehydro-4-hydroxythymol dimethyl ether.

Keywords: *Hypericum japonicum*, *Hypericum sampsonii*, Phytochemical characterization, Biological properties, Natural product applications.

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Poster competition *PC19*

UNVEILING THE POTENTIAL OF *EUPHORBIA* SPECIES AS SUSTAINABLE SOURCES OF BIOACTIVE COMPOUNDS FOR THE FOOD AND PHARMACEUTICAL INDUSTRIES

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Euphorbia hirta and *Euphorbia jolkinii* are two plant species belonging to the Euphorbiaceae family, which is distributed mainly in Asia, Africa, and Latin America. *E. hirta* has been traditionally used in folk medicine for the treatment of several pathologies, such as pulmonary and digestive diseases, gonorrhea, eczema and acne, while *E. jolkinii* has shown grassland degradation capacity. All these properties are linked with the presence of bioactive phytochemicals. Therefore, this study aimed to determine the phenolic compounds present in the whole part of *E. hirta* and *E. jolkinii* through LC-DAD-ESI-MS^n after extraction of dried whole plants with a mixture of H2O:MetOH, v/v 80:20, 1h, at room temperature. A total of 26 and 24 phenolic compounds were identified in *E. hirta* and *E. jolkinii*, respectively. Whereas both extracts presented a good number of phenolic compounds, *E. jolkinii* presented a higher concentration of compounds than *E. hirta*, with 85.72 and 59.77 mg/g extract of dried weight (d.w)., respectively. The primary phenolic compounds present in *E. hirta* were protocatechuic acid hexoside and quercetin-*O*-rhamnoside isomer (12.92 ± 0.04 and 12.53 ± 0.73 mg/g extract d.w., respectively), glycosides of a phenolic acid and a flavonoid. Regarding *E. jolkinii* extract, an isomer of the tannin galloyl-HHDP-hexoside and quercetin-*O*-rhamnoside predominated with 47.08 ± 0.02 and 12.42 ± 0.62 mg/g extract d.w., respectively. Considering the results achieved, the phenolic compounds found in both *Euphorbia* species are suggested to apply in the food industry for the formulation of functional foods and pharmaceuticals in the preparation of nutraceuticals.

Keywords: *Euphorbia hirta*; *Euphorbia jolkinii*; phenolic profile; bioactivities; industrial application

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Poster competition *PC20*

CYTOTOXIC AND APOPTOSIS-INDUCING POTENTIAL OF POLYMETHOXYLATED FLAVONES ENRICHED FRACTIONS FROM *ARTEMISIA ANNUA* L. IN HEK293T CELLS

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Artemisia annua L. known as sweet wormwood is a medicinal plant renowned for treatment of different human diseases. Abundant in various bioactive compounds including polymethoxylated flavones such as chrysosplenol D (CHD) and casticin, this plant demonstrates notable antioxidant, antiproliferative and anti-inflammatory activity. These compounds not only augment the bioavailability but also enhance the therapeutic efficacy of well-known artemisinin. The aim of this study was to analyze the effects on cell viability and apoptotic events of three fractions derived from *A. annua* L. in normal human embryonic kidney cells (HEK293T; ATCC® CRL-3216™). The crude *A. annua* ethanolic extract was prepared from dried leaves using ultrasound assisted extraction and fractionated by preparative high-speed counter-current chromatography (HSCCC).Monitoring of HSCCC fractions was performed using high-performance liquid chromatography coupled with the diode-array detector. Three fractions were prepared: fraction I enriched in CHD, fraction II enriched in CHD spectrally similar compound and fraction III mixture of two previous. HEK293T cells (10^5cells/mL) were cultivated in a standard humidified atmosphere for 48 h. After initial incubation of 24 h, cells were treated with HSCCC fractions purified in polymethoxylated flavones at concentrations of 50, 6.25, 3.125 and 0.3125 µg/mL. Cell viability was assessed through MTT assay and trypan blue exclusion test. Additionally, apoptotic or necrotic stages were identified using the TransDetect® Annexin V-EGFP/PI Cell Apoptosis Detection Kit and analyzed by fluorescent microscopy. Our findings underscore the utility of HSCCC as an effective tool for preparative separation, yielding high purity and excellent recovery of target compounds from the crude extract of *A. annua* L. The MTT assay revealed a dose-dependent increase in cytotoxicity with fractions II and III, while cultures treated solely with CHD-enriched fractions exhibited high viability. However, the trypan blue results indicated a reduction in cell viability across all fractions, necessitating supplementary assays due to potential interference and limitations of colorimetric tests. A higher frequency of late apoptotic cells was observed in all treated cultures compared to the negative control, indicating potent proapoptotic bioactivity of the tested fractions, and requiring further investigations, particularly in cancer cell lines.

Keywords: *A. annua* L., HSCCC fractions, polymethoxylated flavones, cell viability, HEK293T cells

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Poster competition – Short talk *PC21*

NATURAL RESOURCES OF *VERONICA ANAGALLIS-AQUATICA* L. - VOLATILE COMPOUNDS ISOLATED FROM WILD AND CULTIVATED SPECIES

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The genus *Veronica* (speedwells) belongs to the family Plantaginaceae and comprises of about 500 species, which are mainly distributed in the northern hemisphere, especially in the Mediterranean and mountainous regions, and about 40 species have been described in Croatia. Plants of the Veronica genus and their extracts are used worldwide in traditional medicine and nutrition. Extracts obtained from *Veronica anagallis-aquatica* L., the water speedwell, are the subject of the present study. Water speedwell is an edible and medicinal species used in ethnobotany for the treatment of colds and coughs. The compositions of the extracts of investigated species, which include the free volatile compounds, are compared between plants collected in their natural habitat and those that have been cultivated last spring (2023). The cultivated speedwell was grown from seeds collected the previous year (2022). The isolation of the free volatile compounds was performed by microwave-assisted extraction, and each extract obtained consists of two phases: a lipophilic (essential oil) and an aqueous phase (hydrosol). The phytochemical composition of the isolates was determined by gas chromatography-mass spectrometry. The essential oil of *V. anagallis-aquatica* collected in the natural habitat consisted of 25.97% hexahydrofarnesyl acetone, and 9.67% benzene acetaldehyde as main compounds. Hexahydrofarnesyl acetone is present in a similar percentage (22.05%) in the essential oil from cultivated plants, while benzene acetaldehyde was identified at 6.65%. In the hydrosol phase of *V. anagallis-aquatica* from the wild form, one of the major constituents is also benzene acetaldehyde at 18.34%, and (E)-β-damascenone at 20.45%. These two compounds also dominate in the composition of the hydrosol in the cultivated plant with a slightly lower identification percentage of 12.56% for benzene acetaldehyde and 13.87% for (E)-β-damascenone. Previous studies on biological activity have shown that the free volatile compounds of water speedwell have significant antioxidant effect, so it is important to investigate the overall biological activity of these natural compounds. Since the same basic volatiles were identified in both the wild and cultivated species *V. anagallis-aquatica*, it is clear that the cultivated species contains biologically active natural products and this result makes it suitable for cultivation and further studies.

Keywords: *Veronica anagallis-aquatica*, microwave-assisted extraction, essential oil, hydrosol, chemical identification

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Poster competition *PC22*

CHARACTERIZATION OF SERPENTINE BACTERIA: BIOFILM PRODUCTION AND HEAVY METAL TOLERANCE

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Serpentine soils exhibit unique chemical properties, characterized by high concentrations of heavy metals (usually Ni, Fe, Cr, and Co) and limited availability of micronutrients, rendering them unfavorable for numerous microbial species. In response, serpentine bacteria have evolved various adaptive strategies that enable their undisturbed proliferation. Furthermore, serpentine habitats have diverse bacterial communities with potential use in industrial biotechnology and agriculture. Thus, the primary objective of this study was to examine the heavy metal tolerance and quantify biofilm production of bacterial serpentine isolates. In total, 24 sequenced rhizospheric and endophytic serpentine isolates associated with *Robinia pseudoacacia* L. were retrieved from the bacterial repository of the University of Sarajevo - Institute for Genetic Engineering and Biotechnology. Heavy-metal tolerance was evaluated on tryptone yeast agar plates supplemented with Ni, Cu and Co salts with final metal concentrations 100 mg/L and 200 mg/L. After 15 day incubation period at room temperature, positive results were confirmed by observable growth. Biofilm production was assessed utilizing the Microtiter plate assay (MPA) with modifications to accommodate rhizospheric and endophytic bacteria. Absorbance was measured at 570 nm using a Thermo Scientific Multiskan™ reader. The biofilm production was graded based on OD according to the standard scale: non-producers, weak, moderate and strong producers. All the rhizospheric isolates tolerated 100 mg/L concentration of the tested metals while only one isolate failed to grow in the presence of 200 mg/L Ni. No isolates were able to tolerate 200 mg/L Cu. In contrast, tolerance to the tested heavy metals was not a common trait in endophytic isolates. Similar trend was observed regarding biofilm production. While rhizospheric bacteria consistently produced biofilms (2 moderate and 12 low-producers), only three endophytic isolates yielded low biofilm production. Rhizospheric *Pseudomonas* isolates exhibited strong heavy metal tolerance and prominent biofilm producing abilities as opposed to limited tolerance and weak biofilm production by endophytic *Bacillus*, *Brevibacillus* and *Lysinibacillus*. Bacteria produce biofilms as a survival strategy in a response to environmental stressors. Biofilm production requires energy expenditure and endophytes, having procured nutrients and protection by plants, forego this ability. It is an important input when selecting isolates for biotechnological applications.

Keywords: serpentine bacteria, heavy-metal resistance, biofilm production, serpentine soil

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Poster competition *PC23*

PHYTOCHEMICAL ADAPTATIONS OF YOUNG BROCCOLI TO HOT AND COLD WATER STRESS

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As climate change continues to drive alterations in temperature patterns, understanding the biochemical mechanisms by which plants respond to temperature fluctuations becomes increasingly important. Such insights can inform strategies to mitigate the adverse effects of climate change on agricultural productivity and ensure food security in the face of evolving environmental conditions. The objective of the study was to identify resilient and vulnerable characteristics of young broccoli plants (*Brassica oleracea* L. convar. *botrytis* (L.) Alef. var. *cymosa* Duch.) subjected to treatment with cold (CW) and hot (HW) water. Additionally, we aimed to identify potential biomarkers indicating stress from CW or HW treatment in broccoli. The findings revealed that HW impacted a greater number of variables in young broccoli plants compared to CT treatment. Specifically, HW treatment resulted in significant changes in the concentration of several compounds: vitamin C increased by 33%, hydrogen peroxide increased by 10%, malondialdehyde by 28%, and proline increased by 147%. Furthermore, extracts from broccoli exposed to HW exhibited greater efficiency in inhibiting α-glucosidase (65.85 ± 4.85% compared to 52.00 ± 5.16% in control plants), while those from CW-treated broccoli were more effective in inhibiting α-amylase (19.85 ± 2.70% compared to 13.26 ± 2.36% in control plants). Total glucosinolates and soluble sugars were affected differently by CW and HW treatment, indicating their potential as biomarkers for distinguishing between CW and HW stress in broccoli. The study suggests that further investigation into the possibility of utilizing temperature stress to cultivate broccoli enriched with compounds beneficial to human health is warranted. This research could lead to the development of strategies for enhancing the nutritional value of broccoli through controlled stress conditions.

Keywords: bioactive compounds; Brassicaceae; climate change; oxidative stress parameters; osmoprotectants

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Poster competition *PC24*

BIOACTIVE PROPERTIES OF *INULA HIRTA* (L.) SPECIES

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Plants have always been a subject of interest to people because of their bioactive substances, which are used in the treatment of many diseases. The genus *Inula* is known for its medicinal properties, among people all over the world, and especially in Chinese traditional medicine. Among the species of this genus, the species *Inula hirta* has somehow been neglected by science when it comes to the analysis of the pharmacologically active substances it contains. As part of this research, an analysis of the concentrations of phenols, flavonoids and proanthocyanidins in the *Inula hirta* plant extract was carried out, as well as the antimicrobial and antioxidant activities that the extracts of this plant possess. The analysis confirmed a significant concentration of phenolic and flavonoid compounds, which could be used for the production of medicines and other pharmaceutical preparations. Thanks to these and other compounds found in the extract of *Inula hirta*, the antioxidant properties of the plant have been confirmed. In addition, the inhibition of the growth of *Staphylococcus aureus* bacteria is noticeable, which places this plant in the group of plants worthy of further attention and investigation in the field of sources of antibiotic components.

Keywords: bioactive substance, genus *Inula*, antimicrobial and antioxidant activities

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Poster competition *PC25*

BOOSTING CROP SAFETY: HOW INTERCROPPING WITH *SILENE SENDTNERI* REDUCES HEAVY METAL UPTAKE IN *ZEA MAYS* L.

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Environmental contamination by various chemical substances, both organic and inorganic, constitutes a global issue. Given the persistence of heavy metals in the environment and their potential for bioaccumulation and biomagnification over time, environmental remediation is one of the most significant challenges of contemporary science. This study explores how intercropping with *Silene sendtneri* affects heavy metal accumulation in *Zea mays* when grown on contaminated and non-contaminated soils. *Zea mays*, a widely cultivated crop, and *Silene sendtneri*, a hyperaccumulator of heavy metals, were selected to assess their interaction and potential modifications in metal uptake dynamics when intercropped. The experiment involved growing *Zea mays* and *Silene sendtneri* in monoculture and intercropping systems. In monoculture on contaminated soil, *Zea mays* showed significant metal accumulation, with values such as 65.39 mg/kg of Cu, 123.2 mg/kg of Mn, and 134.0 mg/kg of Cd. On non-contaminated soil, these values were considerably lower. *Silene sendtneri* in intercropping demonstrated exceptional uptake capabilities on contaminated soil, particularly for Mn (1207 mg/kg) and Zn (504.2 mg/kg). When intercropped with *Silene sendtneri* on contaminated soil, *Zea mays* exhibited altered heavy metal uptake. The levels of accumulated metals in *Zea mays* decreased compared to its monoculture counterparts, suggesting that intercropping may mitigate heavy metal stress in *Zea mays* by reducing its metal uptake. For example, Mn accumulation in *Zea mays* dropped from 539.6 mg/kg in monoculture to lower levels when intercropped. This study highlights the potential benefits of intercropping *Zea mays* with *Silene sendtneri* for managing heavy metal accumulation in crops. The results indicate that intercropping can influence the uptake dynamics of heavy metals, potentially reducing the burden of contaminants in *Zea mays*. This approach could enhance the safety and productivity of crops grown on contaminated soils, offering a sustainable strategy for phytoremediation and agricultural management. Further research is needed to understand the mechanisms behind these interactions and their implications for long-term soil and crop health.

Keywords: food safety; intercropping; heavy metals; climate change

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Poster competition – Short talk *PC26*

HAIRY ROOT EXTRACTS FROM *HYPERICUM PERFORATUM* L. REVEALED INSULINOTROPIC EFFECTS AND REGULATE HEPATIC CARBOHYDRATE METABOLISM IN DIABETIC RATS

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Hairy root (HR) cultures of *Hypericum perforatum* L. yield significant quantities of xanthones with powerful anti-diabetic properties. *In vivo* studies have revealed that extracts from these HR cultures display antihyperglycemic properties, improving metabolic parameters (body weight, food and water consumption and urine output), lowering lipid levels, and improving serum enzyme activity. Nevertheless, the exact mechanism behind HR extract's actions is still unclear. Therefore, the present research examines the underlying biochemical and molecular mechanism by which HR extract exerts the antihyperglycemic and antidiabetic actions. Identification and quantification of different phenolic compounds in HR extracts were performed by HPLC/DAD/ESI-MSn analysis. HR extract (200 mg/kg body weight) was administered daily to both healthy and streptozotocin-induced diabetic rats for 14 days. Glibenclamide-treated animals served as positive controls. Blood glucose levels, plasma insulin concentrations, liver enzymes involved in carbohydrate metabolism, AMP-activated protein kinase (AMPK) mRNA levels, Protein kinase Cε (PKCε) concentrations, and pancreatic Poly (ADP-ribose) polymerase (PARP) activity were measured. The treatment of diabetic animals with HR extracts increased insulin levels and PARP activity in diabetic rats, resulting in normal blood glucose levels. Furthermore, HR treatment significantly lowered gluconeogenic and increased glycolytic enzyme activities, resulting in a restoration of liver glycogen content. Additionally, rats treated with HR showed an increase in AMPK expression and a decrease in PKCε levels. HR extracts show insulinotropic effects and regulate PARP activity, indicating potential cytoprotective and regenerative effects on β-cells. Moreover, the extract regulate hepatic carbohydrate metabolism in diabetic rats through the modulation of AMPK expression and PKCε concentration. Thus, HR extract could be considered as a potent herbal medicine for treating diabetes and a promising source of compounds for antidiabetic drug development.

Keywords: xanthones, *Hypericum perforatum* L., diabetes

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Poster competition – Short talk *PC27*

COMPARATIVE STUDY OF THE MINERAL COMPOSITION AND ANTIOXIDANT PROPERTIES OF SELECTED CULTIVATED MUSHROOMS

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The present study reports a comparison of the mineral composition and antioxidant properties of four selected cultivated mushrooms: Lion's mane (*Hericium erinaceus*), Reishi (*Ganoderma lucidum*), Pink oyster mushroom (*Pleurotus djamor*) and Oyster mushroom (*Pleurotus ostreatus*). Ca, K, Fe, Zn, Cu, Co, Mn, Ni, Cr, Cd and Pb were determined by flame atomic absorption spectroscopy, while total antioxidant activity was measured by the ferric reducing antioxidant power (FRAP) assay. Total phenolic and flavonoid contents were determined by the Folin–Ciocalteu and aluminum chloride methods, respectively. The most abundant mineral elements in the analyzed mushrooms were potassium, calcium and zinc, ranging between 23703.2–36721.8 mg kg^{-1}, 105.3–123.1 mg kg^{-1} and 45.5–89.9 mg kg^{-1} dried mass, respectively. The content of heavy metals (Ni, Cr and Cd) was very low, while Pb and Co were below detectable levels. The quantities of all studied heavy metals were within the limits recommended by the World Health Organization. This study showed that total phenolic contents ranged from 45.46 ± 3.91 mg of galic acid equivalents 100 g^{-1} fresh mass in Oyster mushroom to 75.64 mg ± 10.91 mgGAE 100g^{-1} fresh mass in Lion's mane mushroom. Total flavonoid contents were very low in all analyzed mushroom species. In this study, Lion's mane, Reishi and Pink oyster mushroom showed significantly higher antioxidant activity compared to Oyster mushroom.

Keywords: cultivated mushroom, antioxidant, mineral composition

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Poster competition – Short talk *PC28*

UNLOCKING THE BIOACTIVE POTENTIAL OF DIMERIC FLAVONOIDS: COMPARISON OF 3'-8''-DIMERS VERSUS MONOMERIC SUBUNITS

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Biflavonoids, particularly 3′-8″-biflavones, have emerged as promising candidates for drug discovery due to their diverse biological activities. In this study, we investigated the comparative effects of 3′-8″-biflavones (amentoflavone, bilobetin, ginkgetin, isoginkgetin, and sciadopitysin) and their monomeric subunits (apigenin, genkwanin, acacetin) on various parameters. We assessed their radical scavenging activity, antifungal potential against mycotoxigenic fungi, and inhibitory effects on key enzymes. While all compounds exhibited weak radical scavenging activity, their antifungal efficacy varied depending on concentration and fungal species. Notably, ginkgetin and isoginkgetin demonstrated potent acetylcholinesterase inhibition, whereas monomeric flavonoids displayed stronger tyrosinase inhibition. Amentoflavone exhibited notable inhibitory effects on α-amylase and α-glucosidase, with 3′-8″-biflavones generally showing enhanced enzyme inhibitory activity compared to monomeric subunits. Overall, our findings suggest that 3′-8″-dimerization enhances certain enzyme activities, albeit influenced by the compound's structural features such as the presence of hydroxyl and methoxy groups.

Keywords: bioflavonoids, 3'-8'' – dimerization, antifungal activity, antioxidant activity, enzyme inhibition

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