Hana Středová (Ed.)

31st International Conference
MendelNet 2024

BOOK OF ABSTRACTS

November 6, 2024
Brno

MENDELU
Faculty
of Agronomy

2024

Mendelova univerzita v Brně

31st International Conference

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Conference MendelNet 2024 was organised by the Faculty of AgroSciences, Mendel University in Brno and supported by IGA project No. IGA24-AF-SK-001.

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ISBN 978-80-7701-007-8 (online ; pdf)
https://doi.org/10.11118/978-80-7701-007-8

ABSTRAKT

Sborník abstraktů z 31. mezinárodní konference doktorandů MendelNet 2024.

Klíčová slova: sborník abstraktů, MendelNet 2024, 31. mezinárodní konference doktorandů, agroekologie a živá příroda, rostlinná produkce a rostlinná biologie, živočišná produkce a potravinářství, živočišná biologie a zvířecí produkce, technika a technologie, aplikovaná chemie a biochemie.

ABSTRACT

Book of abstracts from MendelNet 2024, International Ph.D. Students Conference.

Keywords: Conference, Agroecology and Wildlife Research, Plant Production and Plant Biology, Animal Production and Food Technology, Animal Biology and Animal Production, Techniques and Technology, Applied Chemistry and Biochemistry.

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PREFACE

We are delighted to present the Book of Annotations for the 31st MendelNet Conference, an event where students from diverse agriscience fields gather to share knowledge, foster collaboration, and drive innovation within their disciplines. Over its 31-year history, MendelNet has become a valued platform for students to showcase their findings, exchange ideas with peers and mentors, and gain experience in professional presentation. This year's conference proudly continues that tradition with six specialized sessions: Agroecology and Wildlife Research, Plant Production and Plant Biology, Animal Production and Food Technology, Animal Biology and Animal Production, Techniques and Technology, and Applied Chemistry and Biochemistry. Each session provides a dedicated space for students to present research and insights that address critical challenges within agrisciences.

Beyond the experience of presenting, participants are also eligible for awards recognizing outstanding research and presentation quality. To confirm active participation, students must complete registration, including the submission of an approved annotation, and deliver a 15-minute oral presentation in English. All active participants will receive a Certificate of Participation, recognizing their dedication and contributions to the conference.

To further enhance the impact of this year's conference, we introduced an opportunity for active presenters to publish a short communication of their work in this Book of Annotations. Out of 53 active presenters, 33 expressed interest in this option, and on the following pages, we are pleased to share their scientific efforts with you.

On behalf of the organizational team,
Assoc. Prof. Hana Středová, Ph.D.

MendelNet 2024

ABSTRACTS

HIGH-RESOLUTION IMAGE ANALYSIS OF BARLEY ROOT AND SHOOT TRAITS FOR A SELECTION OF DROUGHT-TOLERANT GENOTYPES

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ABSTRACT

Understanding the morphological responses of barley to osmotic stress is crucial for identifying traits associated with drought tolerance. In this study, we evaluated eight barley genotypes with different growth habits (winter and spring) and from diverse geographical regions. The varieties were pregerminated under controlled conditions and then subjected to osmotic stress induced by PEG 6000 at two levels (-0.5 MPa and -0.7 MPa). The preliminary results revealed significant genotypic differences across the genotypes, with distinct responses observed in root length, root diameter, and shoot length. These traits varied not only between winter and spring barley but also between different regions of origin.

Root length and diameter, often key indicators of drought tolerance, were found to be critical, however, our results suggest that shoot length also plays an important role in the overall stress response. Varieties with longer shoots under stress conditions displayed better adaptive potential, indicating that shoot development may serve as an additional marker for drought tolerance. This multidimensional phenotyping approach, utilizing hight- resolution image analysis, provides valuable insights for breeders. By identifying specific root and shoot traits that contribute to drought tolerance, breeders can make more informed selections to develop barley varieties better suited to withstand osmotic stress and improve crop performance under water-limited conditions.

Keywords: barley phenotyping, high-resolution image analysis, drought tolerance, osmotic stress, root and shoot traits

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USE OF GPS DEVICES IN HORSE BREEDING

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ABSTRACT

Heart rate is understood as an important and objectively measurable indicator – an indicator of health, illness, excitement and stress. Our research was focused on measuring the physical load and heart rate of breeding stallions, during ejaculate sampling at the insemination station at Stud Farm Tlumačov. The topic is based on the hypothesis that GPS devices offer an objective evaluation of the load and heart rate is related to energy expenditure. The data was obtained using a Polar M430 GPS device and an EQUIMO tracker. The results include the specifications and comparison of the offered functions and the resulting data within the Polar M430 and the Equimo tracker. Resting heart rate in horses is 30-40 beats per minute. Analysis of the measured results showed that the average heart rate of stallions during ejaculate collection is 78 beats per minute. The measured average maximum heart rate was 125 beats per minute. With the excitement of the stallion, the heart rate rises sharply before ejaculation and drops sharply again after ejaculation. An increase in heart rate in stallions during ejaculation is associated with individual nervous system excitability.

Keywords: horse, breeding, GPS device, stallion

ACKNOWLEDGEMENT

This research was supported by the IGA project 24-AF-IP-030.

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THE INFLUENCE OF EXTINCT SETTLEMENT ON THE DIVERSITY OF VEGETATION IN THE POSTAGRARIAN LANDSCAPE OF MORAVIA

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ABSTRACT

Abandoned settlements hold extraordinary cultural and historical significance, but their ecological importance is equally crucial and has been underestimated until now. In the landscape, they represent unique habitats that provide opportunities for the existence of distinct communities and ecosystems. Throughout history, many villages, settlements, and agricultural estates have been abandoned for various reasons (changes in land use, wars, or shifts in industrial sectors). When these settlements were abandoned, they often left a legacy in the form of remnants of various landscape features. Abandoned fields, fallow lands, orchards, gardens, and other elements can have long-term effects on the flora and vegetation of the site and its surroundings. After abandonment, the landscape typically undergoes a process of natural succession. Pioneer plant species colonize the area, and over time, changes in the composition and structure of the vegetation occur. Some plant species originally planted and cultivated by humans may persist and naturalize, while others may decline or disappear. The impact of abandoned settlements on biodiversity can be complex. On one hand, the abandonment of agricultural land can lead to an increase in biodiversity. Studying the development of vegetation after the abandonment of human settlements, monitoring changes in species composition, identifying changes in landscape features and vegetation caused by the existence and subsequent decline of human settlements, and comparing the presence of invasive and endangered plant taxa in the context of current management of the studied sites will help us understand the relationship between historical settlements and plant communities that have developed in the areas of abandoned settlements.

Keywords: invasive species, endangered species, plant communities, landscape protection, management

ACKNOWLEDGEMENT

Research „The influence of extinct settlement on the diversity of vegetation in the postagrarian landscape of Moravia“ was financially supported by The Internal Grant Project of Mendel University in Brno IGA24-AF-IP-031. Special thanks for consulting on this research to Mgr. et Mgr. Ing. Hana Vavrouchová, Ph.D., doc. Ing. Bc. Hana Středová, Ph.D. and Mgr. Martin Jiroušek, Ph.D.

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MOLECULAR IMPRINTING PARTICLES AS SOLUTION FOR ESTRADIOL WATER CONTAMINATION

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ABSTRACT

This research focuses on the development of molecularly imprinted particles (MIPs) designed specifically for the detection of estradiol in water samples. Estradiol, a hormone with significant environmental and health impacts, often contaminates water sources, requiring sensitive and selective detection methods. The MIPs were synthesized with high affinity for estradiol and then immobilized on the surface of an electrode to create an electrochemical sensing platform. By exploiting the specific binding properties of the MIPs, the electrode can effectively and selectively detect trace amounts of estradiol in complex water matrices. This approach provides a cost-effective, sensitive, and rapid method for environmental monitoring, addressing the increasing need for detection of hormone pollutants in aquatic ecosystems. The results highlight the potential of MIPs in environmental sensing applications and contribute to the development of advanced electrochemical sensors for water quality monitoring.

Keywords: MIP, Estradiol, Sensor, water pollution

ACKNOWLEDGEMENT

Thanks for financial support to IGA24-AF-IP-036. CIISB, Instruct-CZ Centre of Instruct-ERIC EU consortium, funded by MEYS CR infrastructure project LM2023042 and European Regional Development Fund-Project „UP CIISB“ (No. CZ.02.1.01/0.0/0.0/18 _046/0015974), is gratefully acknowledged for the financial support of the measurements at the CF Nanobiotechnology. The research was financially supported by the IGA MENDELU AF-IGA2023-IP-027, Mendel University in Brno.

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CULTIVATION OF DENDRITIC CELLS USING 3D CELL CULTURE SYSTEM

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ABSTRACT

3D cultivation systems are crucial because they closely mimic natural in vivo conditions, improving the accuracy of experimental results. They also reduce the need for animal testing by providing a reliable alternative for studying cellular behaviors and diseases. Dendritic cells, key players in bridging specific and non-specific immunity, are extensively researched for their role in antigen presentation and potential therapeutic applications in infectious diseases, autoimmune disorders, transplantation, and anti-tumor immunity. Therefore, the development of new 3D models for dendritic cell culture is essential for understanding various disease mechanisms and developing new treatment methods.

This presentation focuses on testing 3D culture systems for dendritic cell cultivation using nanofiber scaffolds composed of biodegradable plastic polycaprolactone and fibroin produced by silkworm (Cricula trifenestrata) in varying concentrations. Results indicated that dendritic cells thrived best on nanofibers with higher fibroin content, while 100% polycaprolactone with random fiber arrangement showed the lowest cell attachment. These findings highlight the superior performance of fibroin-enriched nanofibers in supporting dendritic cell growth, suggesting their potential in advanced tissue culture systems and immunological studies.

Keywords: dendritic cells, 3D culture systems, nanofibers, fibroin, polycaprolactone

ACKNOWLEDGEMENT

This work was supported by the Ministry of Education, Youth and Sport of the Czech Republic, project number 8J23FR005, and by the Internal Grant Agency of Faculty of AgriSciences at Mendel University in Brno, project number IGA24-AF-IP-021.

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MOLECULAR MECHANISMS UNDERLYING IMPACT OF HEAVY WATER ON 2 MODEL PLANT ARABIDOPSIS THALIANA

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Heavy water (D_2O) is scarce in nature, and despite its physical similarity to water, D_2O disrupts cellular function due to the isotope effect. While microbes can survive in nearly pure D_2O, eukaryotes such as Arabidopsis thaliana are more sensitive and are unable to survive higher concentrations of D_2O. To explore the underlying molecular mechanisms for these differences, we conducted a comparative proteomic analysis of E. coli, S. cerevisiae, and Arabidopsis after 180 minutes of growth in a D_2O-supplemented media. Shared adaptive mechanisms across these species were identified, including changes in ribosomal protein abundances, accumulation of chaperones, and altered metabolism of polyamines and amino acids. However, Arabidopsis exhibited unique vulnerabilities, such as a muted stress response, lack of rapid activation of reactive oxygen species metabolism, and depletion of stress phytohormone abscisic acid signaling components. Experiments with mutants showed that modulating the HSP70 pool composition may promote D_2O resilience. Additionally, 19 Arabidopsis rapidly incorporated deuterium into sucrose, indicating that photosynthesis facilitates deuterium intake. These findings provide valuable insights into the molecular mechanisms that dictate differential tolerance to D_2O across species and lay the groundwork for further studies on the biological effects of uncommon isotopes, with potential implications for biotechnology and environmental science.

Keywords: stress response, proteome, ROS metabolism, deuterium oxide, adaptation, HSP70

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EFFECTS OF A LONG-TERM PRESSURE OF ZINC OXIDE AND ITS NANOPARTICLES ON ENTEROCOCCUS FAECALIS

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ABSTRACT

The overuse of zinc oxide (ZnO) in animal agriculture, particularly for preventing post-weaning diarrhea in piglets, has raised concerns about bacterial virulence and antimicrobial resistance, leading to the 2022 European Union ban on high-dose zinc. Zinc oxide nanoparticles (ZnONPs) are being explored as an alternative due to their enhanced antibacterial properties, although their impact on resistance mechanisms remains unclear.

This study examines the long-term effects of ZnO and ZnONPs on Enterococcus faecalis (E. faecalis), focusing on alterations in colony morphology, biofilm formation, and conjugation frequency. In conjugation assays, the untreated OG1RF:pCF10 strain served as the donor, while ZnO- and ZnONPs-treated OG1SSp strains were used as recipients. In the OG1RF:pCF10 strain, exposure to both ZnO and ZnONPs induced pronounced changes in colony morphology and an increase in biofilm production, whereas no morphological or biofilm-related changes were observed in the OG1SSp strain when compared to the control. Notably, exposure to ZnONPs led to a notable increase in conjugation frequency, indicating that ZnONPs may enhance horizontal gene transfer, potentially facilitating the dissemination of antibiotic resistance plasmids.

These findings highlight the need for a thorough assessment of ZnONPs as a replacement for ZnO, especially given their potential to promote biofilm formation and genetic exchange. Further research is necessary to understand the broader implications of ZnONP exposure, particularly in relation to the propagation of antibiotic resistance.

Keywords: zinc oxide, nanoparticles, enterococcus, conjugation, biofilm

ACKNOWLEDGEMENT

This study was financially supported by the Internal Grant Agency of Mendel University in Brno, under registration number IGA24-AF-IP-032.

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ELECTROMECHANICAL FEM SIMULATION OF STRAIN GAUGE

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ABSTRACT

Strain gauges are a relatively common type of sensor designed to measure mechanical strain. They work on the principle of the change in electrical resistance of a material due to mechanical strain. This change in resistance is reflected by a change in the measured stress. In order to measure the change in voltage, strain gauges are connected to a Wheadstone bridge. In such an arrangement we can use one, two or four strain gauges. Two and four strain gauge arrangements are used to compensate for external factors that would affect the measurement, for example temperature. This contribution focuses on the electro-mechanical FEM simulation of strain gauges connected in a full Wheadstone bridge (4 strain gauges). The simulation was performed in Ansys Classic software.

Keywords: FEM simulation, strain gauge, Ansys Classic

ACKNOWLEDGEMENT

This work was supported by HORIZON EU “FreeTwinEV” project no 101159989.

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UTILIZATION OF LIQUID FERTILIZER PRODUCED BY AEROBIC DIGESTION OF SOLID WASTE FROM FISH FARMING IN INDOOR CULTIVATION OF BASIL (OCIMUM BASILICUM L.)

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ABSTRACT

The aim of this study was to test the efficiency of a liquid fertilizer produced by aerobic digestion of solid waste from African catfish (Clarias garipenius) reared in a recirculating aquaculture system (RAS) on the growth of basil (Ocimum basilicum) cultivated in a vertical indoor farm and to compare it with a commercial mineral fertilizer. 180 L of RAS water and 1700 g of dry solid waste were mixed in an aerobic reactor. After 24 days, the concentrated solution was diluted 1:3 with tap water. Basil plants were grown in an indoor vertical hydroponic system using the deep water technique (DWC) in 3 different nutrient solutions: (1) Numazon fertilizer (NUM); (2) fish excrement mineralizate (FEM); (3) Numazon and FEM mix (MIX). Root length was 16.74% higher in the MIX variant compared to the NUM variant. The other biometric parameters (total weight of plants, above-ground biomass, root biomass) were comparable or higher in MIX variant than in commercial NUM variant. Biometric parameters in FEM variant were 15.47 to 19.83% lower than in NUM variant, however, a root weight that was 6.18% higher was recorded. The FEM variant contained the highest amount of dry matter and the lowest nitrate accumulation of all the variants. The content of vitamin C, chlorophyll a, b and carotenoids in the FEM variant was 7.33-12.69% lower than in the NUM variant. This study showed that organic liquid fertilizer has the potential to replace commercial fertilizer and the mixing ratio even increased the biometric parameters of the plants.

Keywords: aquaculture, indoor cultivation, basil, African catfish

ACKNOWLEDGEMENT

This study was funded by the Internal Grant Agency of the Mendel University in Brno (project no. IGA24-AF-IP-039)

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OPTIMISATION OF TRACTOR AGGREGATION IN TERMS OF EFFICIENCY OF TRACTIVE POWER TRANSFER TO THE PAD

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ABSTRACT

The aim of the study is to analyse the tractor‘s traction properties depending on the change of the tractor‘s centre of gravity. To change the centre of gravity position, a sliding ballast in the front three-point linkage was used so as to achieve an increase in the load on the front drive axle. The moment balance of the tractor shows that the front axle is significantly lightened as the tractive force increases, and the rear axle is loaded with this weight. The aim of the measurements is to verify this assumption and to optimise the static loading of the tractor drive axles so that the tractor combination achieves the most efficient transfer of the driving force to the pad. The field measurements were carried out in Žabčice on two types of surfaces, namely concrete and grassland. The results of the measurements show that a suitable change in the position of the centre of gravity has a positive effect on the transfer of the driving force to the pad.

Keywords: centre of gravity, axle load, driving force

ACKNOWLEDGEMENT

This study was supported and financed by the internal grant agency of the Mendel University in Brno – Faculty of Agronomy, No. IP 2024.

The research has been supported by the project No. IGA24-AF-IP-049; Creation of an algorithm and development of a prototype for optimal tractor aggregation in terms of tractive power transfer efficiency; financed by IGA AF MENDELU.

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ORGANIC AND INORGANIC COATING AND HEAT TREATMENT OPTIONS FOR 3D PRINTED MATERIALS

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ABSTRACT

The article deals with the optimization of 3D print coatings made of PET-G (polyethylene terephthalate-glycol), rPET-G (recycled polyethylene terephthalate-glycol), PP (polypropylene) and PA (nylon) materials, produced by FFF (Fused Filament Fabrication) technology. The use of these materials in additive technology has a great potential, both in industry, agriculture and, for example, food industry. The research evaluates different types of surface protection and their mechanical properties of in-house test samples, both with organic and inorganic coatings, including the possibility of heat treatment of the material. The standard has always been samples without subsequent treatments. Mechanical testing of the specimens was carried out using tensile testing (EN ISO 527-2), three-point bending testing (EN ISO 178) and impact toughness testing (EN ISO 179-2). The texture of the samples was evaluated according to EN ISO 4287. Degradation of the test specimens was carried out by cyclic testing using a combination of exposure in a salt spray environment and in a climatic chamber. The results of the experiments show that by a suitable combination of base material and surface protection, a clear improvement in the mechanical properties of the material can be achieved. Extending the lifetime of materials is important not only from an economic point of view, but also from an environmental point of view. Improving the durability of coatings and thus increasing the lifetime of components produced by additive manufacturing is one of the key steps to reduce plastic waste.

Keywords: 3D print, filament, organic coating, inorganic coating, heat treatment

ACKNOWLEDGEMENT

This project was supported by an Internal Grant Agency, namely No.: IGA24-AF-IP-046

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THE INFLUENCE OF BEAR GARLIC ON THE SENSORY QUALITY OF COOKED MEAT PRODUCT

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ABSTRACT

The aim of this study was to produce two variants of sausages with 0.4%, 0.8% and 1.2% addition of kitchen and bear garlic and to monitor their sensory quality. Bear garlic has a distinct pungent taste which is associated with the sulphur compound allin. When the garlic is crushed or chopped, the enzyme alinase is activated, which produces allicin from allin. Allicin is antimicrobial, antifungal and antiviral. The sausages were evaluated a total of two times (day 1 after production and day 14 after production). Chemical analysis (dry matter, fat, protein and salt content), instrumental colour measurement, and sensory evaluation of the sausages produced were carried out. The addition of bear garlic was particularly evident in the sensory evaluation of the garlic flavour pleasantness descriptor, where the sausages with the addition of bear garlic had higher values than those with the addition of kitchen garlic. On day 1 of production, the evaluators found the sausages with 0.8% and 1.2% of cooked and bear garlic more acceptable in the descriptors of garlic aroma intensity, garlic flavour intensity, garlic flavour pleasantness and overall impression.

14 days after production, the sausage with 0,8% added garlic and bear garlic was the most acceptable to the assessors, particularly in the descriptors of overall appearance, pleasantness of garlic aroma, pleasantness of garlic flavour and overall impression.

When comparing the day 1 and day 14 sausages with 0.4%, 0.8%, and 1.2% added kitchen and bear garlic, the sausage with kitchen and bear garlic on day 1 of production was rated best, particularly in the descriptors of juiciness, consistency, and pleasantness of garlic flavor.

Keywords: bear garlic, kitchen garlic, sausage, meat product, sensory analysis

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UTILIZING UAVS AND SATELLITE IMAGERY FOR MAPPING OF CROP DAMAGE BY COMMON VOLE (MICROTUS ARVALIS)

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ABSTRACT

This study explores the use of unmanned aerial vehicles (UAVs) and satellite imagery for mapping crop damage caused by the common vole (Microtus arvalis), a significant agricultural pest. During population outbreaks, the common vole can cause extensive economic losses in crop production. The aim of this research was to validate the effectiveness of UAV and satellite data for accurately assessing crop damage and supporting agronomic decision-making, including the site-specific application of pesticides and fertilizers. The research was conducted in fields of oilseed rape, winter wheat, and alfalfa in spring 2024. UAV imagery was collected using a DJI Mavic 3 Multispectral drone, and satellite data were obtained from the PlanetScope system. Ground surveys using RTK-GNSS were employed to validate remote sensing data. The analysis demonstrated that satellite imagery is suitable for detecting damage over areas larger than 100 square meters, while UAV data can identify damage as small as several square meters. The results highlight that remote sensing can effectively complement traditional field surveys, providing a more efficient and accurate method for monitoring vole damage. This approach offers both economic savings and environmental benefits through targeted applications of agricultural treatments.

Keywords: rodents, remote sensing, drone, GIS

ACKNOWLEDGEMENT

The study was supported by research project of Internal Grant Agency of the Mendel University in Brno as IGA24-AF-IP-055 “Detection of Crop Damage by Common Vole (Microtus arvalis) Using Remote Sensing Methods”.

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MUSHROOM FARMING IN UGANDA: SOCIO-ECONOMIC CONTRIBUTION OF MUSHROOM TRAINING AND RESOURCE CENTRE

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ABSTRACT

In sub-Saharan Africa, the economic benefit of mushroom production is gaining importance. Specifically in Uganda, the tropical climate offers suitable conditions for cultivation of various strains of oyster mushroom all year round. The mushroom cultivation technology was introduced in the country in the early 1990s and has since been promoted as a sustainable source of income for the poor rural communities. The technology uses waste from processing of agricultural plants which are abundant across the country. Waste materials from sorghum, beans, peas, corn, banana, sugarcane, coffee, millet, wheat, rice, and cotton, among others are excellent substrate materials for producing high-quality oyster mushroom fruiting bodies used by rural households for food and income generation. The use of local resources is also fundamental to strengthening environmental sustainability. With the spent substrate material from oyster mushroom production being used as organic manure for improving soil health, some organizations and farmers have adopted the practice as an adaptation measure for improving agricultural production and restoring natural ecosystems. One of such organizations promoting Oyster mushroom farming in Uganda is the Mushroom Training and Resource Centre (MTRC) which has since its establishment in 2007 trained over 30,000 mushroom farmers across the country.

Keywords: mushroom cultivation, oyster mushrooms, substrate material, sustainale agriculture

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METHODS OF ENCAPSULATION FOR TARGETED RELEASE OF ACTIVE COMPOUNDS

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ABSTRACT

Bio-based materials are promising materials for the achievement of carrier nanoparticles with advanced properties for the use in multiple fields including food preservation, agriculture, and medicine. Among various incorporation approaches, an encapsulation is a method of active substance modification, where molecules of an active agent are entrapped within carrier matrix and/or core. Biopolymers and biodegradable polymers have significant potential in the encapsulation to provide a way for targeted delivery and release of an active agent. Polycaprolactone (PCL) was used as the model biodegradable and biocompatible carrier in nanoparticle encapsulation of a model dye Nile red (NR), which is utilized for neutral lipids staining. The nanoparticles were prepared by emulsion method. The Z-average for the resulting polycaprolactone-based nanoparticles was 205±73 nm, 210±22 nm for PCL and Nile red-PCL, respectively. The UV-vis spectrometry was used to determine encapsulation efficiency of 93,3%. To evaluate particle degradation process and achievement of controlled release, lipase induced enzymatic hydrolysis was studied within 2 h.

Keywords: encapsulation, nanoparticles, controlled release, Nile red, polycaprolactone

ACKNOWLEDGEMENT

We would like to acknowledge financial support by the Internal Grant Agency of MENDELU (project no. IGA24-AF-IP-012).

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UTILIZING SKIN RESISTANCE AS AN INDICATOR OF MICROCLIMATE CHANGES IN TECHNICAL SYSTEMS: A CORRELATIONAL ANALYSIS

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ABSTRACT

This study investigates the relationship between microclimate factors – specifically temperature, humidity, and air velocity – and the body's physiological responses. Using correlation analysis, the research aims to uncover patterns that show how fluctuations in these microclimate parameters influence participants' reactions, which are assessed through a measured parameter. The study was conducted during the summer in two distinct environments: a controlled room where microclimate variables could be adjusted, and a car, where conditions were influenced by external weather and vehicle operation. Participants were categorized by sex and age, and individual measurements of different microclimate factors were recorded alongside the corresponding physiological response. To analyze the interrelations between these variables, Pearson's correlation was applied. The results revealed a moderate correlation between changes in microclimate parameters and the measured response, with correlation coefficients ranging from 0.54 to 0.68. Graphical representations of the data demonstrated variations in skin responses to changes in microclimate conditions, indicating that even small adjustments in these parameters could significantly impact participants' reactions. These graphs supported the correlation analysis and helped clarify the complex, non-linear relationships between microclimate factors and the recorded parameter.The findings are essential for improving the design of devices used to monitor microclimate conditions. A better understanding of these interactions allows for the refinement of measurement tools, ensuring their stability and accuracy—key requirements for applications that demand precise and consistent long-term data.

Keywords: HVAC, Intelligent systems, Real-time monitoring, Physiological responses,

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to Mendel University for their continuous support of doctoral students and for fostering the advancement of science both locally and internationally. Their commitment to research and innovation has been invaluable in enabling the success of this work.

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FUNGAL ACCUMULATION OF LEAD NEAR FIRING RANGES

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ABSTRACT

Fungi play a vital role in ecosystems, contributing to nutrient cycling, biomass decomposition, and the food chain. However, human activities increasingly impact the environment, introducing contaminants like heavy metals, which persist in nature and pose health risks. Lead (Pb) is particularly harmful, and its accumulation in edible fungi can spread through the food chain, potentially causing lead poisoning even at low doses. Firing ranges are a common source of lead contamination, as shotgun pellets fall into the surrounding soil. Over time, these pellets break down, increasing the contamination area. Fungi can absorb lead from the soil, which may lead to health issues if consumed. This study focused on analyzing soil and mushroom samples from areas within and outside the expected pellet fallout range at firing ranges. The results were compared with other research across Europe. It was found that lead concentrations in edible forest mushrooms, especially in species like Laccaria amethystina, Laccaria laccata, and Lycoperdon perlatum, remained elevated even when soil lead levels decreased. More commonly gathered mushrooms like Macrolepiota procera and Lactarius sp. also had higher concentrations. This suggests that fungi may retain lead for longer periods, highlighting the importance of establishing safe boundaries around contamination sources like firing ranges.

Keywords: fungi, lead, contamination, accumulation, firing range

ACKNOWLEDGEMENT

Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the project No. 09I03-03-V05-00016.“

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EVALUATION FOR SPOT SPRAYING OF HERBICIDES IN PRECISION AGRICULTURE

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ABSTRACT

Optimalization of herbicides use is key topic in weed management to minimize the environmental risks while achieving a sufficient crop yield productivity. Nowadays farmers can use most precise technique for application of herbicides, such as individual sprayer nozzles control, which allows patch or spot spraying based on the identification of weed infestation. Although there are prototypes of the on-the-go sensors for real-time detection of weeds, currently, the most widely used mapping method is remote sensing by unmanned aerial vehicles (UAV). Orthomosaic with high spatial resolution give us the ability to create maps for application of selective or non-selective herbicides. Based on data of UAV, the varies according to the herbicide treatment application – for non-selective (green on brown) and selective applications (green on green). Detection of weed plants in crop is more demanding by using various trained machine learning models and mostly results in bounding boxes of objects (plants) to be sprayed. The study continues the experiment initiated by a „Skymaps – research project“ (CZ.01.1.02/0.0/0.0/20_321/0024838). The evaluation of the economic benefits of the proven technology is based on the size of field plots and the design of application map for that area. The results showed the need to spray 17 – 100 % of the experimental area depending on intensity of weed infestation. More than 40 % of area (442 ha) showed possible saving of 25 % herbicides by spot spraying.

ACKNOWLEDGEMENT

The study was supported by research project of Internal Grant Agency of the Mendel University in Brno as “Vyhodnocení cílené aplikace herbicidních látek v precizním zemědělství” IGA24-AF-IP-044.

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THE APPLICATION OF GAS CHROMATOGRAPHY FOR THE EVALUATION OF TECHNOLOGICAL AND HEALTH INDICATORS OF BOVINE MILK FAT AFTER DIETARY CHANGES

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ABSTRACT

The study aimed to apply gas chromatography for the evaluation of the effect of inclusion of sorghum silage into dairy cow diet on technological and health indicators of milk fat. The on-farm feeding experiment was carried out on mid-lactating Czech Fleckvieh cows (Agrospol a.d. Knínice, farm Vanovice) and was divided into two consecutive periods of 3 months each. In the first period, cows were fed a total mixed ration based on maize silage and grass haylage (Control), while in the second period, grass haylage was partially replaced by sorghum silage (Sorghum). In each period, samples of evening and morning milk were taken from ten cows and were analysed for FA composition. The FA profile was analysed using gas chromatography with flame ionization detection. The atherogenic and thrombogenicity indexes were lower in Sorghum compared to Control ($P<0.05$). Essential FA content, polyunsaturated to saturated and hypocholesterolemic to hypercholesterolemic ratios were higher in Sorghum group ($P<0.05$). The ratio of n-6 FAs to n-3 FAs was lower in Sorghum group, but the value was still within the recommended intake ratio ($P<0.05$). The inclusion of sorghum silage into the ration also influenced the indexes of technological properties. Indexes of spreadability of manufactured butter and peroxidisability were higher in Sorghum than in Control ($P<0.01$). While the peroxidisability index was higher in Sorghum, for technological properties lower value is preferred due to enhanced stability and reduced oxidation, but higher values are advantageous for health-related properties.

Keywords: gas chromatography, alternative feed, milk fat, fatty acids, technological and health indicators

ACKNOWLEDGEMENT

This work was supported by NAZV project No. QK22010251.

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EFFECT OF CYANIDIN-3-O-GLUCOSIDE ON HUMAN OVARIAN CELL LINES HGL5 AND COV434 IN VITRO

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ABSTRACT

Cyanidin-3-O-glucoside (C3G) is a powerful bioactive anthocyanin commonly found in various fruits, including blackberries, honeyberries, and blueberries. This naturally occurring compound has garnered significant attention in recent years due to its wide range of biological activities, particularly its chemoprotective and anticancer potential. Our study aimed to investigate the effects of cyanidin-3-O-glucoside (5-50 µg. mL-1) over a 24-hour period on cell viability, steroid hormone secretion progesterone and 17ß-estradiol and their receptors (progesterone receptor and total estrogen receptor) in the human ovarian granulosa tumor cell line COV434. Cell viability was measured using the AlamarBlueTM assay, and steroid hormone production and receptor levels were assessed with ELISA. A significant decrease (P≤0.01) viability of COV434 tumor cells occurred at a 50 µg.mL-1 concentration of C3G after 24 hours. However, cyanidin-3-O-glucoside did not affect the release of steroid hormones and their receptor level in these ovarian cells. While our in vitro findings suggest a possible impact of cyanidin-3-O-glucoside on human ovarian tumor cells, further research is necessary to clarify its mechanism of the effect due to limited data and system complexity.

Keywords: anthocyanins, tumor ovarian cells, viability, steroidogenesis

ACKNOWLEDGEMENT

The work was supported by the Ministry of Education, Science, Research and Sport of the Slovak Republic projects VEGA 1/0620/24, APVV-18-0312, APVV-21-0206 and the Operational Program Integrated Infrastructure within the project: Demand-driven research for the sustainable and innovative food, Drive4SIFood 313011V336, co-financed by the European Regional Development Fund.

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TRAM TRACK BIODIVERSITY AND ITS ANNUAL DYNAMICS

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ABSTRACT

At this time, more and more people are moving to cities, which are constantly growing in size. This is causing a loss of biodiversity and natural ecosystems. In order to preserve at least some biodiversity, it is therefore our task to protect the remaining ecosystems and to build artificial ecosystems, such as parks. Tram tracks, which take a significant area of many cities, can also serve as artificial ecosystems. Tram tracks are a very specific environment, as yet minimally studied. Although they may contain non-native species as well as rare and endangered species. The research covered by an ongoing dissertation will deal with the monitoring of the biodiversity of tram tracks in Prague, which is a city large enough to provide enough sites with different surfaces such as gravel, asphalt or cobblestones. The monitoring will include three ecologically distinct groups of organisms, i.e. vascular plants, mosses and invertebrates. The aim of the research will be to evaluate the community structure of the mentioned groups of organisms in space and time. The research will also address basic ecological questions concerning the relationship of each group of organisms to environmental features such as surface texture, climate, track age (vegetation succession after the last track reconstruction). Biodiversity in the broader sense has never been studied in tram tracks. This means that this research will provide completely new knowledge that can be used in practice.

Keywords: tram tracks, biodiversity, urbanisation

ACKNOWLEDGEMENT

I would like to thank my supervisor for his professional guidance and his willingness to work with me on the topic of tram tracks since my bachelor thesis. Also I would like to thank Prague Public Transit Company for their help and making the research possible.

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IN OVO AMINO ACIDS: INSIGHTS FROM DOMESTICATED AND LABORATORY MODEL SPECIES

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ABSTRACT

Poultry production continues to meet increasing global demands, optimizing nutritional strategies such as supplementation of amino acid to improve hatchability, early growth, and overall poultry performance. We reviewed studies published the used the in ovo technique. The review employed explicit methods to search the literature in databases and evaluate the effects of in-ovo amino acid methodologies on hatching, hatching body weight, and postnatal growth. The quality of each article was assessed based on the defined criteria. Among the evaluated studies, 81.1% focused on using individual amino acids, with arginine being the most used amino acid. Some combinations of amino acids, such as threonine and arginine, increased hatchability and postnatal growth compared to the individual amino acids. The optimal amino acid dosages are crucial; excessive amounts induce toxic effects on the developing embryo. The injection site, timing and volume of the amino acid solution, with the amniotic fluid being the most effective site, positively improved the results. Other factors such as egg weight, sealing materials, and temperature of the injected solution could significantly influence the effectiveness of in ovo feeding methods. While amino acids varied among the studies, injection timing on the day also influenced the results. This review found promising results for in ovo amino acid feeding. Extensive should focus to optimise the amino acid feeding techniques considering the embryo‘s physiological environments, injection timing, and other parameters. Such knowledge will enlighten the understanding of the interaction of these factors and the contribution to the improvement of the poultry industry.

Keywords: amino acids, growth, poultry, in ovo

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THE EFFECT OF THE DAILY LIGHT INTEGRAL AND SPECTRUM ON MESEMBRYANTHEMUM CRYSTALLINUM L. IN AN INDOOR PLANT PRODUCTION ENVIRONMENT

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ABSTRACT

This study assessed the impact of four light spectrum variants combined with two photoperiods on the growth and biochemical composition of common ice plant (Mesembryanthemum crystallinum L.). As part of the lighting receipts (LRs), warm white (CT~4200 K), cool white (CT~6300 K), blue (~460 nm), and red (~640 nm) spectra were combined and tested under -18 and -21 hour photoperiods, both with a constant PPFD of 180 μmol.m^{-2}.s^{-1}. This study aimed to optimize growth and phytochemical content of common ice plant under artificial lighting in an indoor setting. Key biometric parameters measured included total shoot biomass, leaf area, and leaf width, while biochemical parameters included dry matter, total antioxidant capacity (TAC), vitamin C, chlorophylls a and b, carotenoids, and nitrates. The highest yield (68±5.9 g) of fresh shoots was observed in the LR3 variant, which combined blue (440 nm) and red (660 nm) spectra with an 18-hour photoperiod. Extending the photoperiod to 21 hours did not improve yield and only resulted in higher operational costs. Incorporating green light (500-600 nm) in the case of prolonged 21-hour photoperiod proved beneficial for enhancing TAC and vitamin C content (by 105.7% and 26.9% when compared to 18-hour photoperiod). In terms of photosynthetic efficiency (pigment production), and low nitrate accumulation, the LR3 variant with an 18-hour photoperiod was the most effective and appears to be the optimal choice for cultivating common ice plant, demonstrating both optimal growth and economic viability.

Keywords: common ice plant, artificial lighting, LED lights

ACKNOWLEDGEMENT

This work was supported and funded by Mendel University in Brno, Faculty of Horticulture, Internal Grant Agency (IGA/ZF/2023-SI1-014).

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INFLUENCE OF DEGRADATION PROCESSES ON CHANGES IN SOIL PROPERTIES AND YIELD POTENTIAL

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ABSTRACT

Soil degradation is a complex process that affects the physical and chemical properties of the soil as well as its biological functions. This phenomenon has a direct impact on potential profitability, both in the context of agricultural production and in the context of soil and water conservation. The presentation will highlight changes in soil rating over time. Real-time yield and erosion assessment will also be shown.

Keywords: erosion, soil, climate change

ACKNOWLEDGEMENT

I would like to thank the Mendel University in Brno, especially the Faculty of Agronomy for the support from the project: IGA24-AF-IP-019. I would also like to thank all my colleagues who helped me and for their valuable advice. Finally, I would like to thank the AgraHorní Dunajovice agricultural cooperative for the opportunity to analyse their land.

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SYNERGIC EFFECTS OF MICROBIAL CONSORTIA ON CROPS

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ABSTRACT

Microbial consortia are diverse communities of microorganisms, including bacteria, fungi, and archaea, that collaboratively support plant growth, health, and resilience. Each species within the consortium plays a distinct role in enhancing the overall productivity of plants. For example, some bacteria are specialized in fixing atmospheric nitrogen, converting it into a form that plants can readily utilize. Fungi, particularly arbuscular fungi, improve water and nutrient absorption by extending their hyphal networks into the soil, effectively increasing the root surface . Additionally, certain microbes solubilize phosphorus and other essential nutrients, making them more accessible to crops. The synergistic effect of microbial consortia is crucial; microorganisms interact in complex ways that amplify their positive impacts on plants. For instance, the presence of beneficial bacteria can enhance the effectiveness of mycorrhizal fungi, while fungi may provide a habitat for other beneficial microbes. Importantly, some microorganisms may not directly influence plant growth but can significantly increase the abundance and activity of those that do. This inter-microbial cooperation creates a robust network that further enhances the overall effectiveness of the consortium. As a result, the combined abilities of these microbial communities not only promote plant health which even finally increases crops yelds.

Keywords: rhizobiome, rhizosphere microbiome, microbial consortia, synthetic microbial communities, synergic effect

ACKNOWLEDGEMENT

Special thanks for consulting on this research to Assoc. Prof. Tomáš Středa, PhD. and Ing. Veronika Berková. I would also like to thank Ing. Ivana Jovanović for introducing me to WinRHIZO software.

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TEST OF ECOLOGICAL HYDRAULIC FLUID

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ABSTRACT

The aim of our research was to test new hydraulic fluid MOL Biohyd 46, in 50 hour normalized examination. University´s Parallel testing device for flow characteristics and technical lifespan measurement of hydraulic transmitters and HYDAC measurement units were used. To get an information about wear of hydraulic pump running with cooperation with tested hydraulic oil, we measured pump´s flow characteristics before, during and after 50 hour normalized VICKERS test. Modern HYDAC measurement units were used and provided us with exclusive measurement precision. Difference between values before and after VICKERS test showed us that efficiency was not reduced, moreover, it grew up. Having this data, we can judge that new oil was still running-in and all additives started to do their job gradually. Our work contributed to testing of new, environmentally friendly hydraulic liquid. hydraulic oil, HYDAC, environmentally friendly hydraulic liquids

Keywords: hydraulic oil, HYDAC, environmentally friendly hydraulic liquids

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OPTIMIZING HERBICIDE APPLICATION USING UAV-BASED WEED DETECTION: A COMPARISON OF CLASSIFICATION TECHNIQUES

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ABSTRACT

The present investigation shows a growing trend of growers directly generating weed maps. An unmanned aerial vehicle (UAV) was employed to capture images of a field infested by field thistle (Cirsium arvense). RGB and multispectral imagery were taken for this work. The study compares four detection methods that growers can use directly. Two of these methods involve supervised classification algorithms - Maximum Likelihood (ML) and Supported Vector Machine (SVM). The Pix4Dfields (Magic Tool) classification algorithm and the Thresholding method were also evaluated. The Thresholding method was performed on the Normalized Difference Vegetation Index (NDVI), and the other algorithms were executed on RGB imagery. The accuracy of the individual algorithms was determined based on the Kappa coefficient and the Overall accuracy. Based on these parameters, the findings indicate that the Thresholding approach exhibited the highest accuracy, while Pix4Dfields demonstrated the lowest. In terms of supervised approaches, SVM outperformed ML. The analysis of UAV imagery for weed infestation identification revealed that only up to 5.56% of the field area is affected by weeds. This suggests that targeted herbicide application can lead to a significant reduction in herbicide usage. With an impressive accuracy of 98.6%, the Thresholding method surpassed the other four established weed detection algorithms (Kappa index: 0.836).

Keywords: precision agriculture, SSWM, Pix4D, remote sensing

ACKNOWLEDGEMENT

The study research was supported by the Internal Grant Agency of the Faculty of AgriSciences at Mendel's University in Brno as the research project IGA24-AF-IP-043.

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THE OCCURRENCE OF PICIFORMES SPECIES IN MID-ALTITUDE FORESTS OF THE CZECH REPUBLIC

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ABSTRACT

A research study of bird species from the order Piciformes was realized on the selected forests (Žákova hora, Radenice, Peperek, Štěpánovice, Blansko, Koryčany). The study was carried out every two months from January 2023 to July 2024. The most frequent species in each forest were Dendrocopos major and Picus viridis. The rarest species was Dendrocopos leucotos in Koryčany. Tree parameters were also measured (tree species, tree height and tree perimeter). In conclusion, the highest number of Piciformes representatives was found in the oak-beech forest in Štěpánovice (6 out of the 10 species with regular occurrence in the Czech Republic). This forest also had the most diverse tree composition.

Keywords: bird species, forests, Piciformes, trees

ACKNOWLEDGEMENT

This research is one part of the dissertation thesis *Vlivy disturbancí na avifauny lesů středních poloh České republiky*. This research did not receive any grant from funding agencies in the public, commercial, or non-for-profit sectors.

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SOLVING THE DNA INTEGRITY PUZZLE: OPTIMIZING PRESERVATION FOR COLEOPTERA AND LEPIDOPTERA IN GENETIC AND ECOLOGICAL STUDIES

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ABSTRACT

Efficient DNA preservation is crucial for successful genetic analyses, such as DNA barcoding or next-generation sequencing (NGS), especially for field-collected samples. This study examines various trapping and subsequent preservation methods for Coleoptera and Lepidoptera species, with a focus on DNA fragmentation and its implications. For Coleoptera, DNA degradation was noted when the archival medium from bottom side of Malaise trap was not replaced in the field, emphasizing the importance of managing the preservation medium. Among the tested methods, 8% brine emerged as the most cost-effective for individual trapping, while drying samples archived in viscous liquids (i.e., propane-1,2-diol and ethane-1,2-diol) had no effect on average fragment size. On the other hand, it was determined that for emergent trap types, using concentrated propylene glycol for fixation offers a viable choice for archiving specimens either through simple drying or maintaining them in concentrated propylene glycol followed by washing with distilled water. In Lepidoptera, DNA average fragment sizes were influenced by the type of fixative solution (chloroform vs. cyanide), the pH after proteinase K treatment, and the specimen‘s body size. Larger species preserved at a lower pH (7.7) yielded the largest DNA fragments. The findings highlight the need to optimize preservation strategies, particularly in field conditions, to maintain DNA integrity, which is critical for molecular ecology applications like DNA barcoding and NGS. These results provide practical guidelines for improving DNA preservation techniques in entomological research, stressing the importance of adjusting methods based on species-specific factors and environmental conditions.

Keywords: arthropods, DNA fragmentation, field collection methods, molecular ecology

ACKNOWLEDGEMENT

I would like to express my gratitude to IGA24-AF-IP-025 for providing the opportunity to conduct this research. I am deeply thankful to Mgr. Jan Šipoš, Ph.D., for guaranteeing the project, and to Prof. Knoll for granting access to the laboratory. Special thanks go to Mgr. Tamara Wijacki, Ph.D., for her invaluable methodological guidance. I would also like to thank Mgr. Tomáš Kopecký, Mgr. Attila Balázs, Ph.D., and Prof. Zdeněk Laštůvka for generously providing samples. Lastly, I am sincerely grateful to Prof. Josef Suchomel for his insightful discussions, which greatly contributed to the progress of this research.

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APPLICATION OF REMOTE SENSING METHODS IN PRECISION AGRICULTURE

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ABSTRACT

The study focuses on the use of modern remote sensing methods in precision agriculture for diagnosing the nutritional status of crop stands. Remote sensing sensors capture reflected electromagnetic radiation from crop canopies, enabling the estimation of key crop parameters such as leaf area index or biomass content. By calculating vegetation indices such as NDVI, NDRE, EVI, or SAVI, we can assess the health status of vegetation based on differences in reflectance in the red and infrared spectra. The study examines the potential of two remote sensing satellite systems: Sentinel-2 and PlanetScope. Despite having higher spatial resolution, the PlanetScope satellite, which provides images every 1-2 days, does not perform as well as Sentinel-2 in terms of results. Sentinel-2, with its 10-meter per pixel resolution, achieves better outcomes in assessing crop health.

Keywords: remote sensing, vegetation indices, nitrogen nutrition

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EFFECT OF POTENTIALLY TOXIC ELEMENTS IN SOIL ON BIOLOGIC PROPERTIES AND THEIR PHYTOSTABILIZATION BY RED FESCUE (FESTUCA RUBRA) IN COMBINATION WITH BIOAUGMENTATION AND BIOCHAR AMENDMENT

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ABSTRACT

Phytostabilization is method for in situ detoxification of soils polluted with potentially toxic elements (PTE), which utilizes plants e.g. grasses. It can be enhanced via immobilization by carbon sorbents i.e. biochar (B) and via bioaugmentation which derives plant resistance to toxicity through soil inoculation with microbes.A pot experiment on soil contaminated with PTE (i.a. As, Cd, Pb, Zn) evaluated phytostabilization by red fescue (Festuca rubra L.) together with bacterial inoculation (IN) or without (control), and with biochar amendment (B) in two dose, low and high (B1 and B2). Plant aboveground biomass (AGB) was harvested and analysed after 8, 16, and 24 weeks. Soil was sampled after 24 weeks. The variant B2 had the lowest content of Cd, Zn in AGB after 24 weeks while inoculation (variants IN, B2 + IN) increased Cd in AGB compared to relevant uninoculated variant. B2 variant showed the lowest accumulation of Zn in AGB too. All treated variants decreased content of As in AGB. Biochar increased soil pH, AGB yield (mainly in combination with IN - by 70% higher than control) and the amount of PTE translocated to fescue in some variants (B1 and B1 + IN). Biochar negatively affected activity of soil enzymes, basal and substrate-induced soil respiration, although not due to reduced microbial biomass, as B2 + IN variant stimulated soil microbiome proliferation (bacteria, fungi, ammonium oxidizing bacteria).Bioaugmentation increased soil pH too and enhanced dehydrogenase, phosphatase, arylsulfatase. Neither bioaugmentation nor biochar improved phytostabilization of PTE.

Keywords: soil pollution, carbon sorbent, microbial inoculum, soil microbiome, plant toxicity

ACKNOWLEDGEMENT

The work was supported by the IGA AF MENDELU- project IGA24-AF-IP-038 and by the Ministry of Agriculture of the Czech Republic- MZE-RO1224.

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EFFECT OF BIOLOGICALLY ACTIVE COMPOUNDS IN DRONE BROOD ON BONE TISSUE CELLS METABOLISM

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ABSTRACT

Drone brood is one of by-products of honeybees. Its consumption is not high even though it contains many potentially beneficial compounds such as protein, fat, antioxidants, vitamins and both male and female hormones. Drone brood can be bought in form of homogenate which is usually conserved by lyophilisation. Osteoporosis on the other hand can be described as non-coordinated resorption of bone intersticium without recovery. Cause of this problem can be found either in hormonal disbalance or in nutritional insufficiency. It troubles both people and domestic animals. In egg laying hens it is common when the laying curve reaches its peak because in this period the need of minerals is highly increased for eggshell production. Two types of cells are responsible for bone formation and consolidation. Osteoblasts are cells that build bone and osteoclasts are cells that resorb the bone matrix and thus make it possible to be rebuild in the case of changing conditions. Progenitor cells of both cell types were isolated from femur of juvenile chicken and those were then cultivated in culture plates in DMEM high glucose with addition of fetal bovine serum and antibiotics in atmospere containing 5% of CO2 and in 37 °C. Later these cells were exposed to various concentrations of drone brood solutions.

Keywords: osteoblasts, osteoclasts, drone brood

ACKNOWLEDGEMENT

This research is financed by the Internal Grant Agency of the Faculty of AgriSciences, Mendel University in Brno (IGA24-AF-IP-028).

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BACTERIAL DIVERSITY AND RESISTANCE PROFILES OF GRAM-POSITIVE BACTERIA ISOLATED FROM INFECTED WOUNDS

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ABSTRACT

Wound infections pose a significant threat to patient recovery, often leading to severe complications and prolonged healing. Accurate identification of the pathogens involved, and their antimicrobial resistance profiles is essential for effective treatment and infection management. Rapid and precise diagnostics can guide targeted therapies, reduce the misuse of antibiotics, and curb the spread of multidrug-resistant strains. In this study, we identified 219 bacterial isolates from 91 patients with infected wounds. The most prevalent pathogens were staphylococci, followed by less abundant genera such as Streptococcus, Enterococcus, Enterobacter, Proteus, and Pseudomonas. The predominance of staphylococci as wound pathogens is particularly alarming due to their ability to develop resistance to multiple antibiotics. In this analysis, Staphylococcus aureus and Staphylococcus epidermidis emerged as the most frequently isolated species, both displaying significant resistance to commonly used antibiotic groups, such as beta-lactams, macrolides, lincosamides, and fluoroquinolones. Additionally, tested Enterococcus isolates exhibited high resistance to lincosamides, beta-lactams, macrolides, and tetracyclines. Furthermore, streptococci also showed resistance to tetracyclines, macrolides, and sulfonamides. This presents a serious challenge for effective treatment, as these drugs are often frontline therapies for combating infections. Notably, a striking finding was the detection of multidrug resistance in all the strains mentioned, significantly complicating treatment options. Further genetic analysis revealed the presence of key resistance genes in resistant staphylococci, streptococci, and enterococci, enabling us to study the mechanisms of resistance and explore more effective treatment strategies, infection control measures, and public health initiatives.

Keywords: resistance, infection, Staphylococcus, Enterococcus, Streptococcus

ACKNOWLEDGEMENT

This research was funded by the Internal Grant Agency of Mendel University in Brno (IGA24-AF-IP-008).

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31ST INTERNATIONAL CONFERENCE
MENDELNET 2024
BOOK OF ABSTRACTS

Editor: Hana Středová

Publisher: Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic
Edition: First from 2024

ISBN 978-80-7701-007-8 (online ; pdf)
https://doi.org/10.11118/978-80-7701-007-8