



25. ODBORNÝ SEMINÁŘ S MEZINÁRODNÍ ÚČASTÍ

AKTUÁLNÍ ASPEKTY PĚSTOVÁNÍ, ZPRACOVÁNÍ A VYUŽITÍ LÉČIVÝCH, AROMATICKÝCH A KOŘENINOVÝCH ROSTLIN

6. - 7. září 2023, Praha,
Česká republika

SBORNÍK PŘÍSPĚVKŮ



Česká zemědělská
univerzita v Praze



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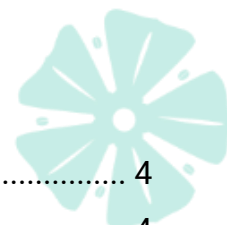
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ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE

KAMÝČKÁ 129, PRAHA – SUCHDOL 165 00, ČESKÁ REPUBLIKA

DOI: 10.5281/ZENODO.8316737



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Vědecký výbor

Pavel Klouček

Česká zemědělská univerzita v Praze

Karel Šmejkal

Masarykova univerzita

Helena Pluháčková

PELERO CZ

Jarmila Neugebauerová

Mendelova univerzita v Brně

Miroslav Habán

Univerzita Komenského v Bratislave

Organizační výbor

Adéla Fraňková

Matěj Božik

Anežka Janatová

Kateřina Jiralová

Jan Tauchen

Pavel Nový

Česká zemědělská univerzita v Praze



V současné době má univerzita více než 18 000 studentů (10 % tvoří zahraniční studenti), 6 fakult a 1 institut. Univerzita nabízí více než 170 akreditovaných studijních programů na bakalářské, magisterské a doktorské úrovni (v 9 bakalářských,

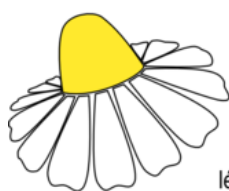
20 magisterských a 18 doktorských programech je vyučovacím jazykem angličtina). Univerzita má 1 700 zaměstnanců, z nichž více než 700 jsou profesori nebo docenti. Od roku 2007 je Česká zemědělská univerzita členem Euroleague for Life Science.

Terpenix s.r.o.



Terpenix s.r.o. je spin-off společnost České zemědělské univerzity v Praze, založená v roce 2013. Společnost se zaměřuje na širší využití potenciálu přírodních látek z rostlin. Naším hlavním posláním je popsat slogan: "Chráněno přírodou" – to znamená snížit současné nadměrné používání syntetických chemických látek používaných v zemědělství a potravinářství, na ochranu rostlin, výživu hospodářských zvířat. Klíčovou oblastí je využívání přírodních látek, zejména silic, které mohou poskytnout větší prostor pro ekologické zemědělství, aniž by měly negativní dopad na životní prostředí, zvířata a zdraví lidské populace.

KKBP



PELERO CZ

Sdružení pěstitelů a zpracovatelů
léčivých, aromatických a kořeninových rostlin

ZEMBAG



Fakulta agrobiologie,
potravinových a přírodních zdrojů

Program - středa 6.9.2023

Sekce 1: Rostliny aromatické kořeninové a léčivé – moderuje: Pavel Klouček

9:00-10:00

Registrace

10:00-10:15

Úvodní slovo

Pavel Klouček

10:15-10:35

Genetické zdroje vybraných léčivých rostlin na ZF MENDELU

Jarmilka Neugebauerová

10:40-11:00

The content of essential oils in five spices of the *Apiaceae* family

Helena Pluháčková

11:05-11:25

Využití biologicky aktivních látek v ochraně rostlin.

Pavel Procházka

11:30-11:35

Terapeutický potenciál *Schkuhria pinnata*, Asteraceae

Dagmar Jankovská

11:40-11:50

Okrasné dřeviny jako zdroj biologicky aktivních látek

Margita Dvorská

12:00-13:30

Oběd

Sekce 2: Léčivé a jedlé produkty přírodní – moderuje: Adéla Fraňková

13:40-14:00

The chemical composition of oils and cakes of *Ochna serrulata* (*Ochnaceae*) and other underutilized traditional oil trees from Western Zambia

Jan Tauchen

14:05-14:25

Jedlé a léčivé houby kultivované v kontrolovaných podmínkách

Miroslav Jozífek

14:30-14:50

Semena olejného lnu, konopí setého a ostropestřce mariánského s ohledem na jejich kvalitativní parametry a potřeby využití

Majka Bjelková

14:55-15:05 poster 01

Premenlivosť sekundárnych metabolitov liečivých rastlín v rôznych pôdno-klimatických podmienkach Slovenska

Marta Habánová

15:05-15:15 poster 02

The effect of biostimulants on quantitative parameters and capsorubin content of selected paprika varieties

Ivana Mezeyová

15:15-15:25 poster 03

Výuka předmětu LAKR na katedře agroekologie a rostlinné produkce FAPPZ ČZU v Praze

Luděk Tyšer

15:25-15:35 poster 04

Environmentálny skrining rozšírenia liečivých rastlín v Slovenskej republike

Veronika Žitniak Čurná

15:35-16:00

Přestávka



Sekce 3: Konopí – moderuje: Anežka Janatová Kosmáková

16:05-16:20

Využití konopí v potravinářství, kosmetice a příklady z praxe

Hanka Gabrielová

16:25-16:40

Legislativní bariéry využití konopného květu a extraktu

František Švejda

16:45-17:00

Nanoformulace extraktů z vybraných genotypů léčebného konopí (*Cannabis sativa* L.)

Tomáš Skala

17:05-17:30

panelová diskuze

18:00-19:00

Raut na střeše, k tanci a poslechu hrají Elvisovi Sirotci

Program - čtvrtek 7.9.2023

Sekce 4: Rostliny aromatické a léčivé – moderuje: Matěj Božik

9:00-10:00

Káva, koláček a kefír

10:00-10:15

Implementace skořicového silice v mlékárenství

Anna Šebová

10:20-10:35

Zpracování bylin a koření CO2 extrakcí

Petr Kolář

10:40-10:50 poster

EP05 Extraction of rosmarinic acid from *Ocimum sanctum* using Nades

Naděnka Vrchotová

10:50-11:00 poster

EP06 Paskalizované homogenáty bylin jako netradiční složka potravin.

Jana Rysová

11:00-11:10 poster

EP07 Potenciál mléčné fermentace při konzervaci čerstvých bylin

Eliška Kovářiková

11:10-11:20 poster

EP08 Hodnocení morfologie a obsahových látek průhonických klonů rodu

Echinacea

Marián Šinko

11:20-11:30 poster

EP09 Hodnocení morfologie a obsahových látek průhonických klonů rodu

Echinacea

Marián Šinko

11:30-11:40 poster

EP10 Epigenetic screening of morphinan alkaloids' biosynthesis in salt stress conditions

Emá Balažová



11:40-11:50 poster

EP11 Testing of flavonoids as possible α -glucosidase inhibitors

Jana Karlíčková

11:50-12:00 poster

EP12 Fermentace jako cesta zpracování bylinek

Eliška Kovářková

12:00

Slavnostní ukončení semináře

12:30

Exkurze

Botanická zahrada FTZ

Potravinářský pavilon





Přednášky



The Genetic Resources of Selected Medicinal Plants in HF MENDELU

Neugebauerová J.

Mendel University in Brno, Faculty of Horticulture, Department of Floriculture and Vegetable Growing, Czech Republic

AIM

The aim of this study is to evaluate the genetic resources of *Achillea*, *Glycyrrhiza*, and *Rheum*.

MATERIALS AND METHODS

The genetic resources of *Achillea*, *Glycyrrhiza*, and *Rheum* are kept in the ex situ field collection of HF MENDELU in Lednice. The biochemical substances were identified in 13 accessions of *Achillea*, 8 accessions of *Glycyrrhiza*, and 11 accessions of *Rheum*, in 2022. The active compounds' content in the aerial parts of *Achillea* species and the underground parts of *Glycyrrhiza* and *Rheum* species were evaluated using Czech Pharmacopoeia methods.

RESULTS

The content of essential oil in *Achillea* species ranged from 0.2 to 2.54 ml/kg DM. The glycyrrhizin content in species of *Glycyrrhiza* varied between 0.56% and 6.91% DM. The rhein content in *Rheum* species ranged from 0.16% to 0.61% DM.

CONCLUSIONS

The evaluation results show that five items of the *Achillea* accessions meet the requirements of the Czech Pharmacopoeia (*Millefolii herba*, with at least 2.0 ml/kg DM of essential oil). The content of glycyrrhizin complies with the requirements of the Czech Pharmacopoeia in *Liquiritiae radix* (at least 4.0% DM) in only one sample of *Glycyrrhiza* species. None of the evaluated items of the *Rheum* accessions meet the requirements of the pharmacopoeia for *Rhei radix* (not less than 2.2% DM of hydroxyanthracene derivatives, expressed as rhein).

Keywords: *Achillea*; essential oil; *Glycyrrhiza*; glycyrrhizin; *Rheum*; rhein

Contact person:

Jarmila Neugebauerová, jarmila.neugebauerova@mendelu.cz

ACKNOWLEDGMENT

The results were obtained with the support of Ministry of Agriculture via the National Programme on Conservation and Utilization of Plant Genetic Resources and Agrobiodiversity (No. 6.2.10/MZE-62216/2022-13113). Thanks to Mrs Marcela Hořínková for technical assistance.

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Vymyslický T., Neugebauerová J. (2012): Metodika hodnocení rodu lékořice (*Glycyrrhiza* L.). Výzkumný ústav pícninářský, Troubsko

The content of essential oils in five spices of the *Apiaceae* family

Helena Pluháčková^{1*}, Barbora Kudláčková², Lenka Svojanovská²

¹ Mendel University in Brno, Zemědělská 1665/1, 613 00 Brno, Czech Republic

² Institute of Analytical Chemistry, Czech Academy of Sciences, Veveří 967/97, 602 00 Brno, Czech Republic

ABSTRACT:

Essential oils obtained from spices, herbs, and medicinal plants are well known in traditional medicine and are an area of interest due to their various biological activities.

The present study investigates the yield, composition of essential oils (EOs) in five spices (caraway, anise, coriander, fennel, dill) of the *Apiaceae* family. EOs obtained by hydrodistillation were analyzed and identified by gas chromatography coupled to mass spectrometry. Yields of EOs ranged between 0.7–5.3%. Results showed that the major components present in caraway were carvone (60%) and limonene (40%); in anise trans-anethole (95%); in coriander linalool (62–68%); in fennel trans-anethole (86–93%) or estragole (90%); in dill either limonene and carvone (about 47% each), or dill apiole (42%) and limonene (30%).

RESULTS

Investigating the chemical composition of commonly used therapeutic herbs is important for elimination of health-threatening substances in the herb material.

CONCLUSIONS

The aim of this study was to compare the differences in yield and essential oil composition of selected spices of the *Apiaceae* family. Approximately 20–30 components of EOs were found in all samples. Carvone (60%) and limonene (40%) was observed as major constituents in caraway. Trans-anethole (94–96%) was the predominant component in EOs from anise. Coriander EOs were characterized by linalool (62–68%), γ -terpinene (12–14%) and α -pinene (5–8%). Significant differences in the composition of fennel EOs were evident. Trans-anethole prevailed in samples FOEG, FOES and FOEB (86–93%), whereas estragole was the main component in FOEV (90%) sample. Dill samples were significantly different from each other. ANEG sample contained mainly carvone and limonene (47% each) and ANEB sample was consisted mostly of dill apiole (42%), limonene (30%) and carvone (12%). The results presented suggest that the composition of EOs may be attributed to many factors such as variety, geographical, environmental and climatic conditions.

The differences in EOs components, particularly for fennel (FOEV), are alarming due to the potential genotoxic and carcinogenic effects of estragol. It is important that spice producers correctly label and identify the botanical species they process into spices.

Further research is need to assess the potential risk to human health and set a limit of dangerous compounds as alkoxy-substitued allylbenzenes in all raw materials not only those used as pharmaceuticals.

Keywords: *Apiaceae*; spices; essential oils; GC-MS

Contact person: Ing. Helena Pluháčková, Ph.D., helena.pluhackova@mendelu.cz

ACKNOWLEDGMENT

This research was supported by the Ministry of Agriculture of the Czech Republic (Institutional Support MZe-RO1923) and by the Czech Academy of Sciences (Institutional Support RVO:68081715).



Využití biologicky aktivních látek v ochraně rostlin

Procházka P.



The therapeutic potential of *Schkuhria pinnata* Lam., Asteraceae

Jankovská D.¹, Kunovská R.¹ Malaník M.¹

¹ Department of Natural Drugs, Faculty of Pharmacy, Masaryk University Brno

AIM

The aim of the work was a literature search that would summarize the information published about *Schkuhria pinnata* Lam., Asteraceae. We focused on the separation of the ethyl acetate extract. The isolated substances were characterized by spectroscopic methods.

MATERIAL AND METHODS

The air-dried plant *S. pinnata*; solvents for extraction and column chromatography on silica gel, solvents for HPLC and LC; the spectroscopic methods: UV, NMR, HRMS, IR.

RESULTS

S. pinnata, Asteraceae is an annual herb. It is native to South America but has been introduced into other countries (Kimani NM. et al. 2018). The extracts of *S. pinnata* exert antibacterial, antiprotozoal activity (Kudumela RG. et al. 2019).

The EtOAc extract was subjected to a silica gel column chromatography to afford 88 fractions, based on HPLC analysis were combined into 26 fractions. Fractions SCH_H_E_32-42 and SCH_H_E_70-71 were selected for separation on semi-preparative HPLC. Two flavonoids and several sesquiterpene lactones were obtained. After evaluating the RESULTS

by spectroscopic methods and comparing them with the literature, the following substances were identified as pectolinarigenin, hispidulin, and the dominant sesquiterpene lactones – schkuhrin I and schkuhrin II (Herz W. 1980). Other substances have not been identified yet.

CONCLUSIONS

Schkuhria pinnata, Asteraceae is a source of interesting substances. After the identification of the isolated substances, cytotoxicity tests and possibly testing of antiproliferative and anti-inflammatory activity are planned.

Keywords: *Schkuhria pinnata*, sesquiterpene lactones, anti-inflammatory activity

Contact person: Dagmar Jankovská, jankovskad@pharm.muni.cz

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Kudumela RG, Mazimba O, Masoko P. (2019): Isolation and characterisation of sesquiterpene lactones from *Schkuhria pinnata* and their antibacterial and anti-inflammatory activities. *South Journal of Botany*, 126, 340-344, <https://doi.org/10.1016/j.sajb.2019.04.002>

Herz W, Govindan SV. (1980): Eucannabinolide and other constituents of *Schkuhria virgata*. *Phytochemistry* 19, 6, 1234-1237, [https://doi.org/10.1016/0031-9422\(80\)83094-9](https://doi.org/10.1016/0031-9422(80)83094-9)



Ornamental trees as the source of compounds with potential biological activity

Dvorská M.¹

¹ Department of Natural Drugs, Faculty of Pharmacy, Masaryk University

The increase of civilization diseases, infections, problems with antibiotic resistance, etc. leads to the searching for new compounds with specific biological activity. The plant sources of these substances usually come from plants historically used in the traditional medicine of various countries. These are not always representatives of native domestic species, so there may be a problem with their availability. A suitable alternative can be plants used somewhere only for ornamental purposes, but for which the professional literature describes potential or already confirmed biological effects. E.g. antioxidant, antimicrobial, anti-inflammatory or cytotoxic activity is often mentioned.

*Very interesting compounds were isolated for example from plant genera *Paulownia*, *Maclura*, *Catalpa* and others. In *Paulownia* trees geranyl flavonoids are typically connected with the biological effects same as prenyl flavonoids and xanthenes from *Maclura* spp. or iridoids isolated from *Catalpa* spp.*

Information about distribution of active secondary metabolites in certain species, evaluation of structure/effect relationship and next biological studies are necessary part of research of potential natural drugs.

Ornamental plants so could be suitable and available source enabling targeted phytochemical studies and the isolation of potentially therapeutically usable compounds.

Keywords: *Paulownia, Maclura, Catalpa, secondary metabolites, activity*

Contact person: Dvorská Margita, dvorskam@pharm.muni.cz

ACKNOWLEDGMENT

MUNI/A/1688/2020

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Chemické složení olejů a pokrutin z *Ochna serrulata* (Ochnaceae) a dalších nedostatečně využívaných tradičních olejnin ze západní Zambie

Tauhen J.

Katedra kvality a bezpečnosti potravin, Česká zemědělská univerzita v Praze

Tradiční lokální rostliny představují jednu z možností, kterou se dají zmírnit negativních dopady spojené s intenzivním zemědělstvím. Chemické složení mnoha těchto rostlin je však stále neznámé, znemožňující jejich využití v potravinářském a dalším průmyslu. Sója zůstává jednou z hlavních olejovin pěstovaných v Zambii (i jinde ve světě), leč tradiční olejodárné rostliny zůstávají opomenuty. V této studii bylo zkoumáno chemické složení tří olejovin, které jsou místními obyvateli (Lozi) využívány zejm. pro kuchyňské účely. Olej z *Parinari curatellifolia* a *Schinziophyton rautanenii* jsou složeny hlavně z kys. α -eleostearové (28,58–55,96 %), linolové (9,78–40,18 %) a olejové (15,26–24,07 %), zatímco *Ochna serrulata* obsahuje hlavně kys. palmitovou (35,62–37,31 %), olejovou (37,31–46,80 %) a linolovou (10,61–18,66 %); výtěžek olejů byl rovněž vysoký (39–71 %). *S. rautanenii* a *O. serrulata* byly bohaté na γ -tokoferol (3236,18 $\mu\text{g/g}$, resp. 361,11 $\mu\text{g/g}$). Tyto rostliny mají potenciál pro použití v potravinářském, technickém nebo farmaceutickém průmyslu.



Jedlé a léčivé houby kultivované v kontrolovaných podmínkách

Jozífek M.¹, Jablonský I.¹, Praus L.², Niček K.³

¹ Department of Horticulture, Czech University of Life Sciences Prague

² Laboratory of Environmental Chemistry, Czech University of Life Sciences Prague

³ Amanita CZ s.r.o.

AIM

Medicinal mushrooms have been used for centuries in various cultures (Chinese, Ayurvedic, and Native American healing practices). These fungi contain bioactive compounds that support human health. Mushrooms are also bioaccumulators of various elements (for ex. Se and Zn) (de Oliveira et. al 2022). Selenium and zinc are among the trace elements that have irreplaceable role in the metabolism of the human body (Gać et al. 2021). The aim of the work was to determine the differences in the accumulation of Se and Zn between individual species.

MATERIAL AND METHODS

Medicinal fungi were grown on supplemented hardwood sawdust in controlled fruiting chamber at CULS. Namely *Pleurotus ostreatus*, *Ganoderma* sp., *Lentinula edodes*, and *Hericium erinaceus*. Gradually increasing doses of selenium (2, 6 and 18 mg/kg) in substrates in the form of Na₂SeO₃ and zinc (10, 20, and 40 mg/kg) in the form of ZnSO₄ in cultivated fungi were studied. The content of individual elements in the samples of fruiting bodies was determined by inductively coupled plasma mass spectrometry (ICP-MS) after mineralization of the samples in a microwave digestion system.

RESULTS

A significant increase in the content of Se in fruiting bodies occurred at a dose of 18 mg selenium per 1 kg of substrate without significant loss of yields. The highest uptake of selenium among all species was observed in *P. ostreatus*. Different concentrations of selenium were obtained from caps and stipes as well as in different strains. The effect of the enrichment of the substrate with zinc in all studied species was less pronounced than that of Se enrichment. Increased fortification of zinc led to decreasing yields. Dried selenium-enriched fruiting bodies of *P. ostreatus* were used in production of dietary supplements. One capsule (300 mg) contains 37% RDA selenium.

CONCLUSIONS

Analyses had showed that Se uptake increased in all fungi in proportion to increasing Na₂SeO₃ dose. On the contrary, increasing doses of Zn did not lead to significant accumulation in fruiting bodies even at higher concentrations.

Keywords: selenium, zinc, medicinal mushrooms, *Hericium*, *Pleurotus*, *Ganoderma*

Contact person: i.jablonsky@seznam.cz; miroslav.jozifek@gmail.com

ACKNOWLEDGMENT

This work was supported by the Ministry of Agriculture of the Czech Republic under NAZV project No. QK1910209

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Semena olejného lnu, konopí setého a ostropestřce mariánského s ohledem na jejich kvalitativní parametry a potřeby využití

Bjelková M.

Agritec Plant Research s.r.o.



Je možno konstatovat, že semena lnu, konopí a ostropestřce se uplatňují v potravinářství nebo průmyslu a jejich vedlejší produkty jsou využívány jako krmné bílkovinné komponenty (pokrutiny a extrahované šroty). Použití celých semen není časté, ale možné například u slunečnice, lnu, máku a podobně. V posledních letech jsou nové perspektivy využitelnosti jako obnovitelných a hodnotných surovin pro procesy reagující na naléhavou potřebu přechodu na model oběhového hospodářství založený na konceptu nulového odpadu. Mimo technická využití jsou ideálními produkty moučky a výlisky z olejnatých semen, odvozené z extrakce oleje ze semen, představující vysoký obsah bílkovin, také pro přítomnost bioaktivních látek, jako jsou fenolové kyseliny, flavonoidy, lignany a další antioxidantní sloučeniny. Pokud hovoříme o pozitivitě z pohledu upotřebení, je nutné podtrhnout také zlepšující agrotechnické vlastnosti. Tyto plodiny se vyznačují nejen pozitivními agronomickými vlastnostmi, a navíc jsou mnohdy vhodné do okrajových lokalit, kde mohou mít i pozitivní dopad na udržitelnost a odolnost agroekosystémů.



Využití konopí v potravinářství, kosmetice a příklady z praxe

Gabrielová H.





Legislativní bariéry využití konopného květu a extraktu

Švejda F.

Přednáška se zaměřuje na aktuální témata v potravinářství - využití květu a extraktu z technického konopí a související legislativní bariéry. Technické konopí, bohaté na kanabinoidy a další užitečné látky, nabízí širokou škálu potenciálních aplikací v potravinářském průmyslu.

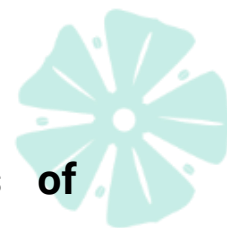
Okvěť technického konopí je především zemědělský produkt, který aktuálně pro pěstitele představuje nejvýnosnější část rostliny. Bohužel existují otázky, které nejsou dořešeny na celoevropské úrovni, které brání uplatnění jeho významného potenciálu.

Zpracování květu a extraktu: Představíme různé techniky extrakce a zpracování, které umožňují výrobu kvalitních potravinářských produktů z konopí.

Legislativní bariéry: Diskutujeme o aktuálních zákonech a regulacích, které ovlivňují využití konopí v potravinářství.

Budoucnost využití konopí v potravinářství: Závěrem se podíváme na perspektivy tohoto odvětví a možné trendy vývoje.

Přednáška je určena odborníkům v potravinářském průmyslu, právním expertům a všem, kteří mají zájem o tuto aktuální problematiku. Naším cílem je poskytnout komplexní pohled na využití konopí v potravinářství a osvětlit současné legislativní výzvy a příležitosti.



Nanoformulations of extracts from selected genotypes of medicinal cannabis (*Cannabis sativa* L.)

Skala T.¹, Fraňková A.¹, Kahánková Z.¹, Janatová Kosmáková A.¹, Tauchen J.¹, Bernardos Bau A.², Klouček P.¹

¹ Czech University of Life Sciences Prague

² Universidad Politécnica de Valencia

AIM

The public and health care providers are increasingly curious about the potential medical benefits of cannabis. Results from *in vitro* and *in vivo* studies demonstrated many beneficial effects of cannabis on human health, making it a potentially attractive therapeutic agent for skin diseases, such as acne, dermatitis, wound healing and inflammation [1]. Since topical application of cannabis in the form of extract is quite challenging due to its physical properties, a nanomaterial as a carrier for cannabis extract could serve as an alternative to facilitate its application. Indeed, nanomaterials have been used in medicine and cosmetics for many years.

MATERIAL AND METHODS

Five vehicles were prepared and ethanol extracts from selected varieties of medicinal cannabis with different cannabinoid profiles were subsequently incorporated. The prepared particles were then characterized for certain physical properties (size, Z-potential, etc.) in collaboration with the Polytechnic University of Valencia. In the case of chitosan particles, antimicrobial and cytotoxicity tests were also performed.

RESULTS

The characterisation of particles confirmed the formation of nanoparticles containing cannabis extract in most of the samples. These results were also confirmed by electron microscopy. A relatively strong antibacterial and antifungal effect was observed for the chitosan particles containing cannabis extracts (64-1024 µg/ml), which varied between each extract (the most active was high THC extract). Cytotoxicity tests on human skin cells confirmed the low toxicity of the encapsulated cannabis compared to the pure extracts, except for the particles containing CBD extract, which were cytotoxic at concentrations >64 µg/ml (extract alone >32 µg/ml). For the other particles the value was >256-512 µg/ml. Preliminary results suggest a promising potential of cannabis extracts in conjunction with several different carriers to combat skin pathogens, however, more research is needed in the future.

Keywords: *medical cannabis, nanomaterials, formulation, antimicrobial activity*

Contact person: Tomáš Skala, email: skalat@af.czu.cz

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Innovation of a fermented goat milk product

Kejdova Rysova L.¹, Sebova A.¹, Pracharova S.¹, Legarova V.¹

¹ Department of Food Science, Faculty of Agrobiolgy, Food and Natural Resources, Czech University of Life Sciences Prague

AIM

The pilot study evaluated the microorganism counts and sensory analysis of kefir from goat milk fortified with cinnamon essential oil and honeydew honey.

MATERIAL AND METHODS

Pasteurized goat milk was used for kefir production, which was inoculated with kefir culture (Chr. Hansen). Cinnamon essential oil and honeydew honey were added to the milk before fermentation. Four sets of kefir were made, the first of which was maintained as a control, without any addition of flavouring. The other three sets varied in the concentration of cinnamon essential oil: 100 µl/l, 200 µl/l, and 300 µl/l. The honeydew honey content was constant at 5% (w/v) for these three sets. The production was repeated three times in total. The microbiological analysis included determining yeast, thermophilic, and mesophilic bacteria counts. Furthermore, the effect of the addition of flavourings on the sensory profile and physical milk parameters was analysed.

RESULTS

It was found that adding flavourings affected all microbial representatives of the kefir culture, but *Streptococcus thermophilus* was the most affected. The fortification suppressed the typical goat taste and odour of goat kefir milk.

CONCLUSIONS

Based on these results, the antibacterial properties of cinnamon essential oil were demonstrated. However, despite this, the numbers of yeasts and lactic acid bacteria met the limits set by Decree No 397/2016 for the fermented milk product referred to as kefir milk. The RESULTS of the sensory analysis confirmed that the addition of cinnamon essential oil and honeydew honey positively influences the acceptability of goat kefir, which in some cases is rejected by consumers because of its strong vinegary, yeasty, and sour taste and odour.

Keywords: *cinnamon essential oil, fermented milk products, goat milk, honeydew honey, kefir*

Contact person: Ing. Lucie Kejdova Rysova, Ph.D., rysoval@af.czu.cz

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Zpracování bylin a koření CO₂ extrakcí

Kolář P.

TRUMF INTERNATIONAL s.r.o.

Touto prezentací Vás chci seznámit se způsoby získávání látek z rostlinných materiálů pomocí různých druhů extrakcí, se zaměřením na superkritickou extrakci oxidem uhličitým.

Součástí prezentace je přehled různých druhů extrakcí, včetně několika historických, které se využívají dodnes, příkladem je třeba parní destilace. Nejzajímavější technika extrakce je pomocí rozpouštědla CO₂, a to v jeho superkritickém stavu neboli stavu, kdy se plyn začne chovat jako kapalina a velice dobře v sobě rozpouští požadované látky z extrahované suroviny.

Seznámíme se s podmínkami pro vznik superkritického stavu, jaké jsou jeho výhody, nevýhody a které látky je možné vyextrahovat, zda vznikne více frakcí a jak je možné extrakty dále zpracovávat, a to nejen v potravinářském průmyslu, ale i v kosmetice nebo farmacii.

Obecně se jedná o šetrnou separační metodou, pomocí ní lze z rostlinných materiálů získat v nich obsažené látky, jako jsou například těkavé etherické látky – silice, aromata, oleje, barviva, vosky, a mnohé další složitější složky, jako jsou např. terpeny, alkaloidy ...

Superkritická extrakce, jako druh extrakce, je vhodná obzvláště pro přírodní materiály, u nichž nedochází ke zvýšenému tepelnému namáhání suroviny a ke kontaminaci produktu zbytkovým rozpouštědlem. Rovněž působením vysokého tlaku v extraktoru je zaručena mikrobiologická čistota produktu. Extrahovatelnost různých druhů látek závisí na jejich polaritě. Platí zde známé pravidlo, že „podobné rozpouští podobné“.

Společnost TRUMF International s.r.o. provozuje linku pro superkritickou extrakci CO₂ v režimu, který lze označit jako dynamický mód extrakce, kdy extrakční činidlo prochází kontinuálně vzorkem během celého trvání extrakce.

Na naší lince je možné extrahovat různé druhy koření, bylin a také různé další speciality, jako je třeba technické konopí, astaxanthin a další.

Touto prezentací bych chtěl oslovit případné zájemce o spolupráci pro využití tohoto zařízení a rád bych poděkoval spolupracovníkům z firmy TRUMF za pomoc při přípravě podkladů pro prezentaci.

Keywords: *supercritical CO₂ extraction, spices, medicinal herbs, astaxanthin, hemp*

Contact person: Kolář Petr , kolarp@trumf.cz,

Postery





EP01 Variability of secondary metabolites of medicinal plants in different soil and climatic conditions of Slovakia

Habán M.^{1,2}, Habánová M.³, Žitniak Čurná V.¹, Ražná K.⁴, Korczyk-Szabó J.¹

¹ Institute of Agronomic Sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 71 Nitra, Slovak Republic

² Department of Pharmacognosy and Botany, Faculty of Pharmacy, Comenius University in Bratislava, Odbojarov 10, 832 32 Bratislava, Slovak Republic

³ Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 71 Nitra, Slovak Republic

⁴ Institute of Plant and Environmental Sciences, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 71 Nitra, Slovak Republic

The system approach to the evaluation of the extension of natural plant resources in Slovakia, depending on the determinants of the environment, make it possible to carry out an inventory of potential raw materials usable in various industries. Qualitative indicators were assessed through phytochemical content analysis of the biologically active substances of secondary metabolism, such as essential oils, polyphenolic substances, antioxidants and their variability due to different soil-climatic conditions. Original and effective approach to research and evaluation was supported by genomic analysis based on microRNA regulatory molecules. The output of the research will be a processed list of natural plant sources for the Pharmacognostic map of Slovakia.

Keywords: *environment; qualitative indicators; genomic analysis; pharmacognostic map; Slovakia*

Contact person: prof. Ing. Marta Habánová, PhD., Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 71 Nitra, Slovak Republic, email: marta.habanova@uniag.sk

ACKNOWLEDGMENT

This research was created thanks to the support within the research project VEGA 1/0749/21: Environmental screening of variability of secondary metabolites of plant natural resources in soil-climatic conditions of Slovakia.

EP02 The effect of biostimulants on quantitative parameters and capsaicin content of selected paprika varieties

Mezeyová, I.¹, Golian, M.¹, Andrejiová, A.¹, Vavrek, M.¹,

¹ Horticulture and Landscape Engineering Faculty, Institute of Horticulture, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia

AIM

In recent days, several technological innovations were proposed to improve the production and sustainability through a significant reduction in use of agrochemicals. One of the best approaches to increase crop productivity is the utilisation of environment-friendly organic products such as "Biostimulants" (Padmaja et al., 2023). The AIM

of the experiment was to verify the effect of selected preparations on the quantitative parameters and capsaicin content in annual peppers - varieties 'Žitava', 'Karkulka' and 'Hodonínska sladká'.

MATERIAL AND METHODS

As part of the field experiment, Energen Fulhum Plus was applied 1 time, before planting the plants by soaking the root ball. The preparation Energen Fruktus Plus was applied 2 times during vegetation by spraying on the leaf. The preparation Humix (new composition) Universal was applied 3 times (before planting by treating transplants + 2 applications during vegetation by spraying on leaves). Within the framework of two harvests, the yield parameters were determined and the capsaicin content of the fruits according to STN 7541 was determined spectrophotometrically from the ground dry pepper fruits.

RESULTS

An increase in the yield of fresh matter under the influence of the Humix biostimulant was recorded in the case of the variety 'Karkulka' by 51 %, 'Hodonínska sladká' by 23% and 'Žitava' by 9%. Under the influence of the biostimulant Energen, a decrease was recorded in the case of the 'Žitava' variety, but an increase again in both other varieties. The highest capsaicin content was achieved in the case of application of Energen, but also Humix caused an increase compared to the control.

CONCLUSIONS

It is necessary to verify the positive effect of the preparations by repeating the experiment under different agroclimatic conditions (next year). If the RESULTS are confirmed, we recommend using both monitored biostimulants in practice to increase yields and capsaicin content in large-scale cultivation.

Keywords: *sweet pepper, yields, capsaicin, biostimulants*

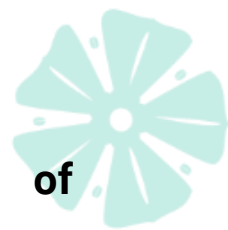
Contact person: doc. Ing. Ivana Mezeyová, PhD., ivana.mezeyova@uniag.sk

ACKNOWLEDGMENT

This research was funded by KEGA, grant number KEGA 004SPU-4/2022, "Interactive Classroom for Horticulture study program in the Context of Innovation of the Current Student's Teaching Process".

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EP03 Teaching the MASP course at the Department of Agroecology and Crop Production of the FAFNR CZU Prague

Tyšer L., Košnarová P., Kolářová M., Dvořák P., Pazderů K.

Department of Agroecology and Crop Production, Faculty of Agrobiological Sciences, Food and Natural Resources, Czech University of Life Sciences Prague

Department of Agroecology and Crop Production at the FAFNR Czech University of Life Sciences Prague has been teaching the course of medicinal, aromatic and spice plants (MASP) for a long time. In addition to the general issues of MASP (history and present, legislation, seeds, varieties, plant active ingredients), the spectrum of basic plant taxa that are most often cultivated, collected and used in the Czech Republic is discussed. In total, almost 80 main representatives of cultivated and collected MASP are listed, which are logically discussed according to the main used part of the plant (root, stem and leaf, flower, fruit). For the cultivated species, the main technologies and conditions of their production are given. The lecture is also devoted to the specifics of MASP cultivation within the organic farming system. Among other things, plant and dried drug diagnostics and some possibilities of practical use of MASP are discussed. The MASP demonstration botanical garden, which is regularly maintained and expanded by the department, is an integral part of the teaching. Nearly 50 representatives of mainly cultivated MASP are maintained here. One lecture and exercise is also devoted to an overview of the most important imported species, mainly from the exotic spice group.

Keywords: MASP, teaching, Czech University of Life Sciences Prague

Contact person: Luděk Tyšer, tyser@af.czu.cz





EP04 Environmental screening of medicinal plants extension in the Slovak Republic

Habán M.^{1,2}, Žitniak Čurná V.¹, Korczyk-Szabó J.¹, Macák M.¹

¹ Institute of Agronomic Sciences, Faculty of Agrobiolgy and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 71 Nitra, Slovak Republic

² Department of Pharmacognosy and Botany, Faculty of Pharmacy, Comenius University in Bratislava, Odbojarov 10, 832 32 Bratislava, Slovak Republic

AIM

Aim of presented research is the mapping of selected medicinal plant species in the Slovak Republic. Systematic approach to assessing the extension of natural plant resources is supported by the evaluation of the variability of quantity and quality indicators of current and prospective plant resources with medicinal effects based on environmental screening. This research is the basis for the database and the creation of the Pharmacognostic map of Slovakia.

Keywords: *natural plant resources; healing effects; occurrence mapping; Slovak Republic*

Contact person: Veronika Žitniak Čurná, veronika.curna@uniag.sk

ACKNOWLEDGMENT

This research was created thanks to the support within the research project VEGA 1/0749/21: Environmental screening of variability of secondary metabolites of plant natural resources in soil-climatic conditions of Slovakia





EP05 Extraction of rosmarinic acid from *Ocimum sanctum* using Nades

Tříška J.¹, Vrchotová N.¹, Pavela R.²

¹ Global Change Research Institute CAS, Bělidla 986/4a, 603 00 Brno

² Crop Research Institute, Drnovská 507/73, 161 06 Praha 6

AIM

Rosmarinic acid (RA) and its derivatives exhibit biological actions against various diseases such as cancer, diabetes, cardiovascular disease, neurodegenerative and inflammatory disorders (Noor et al., 2022). The most used conventional techniques for RA extraction from plants are Soxhlet extraction, maceration and new techniques have been introduced such as ultrasound-assisted extraction, microwave-assisted extraction, and supercritical fluid extraction using mainly organic solvents, e.g., ethanol, or acidified ethanol. Due to legislation restriction regarding ethanol, there is a demand for a solvent meeting the requirements (food industry). The solution could be Nades (Natural Deep Eutectic Solvents) (Dai et. al., 2015), which are very closed to the plants physiology. We studied mixtures of choline chloride:glucose, choline chloride:propane-1,2 diol and citric acid:glucose as examples of RA extraction using Nades.

MATERIAL AND METHODS

Dried, and ground basil leaves were mixed with the prepared Nades and extracted at laboratory temperature with constant stirring, then the mixture was analysed by HPLC.

RESULTS

Extraction with citric acid:glucose mixtures is more selective and provides comparable or even higher yields of RA compared to methanol extraction.

CONCLUSIONS

Extraction of RA using citric acid:simple sugar mixtures is a suitable alternative for the extraction of RA in the food industry and is also a way to develop extracts for diabetics.

Keywords: *Rosmarinic acid; Ocimum sanctum; extraction; Nades*

Contact person: Jan Tříška, triska.j@czechglobe.cz

ACKNOWLEDGMENT

This work was supported by the Ministry of Agriculture of the Czech Republic (Project No. QK1910103).

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EP06 Pascalized homogenates of herbs as a non-traditional food ingredient

Houška M., Novotná P., Strohalm J, Rysová J.

Food Research Institute Prague, Radiová 1285/7, 102 00 Praha 10

AIM

The aim of the work was the use of fresh aromatic and spice plants with maximum utilization of aromatic and biologically active substances with health benefits

MATERIAL AND METHODS

Fresh raw material - leaves, stems, flowers or flower heads were homogenized with a certain proportion of water to a homogeneous pulpy mass. This mass (homogenate) was treated without heating using an isostatic press CYX 6/103 (Žďas a.s.) under pressure of 400 - 500 MPa. The homogenates treated in this way were stored in the cold and added into food products.

RESULTS

A method of preparation of homogenates and a suitable regimen for their high pressure treatment were developed. The microbiological stability of the homogenates and the content of selected nutrients were monitored. The homogenates were then applied to candies, muesli bars, syrups, dressings and dairy products.

CONCLUSIONS

Herb homogenates have been found to be an optimal alternative to using fresh, dried or frozen herbs or herbal extracts. Aromatic substances and substances with antioxidant activity are preserved in the homogenates. Confectionery with the addition of herb homogenates is available in the retail network.

Keywords: *herbs, homogenates, foods, high pressure treatment*

Contact person: Ing. Jana Rysová, j.rysova@vupp.cz,

ACKNOWLEDGMENT

This work was supported by METROFOOD-CZ project MEYS Grant No: LM2023064 and by MA project QK1910103.

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EP07 Fermentation as a way of processing herbs

Kováříková E.

Food Research Institute Prague, Radiová 1285/7, 102 00 Praha 10

AIM

LACTIC ACID FERMENTATION IS A PROCESS THAT CAN PROTECT PLANT MATERIAL AGAINST DECOMPOSITION BY LOWERING THE PH AND ACCUMULATING PROTECTIVE SUBSTANCES PRODUCED BY LACTIC BACTERIA.

MATERIAL AND METHODS

Portulaca oleracea, *Tropaeolum majus* and *Aegopodium podagraria* were harvested during the period of intensive growth. Fresh material was mixed with NaCl (1.5% w/w). Sauerkraut juice (1% w/w) was used as inoculum. Fermentation took place in closed PA/PE bags, statically without access to air and at a temperature of 18-20 °C. The acidification effect was controlled by monitoring the pH.

RESULTS

The fermentation *Portulaca oleracea* was very successful and the pH dropped from 5.61 to 3.55 within 5 days. In contrast, *Aegopodium podagraria* does not appear to be suitable for fermentation. The pH change was from 4.86 to 5.02 in 9 days. *Tropaeolum majus* was fermentable easily, the pH dropped from 4.68 to 3.80 in 5 days.

CONCLUSIONS

The possibility of preserving herbs using the lactic fermentation process depends greatly on the composition of the herb, especially on the content of fermentable sugars and the presence of antimicrobial substances. Antimicrobial activity is attributed to *Portulaca oleracea* and *Tropaeolum majus*, they can be successfully fermented. The poor fermentability of *Aegopodium podagraria* can be a consequence of the low concentration of fermentable sugars as well as the antimicrobial effects of substances contained in the material.

Keywords: fermentation, herbs, antimicrobial effect

Contact person: Ing. Eliška Kovářiková, Ph.D., eliska.kovarikova@vupp.cz

ACKNOWLEDGMENT

This work was supported by METROFOOD-CZ project MEYS Grant No: LM2023064 and by MA project QK1910103.

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EP08 Evaluation of substances contained in clones of the genus *Echinacea*

Marián ŠINKO¹, Jarmila NEUGEBAUEROVÁ²

¹ Výzkumný ústav Silva Taroucy pro krajinu a okrasné zahradnictví v.v.i.; ² Zahradnická fakulta Mendelovy univerzity v Brně

AIM

The aim of the study was to compare the content of active substances in individual parts of the plant in selected clones of hybrids of the genus *Echinacea* created at the VÚKOZ workplace in Průhonice during 2012-2015. In 2019, 23 clones were analyzed and compared together with the botanical species *Echinacea purpurea*, originating from the Gene Bank of the Institute for Research and Development. The total content of the sum of caftar and cichoric acid values was monitored in flowers, roots, leaves and whole aerial part according to the Czech Pharmacopoeia as the sum of the values of both acids. As a result, the contents of the monitored acids were several times higher in individual parts of the plant.

MATERIAL AND METHODS

Breeding of the genus *Echinacea* was started in Průhonice in 2011 as part of the project of breeding perennials, with the intention of breeding new ornamental varieties. However, we were also interested in whether selected clones could have an increased content of active substances usable for the pharmaceutical industry. In cooperation with VÚKOZ in Průhonice and ZF MENDELU based in Lednice, the evaluation of the assortment of bred clones of the genus *Echinacea* at the Průhonice workplace in Michovka was launched in 2017. In 2019, samples (flowers, roots, leaves and aerial part) were taken again for repeated evaluation and monitoring of the content in individual parts of the plant. Samples were taken at the time of full flowering (July) and roots at the end of vegetation (October). The samples were dried at 40 °C. Laboratory evaluation of samples from leaves and roots was performed by liquid chromatography, according to the methods of the Czech Pharmacopoeia in the laboratory of the Department of Vegetable Growing and Floriculture ZF MENDELU.

RESULTS

According to the Czech Pharmacopoeia, a minimum content of 0.1% of the sum of caftaric acid and cichoric acid is required for *Echinacea purpureae herba*. For *Echinacea purpureae radix*, the minimum content of the sum of caftaric acid and cichoric acid is 0.5%, always given as the sum of the two parts and calculated per dried drug. In selected clones, the average contents of the sum of caftaric acid and cichoric acid in flowers ranged from 0.65% to 6.59%. In the roots, the average sum of these acids ranged from 0.37% to 2.70%. The leaves ranged from 0.39% to 3.76%, and the whole aerial part ranged from 0.44% to 4.16%. The highest acid sum content was found in inflorescences of clones 57/13, 175/13 and 31/13.

CONCLUSIONS

In conclusion, it can be said that the determined amount of the sum of acids in the majority of *Echinacea* samples meets the conditions of the Czech Pharmacopoeia.

Keywords: *Echinacea*; caftaric acid, cichoric acid

Contact person: Marián Šinko, marian.sinko@vukoz.cz; Jarmila Neugebauerová, jarmila.neugebauerova@mendelu.cz

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EP09 Microscopic analysis and therapeutic effects of plants of the family *Lamiaceae* and *Asteraceae*

Bačkorová M.¹, Magdoško R.¹, Tkáčiková L.²

¹ Department of Pharmaceutical Technology, Pharmacognosy and Botany, University of Veterinary Medicine and Pharmacy, 041 81, Košice, Slovak Republic

² Department of Microbiology and Immunology, University of Veterinary Medicine and Pharmacy, 041 81, Košice, Slovak Republic

AIM

The aim of this work was to examine the plants from the family *Lamiaceae* and *Asteraceae* (*Origanum vulgare* L., *Satureja hortensis* L., *Centaurea cyanus* L., and *Cichorium intybus* L.). The antioxidant activity and antibacterial effect of the plant extracts were studied on selected pathogens as well as the microscopic identification of glands and evaluation of their characteristics.

MATERIAL AND METHODS

The morphological features of the preparations were observed using a light microscope. The antioxidant activity was determined according to the DPPH radical method and the FRAP method. Antimicrobial activity was evaluated by the agar well diffusion method. The tested bacteria *Staphylococcus aureus* and *Escherichia coli* were obtained from the Czech Collection of Microorganisms (CCM, Brno, Czech Republic).

RESULTS

The occurrence of glandular trichomes was confirmed in the *Lamiaceae* family. In the *Asteraceae* family, it was possible to confirm the occurrence of multicellular trichomes on a cross-section of *Cichorii flos*. *Saturejae herba* had the highest antioxidant activity and *Cyani flos* flower extract had the lowest one. The extracts from *Saturejae herba* and *Cichorii flos* had the highest antibacterial potential against both pathogens.

CONCLUSIONS

A specific characteristic found on the leaves of the *Lamiaceae* family is the *Lamiaceae*-type gland, which is composed of 8 segments and has a star-shaped polygon. The essential oils, specifically thymol, and carvacrol are mainly responsible for the antibacterial effect.

Keywords: antioxidant, antibacterial effect, *Asteraceae*, *Lamiaceae*

Contact person: Miriam Bačkorová, miriam.backorova@uvlf.sk

ACKNOWLEDGEMENTS

This study was financially supported by KEGA 010UVLF-4/2021.

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EP10 Epigenetic screening of morphinan alkaloids' biosynthesis in salt stress conditions

Balažová E.¹, Balažová A.¹, Tothová K.¹, Bábiková B.¹, Obložinský M.¹

¹ Department of Cell and Molecular Biology of Drugs, Faculty of Pharmacy, Comenius University Bratislava, Kalinčiakova 8, 832 32 Bratislava, Slovakia.

AIM

: In plants, epigenetic modifications play a role in adaptation to various environmental changes. Changes in epigenome result in altered methylation patterns of DNA which influences gene expression and possibly secondary metabolites production (Lämke and Bäurle, 2017).

MATERIAL AND METHODS: Opium poppy plants cultivated in a hydroponic system were subjected to salt stress (different concentrations of NaCl were used). Using the RT-qPCR method we determined the relative expression of genes involved (i) in the regulatory processes of epigenetic modifications, especially DNA methylation (MET1, CMT3, DRM2, ROS1, DME), and (ii) in the biosynthetic pathway of benzylisoquinoline alkaloids (4OMT, CNMT, SalAT, COR).

RESULTS: Enzyme DRM2 is involved in *de novo* DNA methylation. The expression of the gene for DRM2 was significantly reduced in plants exposed to 5 mmol/l NaCl ($p < 0,05$). Interestingly, we observed an increase in the relative expression of the same gene in the group stressed with 15 mmol/l NaCl, although this was not a significant difference. We observed a significant decrease ($p < 0,05$; $p < 0,01$; $p < 0,0001$) in the expression of investigated genes in alkaloid biosynthesis.

CONCLUSION: Based on these RESULTS

we assume that the production of alkaloids is affected by salt stress (concerning the changes occurring within the biosynthetic pathway of morphinan alkaloids) and changes in DRM2 expression levels indicate altered methylation status of DNA in the CHH context (H = G, A, T) concerning different NaCl concentrations.

Keywords: *Papaver somniferum L.*; alkaloid biosynthesis; epigenetics; DNA methylation; RT-qPCR.

Contact person: Ema Balažová, balazova168@uniba.sk

ACKNOWLEDGMENT

The financial support by the Slovak Grant Agency VEGA of the Slovak Republic (project no. 1/0101/23) and Grants of Comenius University for PhD students (UK/172/2023) are gratefully acknowledged.

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EP11 Testing of flavonoids as possible α -glucosidase inhibitors

Karlíčková J.¹, Kašpárková M¹., Mladěnka P.²

¹ Department of Pharmacognosy and Pharmaceutical Botany, Faculty of Pharmacy in Hradec Králové, Charles University

² Department of Pharmacology and Toxicology, Faculty of Pharmacy in Hradec Králové, Charles University

AIM

To test if selected flavonoids can inhibit α -glucosidase at biologically relevant concentrations and to establish the structure-activity relationship.

MATERIAL AND METHODS

In vitro screening was performed by a spectrophotometric method using α -glucosidase from *Saccharomyces cerevisiae*, *p*-nitrophenyl α -D-glucopyranoside as a substrate and the registered drug acarbose was chosen as the standard substance. Twenty-two flavonoids were investigated.

RESULTS

Six compounds had a higher inhibitory activity than the standard drug acarbose. Quercetin had an IC_{50} of 1.5 μ M while kaempferol and morin were about 4-5 times less potent. Luteolin, hesperidin and 7,8-dihydroxyflavone were even less active but still appeared more potent than acarbose.

CONCLUSIONS

Flavonoids could be an interesting alternative to acarbose, but their effects on mammalian α -glucosidase still need to be confirmed in the further experiments.

Keywords: flavonoids, α -glucosidase inhibitors, enzyme from *Saccharomyces cerevisiae*, *in vitro* testing

Contact person: Jana Karlíčková, karlickova@faf.cuni.cz

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EP12 Fermentation as a way of processing herbs

Kováříková E.

Food Research Institute Prague, Radiová 1285/7, 102 00 Praha 10

AIM

Lactic acid fermentation is a process that can protect plant material against decomposition by lowering the pH and accumulating protective substances produced by lactic bacteria.

MATERIAL AND METHODS

Portulaca oleracea, *Tropaeolum majus* and *Aegopodium podagraria* were harvested during the period of intensive growth. Fresh material was mixed with NaCl (1.5% w/w). Sauerkraut juice (1% w/w) was used as inoculum. Fermentation took place in closed PA/PE bags, statically without access to air and at a temperature of 18-20 °C. The acidification effect was controlled by monitoring the pH.

RESULTS

The fermentation *Portulaca oleracea* was very successful and the pH dropped from 5.61 to 3.55 within 5 days. In contrast, *Aegopodium podagraria* does not appear to be suitable for fermentation. The pH change was from 4.86 to 5.02 in 9 days. *Tropaeolum majus* was fermentable easily, the pH dropped from 4.68 to 3.80 in 5 days.

CONCLUSIONS

The possibility of preserving herbs using the lactic fermentation process depends greatly on the composition of the herb, especially on the content of fermentable sugars and the presence of antimicrobial substances. Antimicrobial activity is attributed to *Portulaca oleracea* and *Tropaeolum majus*, they can be successfully fermented. The poor fermentability of *Aegopodium podagraria* can be a consequence of the low concentration of fermentable sugars as well as the antimicrobial effects of substances contained in the material.

Keywords: fermentation, herbs, antimicrobial effect

Contact person: Ing. Eliška Kovářiková, Ph.D., eliska.kovarikova@vupp.cz

ACKNOWLEDGMENT

This work was supported by METROFOOD-CZ project MEYS Grant No: LM2023064 and by MA project QK1910103.

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Název: 25. ODBORNÝ SEMINÁŘ S MEZINÁRODNÍ ÚČASTÍ: AKTUÁLNÍ ASPEKTY PĚSTOVÁNÍ, ZPRACOVÁNÍ A VYUŽITÍ LÉČIVÝCH, AROMATICKÝCH A KOŘENINOVÝCH ROSTLIN. SBORNÍK PŘÍSPĚVKŮ

Editoři: Matěj Božik Pavel Klouček.

Obálka: Matěj Božik

Vydavatel: Česká zemědělská univerzita v Praze

Počet stran: 38

Datum vydání: září 2023

DOI: 10.5281/zenodo.8316737

Za obsah příspěvků odpovídají jejich autoři.



DOI: 10.5281/zenodo.8316737

