BOOK OF ABSTRACTS

MycoRise Up!

Youth in Mycology

5th edition

25 – 26.05.2024 Cracow

Institute of Zoology and Biomedical Research, Faculty of Biology

Jagiellonian University

POLSKIE TOWARZYSTWO MYKOLOGICZNE

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SPECIAL GUEST

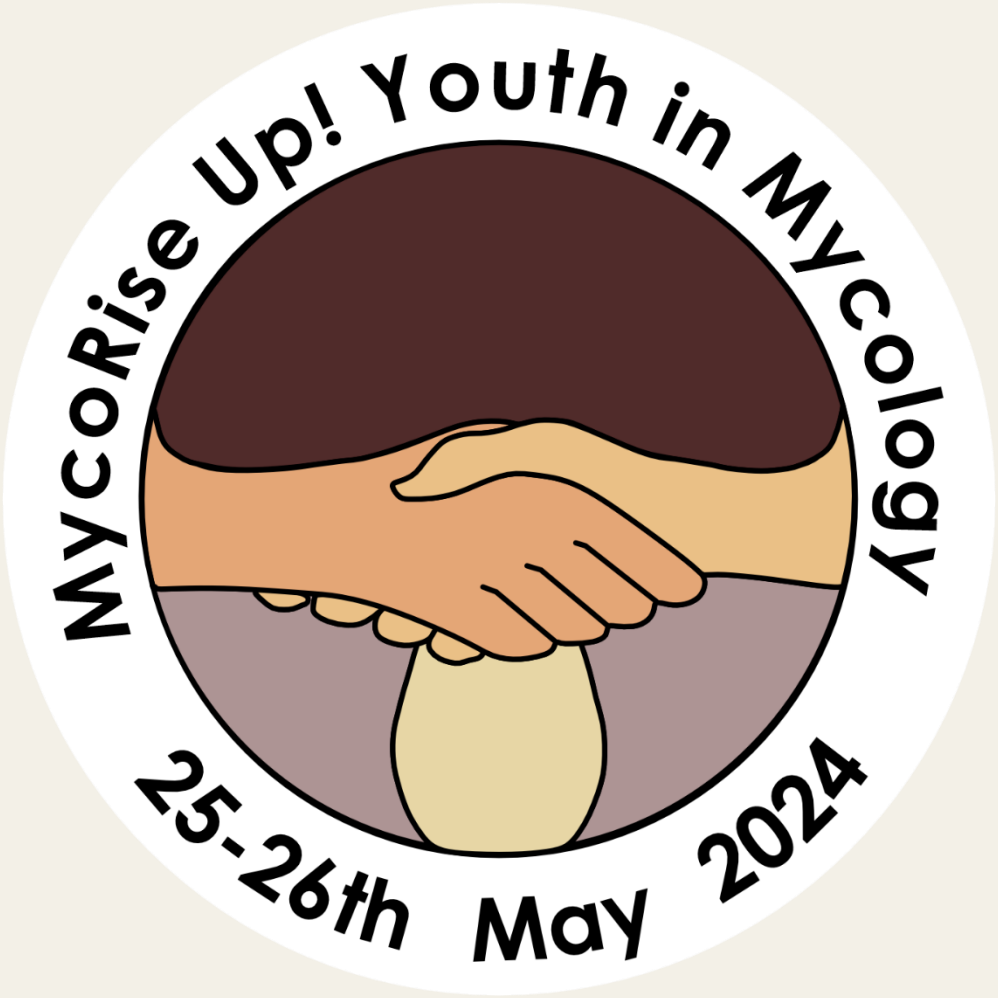
- **Prof. Marc-André Selosse**, National Museum of Natural History, Paris, France

Saturday, 25.05.2024 r. **Institute of Zoology, Gronostajowa 9**	
9:00-10:00	**Registration of the participants**
10:00-10:30	**Opening ceremony**
10:30-11:00	**Opening talk**: Dr hab. Kaja Skubała, prof. UJ – Life on the edge – the extraordinary ability of lichens to survive extraterrestrial conditions
11:00-13:15	**Talk Session I**: **Fungal interactions with plants and animals - from mutualism to parasitism**
	Plenary talk: prof. Marc-André Selosse – The mycorrhizal symbioses
(11:30-11:45)	**Coffee break**
	Maciej Móll - Microbiological and physicochemical properties of substrata, fungal root colonisation and performance of ornamental plant species
	Edoardo Massetani - Parasite in disguise or colony anti-hero? Interaction between *Rickia wasmannii* and *Myrmica scabrinodis* ants
	Michał Kochanowski - The effect of fungal infection (*Rickia wasmannii*) on the colony structure, division of labour and the immune response of the ants *Myrmica scabrinodis*
	Agata Michalska - Ant dermatologists wouldn't have it easy – surprising insights into phylogeny of ectoparasitic *Aegeritella genus*
13:15-13:30	**Coffee break**
13:30-14:45	**Talk Session II: Mycology in medicine and health**
	Dawid Piec - Coffee with *Cordyceps militaris* and *Hericium erinaceus* as a source of essential bioelements
	Monika Trepa - Extraction of health-promoting compounds of *Laetiporus sulphureus* and *Flammulina velutipes* into artificial digestive juices
	Wojciech Polak - Potential use of *Cordyceps* spp. and *Antrodia camphorata* in the prophylaxis and treatment of osteoporosis
	Natalia Klocek - Antifungal properties of methacrylamido propyl trimethyl ammonium chloride polycations against *Fusarium* fungi
15:00-16:00	**Dinner break**
Botanical Garden, Kopernika 27	
17:30-20:00	**Poster Session and pizza party**

Sunday, 26.05.2024 r. **Institute of Zoology, Gronostajowa 9**	
9:00-9:30	**Opening talk**: dr Danny Haelewaters - Elevating mycology through the study of unexplored taxa
9:30-10:00	Dr hab. Anna Ronikier, prof. UJ – Importance of including type specimens in phylogenetic studies – the case study of Myxomycetes
10:00-10:30	**Coffee break**
10:30-12:00	**Talk Session III: Physiology and ecophysiology of fungi**
	Volha Rusetskaya -*Trichoderma* fungi ability to degrade PBAT
	Beniamin Abramczyk - Ecophysiology of *Entomortierella ferrotolerans*
	Łukasz Słowik - Iron release mechanism of *Entomortierella ferrotolerans*
	Aleksander Kossakowski - LCR in fungi display functional groups and are depleted in positively charged amino-acids
	Drishtee Barua - Non-Dikarya fungi have mTOR instead of ScTOR pathway
12:00-12:15	**Coffee break**
12:15-14:00	**Talk session IV: Fungal interactions with environment**
	Plenary talk: dr Alicja Okrasińska - Soil Mucoromycota: endohyphal bacteria and adaptations to the environment
	Paulina Pacek - Are native maple trees in danger? The study of fungus isolated from invasive *Acer negundo*
	Nina Trochanowska - Does tree encroachment and mowing impact arbuscular mycorrhizal fungal communities in fen peatlands?
	Olsza Borys - How changes in structure of peat-inhabiting fungal communities reflect disturbances in fens.
	Kamil Kisło - The influence of fungi on the decomposition of *Solidago canadensis*
	Dorota Wiktorowicz - Plastic eaters from Arctic rubbish
14:00-14:30	**Coffee break**
14:30-15:00	**Closing ceremony**

Talk Session I:

Fungal interactions with plants and animals - from mutualism to parasitism



Microbiological and physicochemical properties of substrata, fungal root colonisation and performance of ornamental plant species

Maciej Móll[1], Kaja Skubała[1], Katarzyna Baran[1], Maria Wróbel[1], Małgorzata Stanek[2], Aleksandra Orzechowska[3], Szymon Zubek[1]

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In recent years, great progress has been made in the development of practices that increase the production of ornamental plants. However, the relationships of ornamental plants with soil microorganisms that affect their performance are still unexplored. We therefore studied 10 common ornamental plant species available in DIY stores to examine the microbiological and physicochemical properties of substrata used for their cultivation and to evaluate their colonisation by root-inhabiting fungi, i.e. arbuscular mycorrhizal fungi (AMF), dark septate endophytes (DSE) and *Olpidium*. The properties of the substrata varied greatly, depending on both their DIY store origin and the plant species. With the exception of *Echinacea purpurea*, hyphae and spores of AMF were not found in any of the root or substrata samples. However, 8 species were colonised by DSE and 8 by *Olpidium*. Substrata with a high organic matter content, lower pH values and the ability to retain water favoured the root colonisation by *Olpidium* spp., while the opposite trend was observed for DSE. In conclusion, commercially available ornamental plant species in pot cultivation are unlikely to establish arbuscular mycorrhiza. However, they often form associations with other root-inhabiting fungi, such as DSE and *Olpidium* spp. These results might be due to the high levels of nutrients, organic matter and water contents in substrata.

Are native maple trees in danger? The study of fungus isolated from invasive *Acer negundo*

Paulina Pacek, Katarzyna Patejuk

Department of Plant Protection, University of Life and Environmental Sciences in Wroclaw, Wrocław, Poland

Plant invasions are a global phenomenon, with human activity cited as the main cause. Alien species can lead to the displacement of native ones, which significantly affects the performance of entire ecosystems. In Poland, the ash-leaf maple, *Acer negundo*, was brought to botanical gardens in the early 19th century. In the following decades, the spread of this species outside the gardens was observed, which was the first stage of invasion. Alien species can be reservoirs of pathogens that can affect native species, a phenomenon known as spillover. The aim of the study is to answer the question: does *Colletotrichum acericola*, isolated from ash-leaf maple, pose a phytosanitary threat to native species: *Acer platanoides* and *Acer pseudoplatanus*? In order to answer this question, several pathogenicity assays, using strains of *C. acericola*, were conducted on both leaves and shoots of three chosen species of maple trees that are found in Poland, including the invasive *A. negundo*. The first results show that *C. acericola* can infect leaves of *Acer pseudoplatanus* and *Acer platanoides* but infection rate was observed to be low. This could be due to the fact there are many other fungi inhabiting leaves and within time also saprotrophic fungi develop on the surface of the leaf. Because of that it's possible that there were antagonistic interaction developed between *C. acericola* and other fungi. This makes is challenging to point which fungi played the crucial role in the infection process.

Parasite in disguise or colony anti-hero? Interaction between *Rickia wasmannii* and *Myrmica scabrinodis* ants

Edoardo Massetani

University of Turin, Turin, Italy

Belonging to the order *Laboulbeniales*, the fungus *Rickia wasmannii* is an entomopathogenic parasite that can impact hosts' survival by sprouting on their cuticle. *Myrmica scabrinodis* ants are among the most affected species by the fungus, with infection prevalence reaching up to 100% at colony level. Besides lifespan shortening, the effects of *R. wasmanni* on this ant species include behavioural alteration: infected workers are less aggressive towards non-nestmates, including queens. The increase of genetic variability due to the adoption of foreign members can stretch the colony lifespan and colony stability, shaping an advantageous environment for both species. The causes and mechanisms leading to reduction of aggressive behaviour in *R. wasmannii* infected ants are still poorly understood: both direct manipulation by the parasite and indirect modifications by endogenous factors, such as stress response and immune system activation, could be involved in defining the behavioural output. Due to the crucial role of biogenic amines like dopamine in eliciting aggressive behaviour in ants, alterations of their brain levels in the hosts may be the last stage of the process resulting in the acceptance of non-nestmates into the colony. Deepening the relationship between *R. wasmannii* infection and alteration in biogenic amines brain titers of host ants would allow a better characterization of this complex interaction and provide new insights about parasites exploiting social systems.

The effect of fungal infection (*Rickia wasmannii*) on the colony structure, division of labour and the immune response of the ants *Myrmica scabrinodis*

Michał Kochanowski[1], Enikő Csata[1], Anna Dubiec[1], Aleksander Juszczak[2], Igor Siedlecki[3], Piotr Ślipiński[1], Magda Witek[1], Marta Wrzosek[3]

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[2] *Faculty of Biology, University of Warsaw, Warsaw, Poland,*
[3] *Botanic Garden, University of Warsaw, Warsaw, Poland*

The order *Laboulbeniales* (*Ascomycota*) is a group of fungi growing as the ectoparasites of arthropods, mostly insects. Interactions between *Laboulbeniales* and their hosts still need to be fully understood. While *Rickia wasmannii* infects ants from the genus *Myrmica* in high density, it does not penetrate the cuticle or feed on the nutrients inside the ant. It is already known that *R. wasmannii* slightly reduces the workers' lifespan, decreases the colony's fitness and changes ants' behaviour. In our study, we investigated how *R. wasmannii* infection affects (1) the structure of the ants' colony; (2) the immune response, and (3) the division of labour. We collected 10 infected and 10 uninfected colonies from the field, and we performed the behavioural experiment in the laboratory to check whether infected ants would change the task earlier, to check the immune response of the ants we performed spectrophotometric assays to measure the phenoloxidase level. We found that (1) infected colonies are less numerous, (2) infected queens have a higher level of phenoloxidase and (3) infection intensity is positively correlated with earlier task switch from intranidal to forager compared to their uninfected counterparts. Moreover, we found that winged queens (gynes) can potentially transfer the infection to the new colonies.

Ant dermatologists wouldn't have it easy – surprising insights into phylogeny of ectoparasitic *Aegeritella* genus

Agata Michalska[1], Igor Siedlecki[1], Julia Pawłowska[2], Michał Kochanowski[1], Marta Wrzosek[1]

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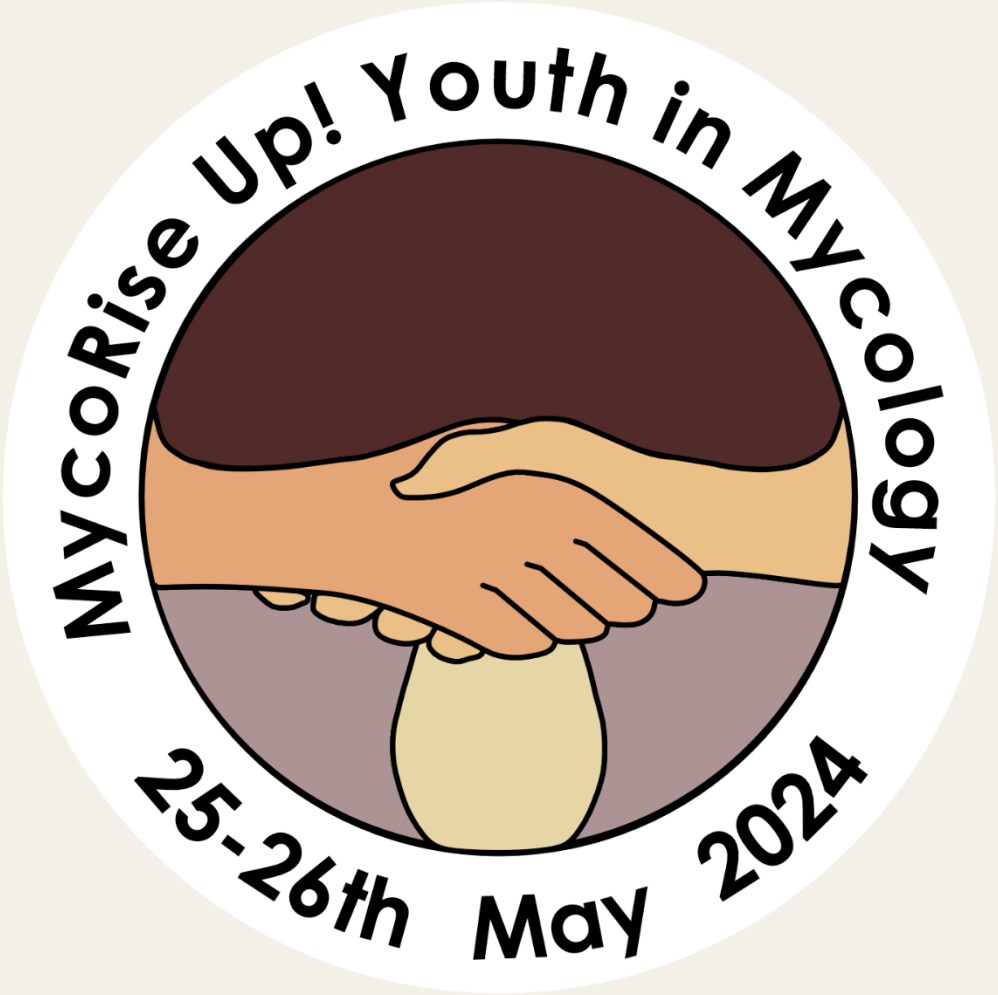
[2] *Institute of Evolutionary Biology, Faculty of Biology, Biological and Chemical Research Centre, University of Warsaw, Warsaw, Poland*

Aegeritella is a genus comprising five species of ectoparasitic fungi found on the cuticle of various ant species, where they grow in the form of dense, dome-like fungal patches (bulbils). Their biology and phylogenetic relationship remain elusive 50 years after the description of the genus. Our aim was to determine the phylogenetic position of *Aegeritella superficialis*, the type species of the genus, using both molecular methods and morphological analysis. We isolated over a hundred bulbils of *A. superficialis* from 15 colonies of *Formica polyctena* ants. Though the fungus was previously known as unculturable, we obtained live colonies on artificial media, which provided us with interesting insight into its morphology and biology. Within the bulbils, *A. superficialis* seems to coexist with yeasts usually belonging to the *Wickerhamiella/Candida* clade, which was also visible in the results of high-throughput sequencing. Barcoding using the LSU marker places *A. superficialis* within the order *Capnodiales*, revealing it to be entirely unrelated to *Aegeritella tuberculata* (*Trichosporonales*), making a revision of the genus an interesting future direction. Additionally, the close phylogenetic relationship of *A. superficialis* to fungi classified as sooty molds could point to an important role of interactions with plants and/or aphids in its ecology, and provokes the question of whether the symbiosis with ants is an indispensable part of its lifecycle, or just an opportunistic infection.

Talk Session II:

Mycology in medicine and health



Coffee with *Cordyceps militaris* and *Hericium erinaceus* as a source of essential bioelements

Dawid Piec[1], Katarzyna Kała[1], Agata Krakowska[2], Katarzyna Sułkowska-Ziaja[1], Bożena Muszyńska[1]

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Drinking coffee is a daily routine for many people. Supplement manufacturers have proposed the addition of powdered *Cordyceps militaris* mycelium, which is known for ergogenic and immunostimulating properties and *Hericium erinaceus* known for its nerve growth factor (NGF) stimulating properties, to coffee. The aim of this work was to compare the bioelements content in three types of coffee: from a coffee machine, instant and traditionally brewed, prepared with the addition of powdered *H. erinaceus* and *C. militaris* fruiting bodies. The tested material consisted of three types of coffee (200 mL) prepared both as a control sample, but also with the addition of powdered *H. erinaceus* or *C. militaris* species (2 g of lyophilized material). The analysis of bioelements: Mg, Zn, Cu, Fe, Na, K and Ca was performed using flame AAS method. Among the control samples of coffee, the best source of bioelements was traditionally brewed coffee. Considering the mushroom species tested, the best additional source of Mg, Zn, Cu, Na, K and Ca was *C. militaris*. A slightly higher Fe content in combination with traditionally brewed coffee was determined for the addition of *H. erinaceus*. In conclusion, the *C. militaris* species has been proven to be a better source of bioelements as a coffee additive in the daily diet. To ensure the maximum possible dose of bioelement supplementation, mushroom powders should be consumed in addition to traditionally brewed coffee.

Extraction of health-promoting compounds of *Laetiporus sulphureus* and *Flammulina velutipes* into artificial digestive juices

Monika Trepa[1], Katarzyna Sułkowska – Ziaja[2], Katarzyna Kała, Bożena Muszyńska[2]

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[2]*Department of Pharmaceutical Botany, Faculty of Pharmacy, Collegium Medicum, Jagiellonian University, Cracow, Poland*

Laetiporus sulphureus and *Flammulina velutipes* are common edible mushrooms with proven pro-health properties, such as anti-inflammatory, anticancer, antioxidant and antimicrobial effects. The aim of the study was to evaluate the efficiency of the release of bioelements and bioactive compounds from mycelial cultures and comparatively from fruiting bodies into artificial digestive juices. The study material consisted of mycelium obtained in bioreactors with an air-lift aeration system and comparatively fruiting bodies collected from the natural state. Extraction into artificial digestive juices was carried out using a Gastroel-2014 apparatus. Bioelements were analyzed using the AAS method, organic compounds were analyzed using the RP-HPLC-DAD method. Methanolic extracts were used as a reference sample. Both mycelium and fruiting bodies were found to contain bioelements (e.g. Ca, Cu) and organic compounds (e.g. phenylalanine, ergothioneine) with biological activity. After extraction into artificial digestive juices, significant contents of substances transferring into gastric or intestinal juice, respectively, were found. Both species show high health-promoting potential due to the presence of bioelements and organic compounds in significant amounts. In addition, the high level of extraction of bioactive substances into artificial digestive juices may indicate their potential high bioavailability found in the studied species, making them suitable for use as functional foods.

Potential use of *Cordyceps* spp. and *Antrodia camphorata* in the prophylaxis and treatment of osteoporosis

Wojciech Polak, Bożena Muszyńska

Department of Pharmaceutical Botany, Faculty of Pharmacy, Jagiellonian University Medical College, Cracow, Poland

It was estimated that 22,1% of women and 6,1% of men over the age of 50 years old suffer from osteoporosis. Present pharmacological treatments include calcium and vitamin D supplementation, bisphosphonates, PTH (parathormone) analogues, and appropriate antibodies. However, other therapeutic options are still being investigated due to the side effects and limitations of currently available therapies. The results of studies of freeze-dried mushroom raw material and compounds extracted from mushrooms indicate that they may have potential for the prevention and treatment of osteoporosis. The aim of this study was to find out the currently researched activity of *Cordyceps* spp. and *Antrodia camphorata* in the treatment and prevention of osteoporosis. Sources of information were selected articles from scientific press, journals, academic manuals, scientific publications. Current research indicates that mushroom extracts and the compounds isolated from them may have multidirectional effects on bone, including increasing bone housing, reducing bone loss, increasing bone mineralization and other positive impacts. Studies show that mushrooms and substances derived from them have potential in the treatment or prevention of osteoporosis. More in vitro and in vivo studies are needed to determine the effect, mode of administration and dose of the fungal material or isolated substance (for example, cordycepin).

Antifungal properties of methacrylamido propyl trimethyl ammonium chloride polycations against *Fusarium* fungi

Magdalena Skóra[1], Natalia Klocek[2], Aleksandra Mosurek[1], Małgorzata Tymecka[3], Kamil Kamiński[4]

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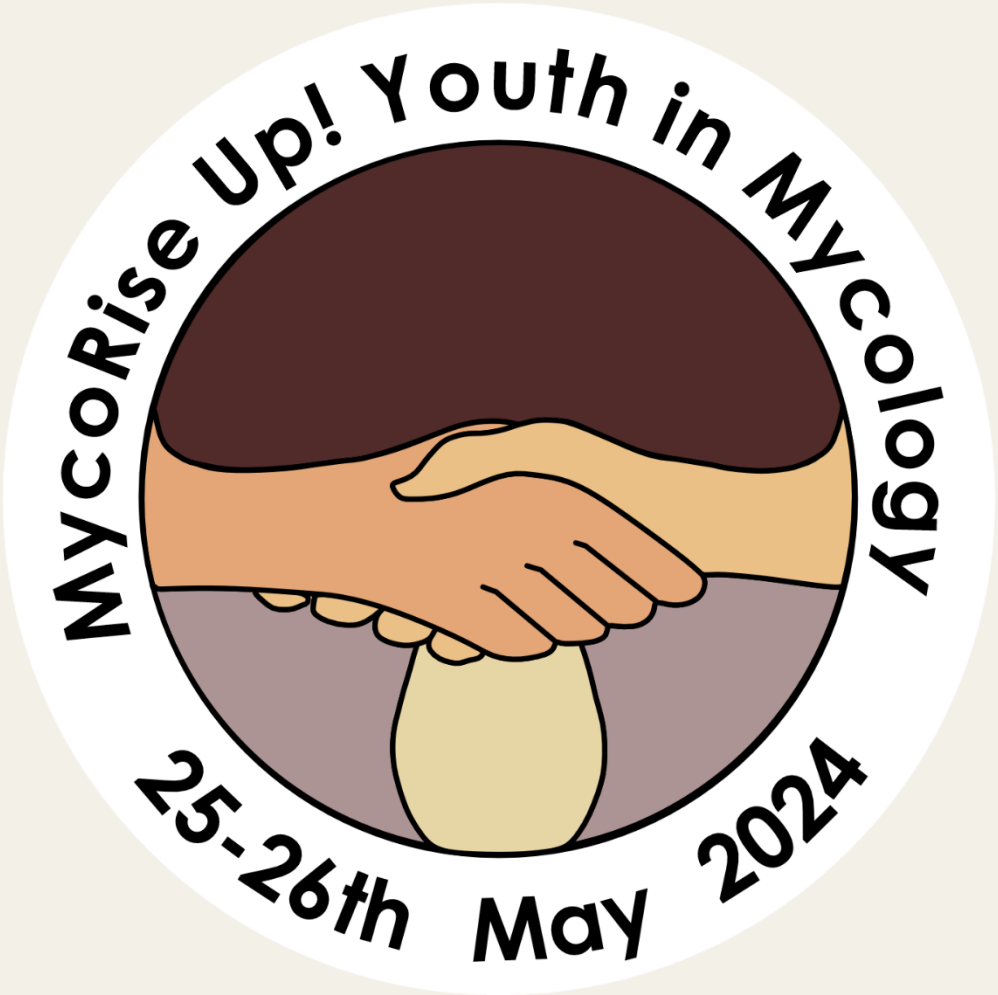
Our preliminary studies indicated that methacrylamido propyl trimethyl ammonium chloride (MAPTAC) polymers demonstrate selective antifungal activity. The genus *Fusarium* includes numerous species of clinical and environmental significance. Its adverse effect on living organisms is related to infections and toxic metabolites. As plant pathogens, they contribute to large crop losses. *Fusarium* fungi often show high minimal inhibitory concentration (MIC) to antifungal drugs. Resistance to pesticides also has been described. The aim of the study was to evaluate the in vitro antifungal activity of MAPTAC polymer with a molecular weight of approximately 0.5 mDa against various *Fusarium* species. In the study 10 strains of *F. oxysporum*, 7 of *F. solani*, 7 of *F. proliferatum*, 1 of *F. graminearum*, and 1 of *F. verticillioides* were used. Antifungal activity testing was performed with European Committee on Antimicrobial Susceptibility Testing microdilution method for moulds and Al-Hatmi et al. (2017) recommendations for *Fusarium* fungi. MIC values were read visually and established as the lowest concentration of the polymer with complete inhibition of fungal growth compared to the growth control well. MIC values against tested *Fusarium* strains ranged from 2 μg/mL to > 250 μg/mL. MIC50 and MIC90 were 3.9 μg/mL and 15.6 μg/mL, respectively. The results obtained suggest that tested polymer can be considered as promising antifungal substance against *Fusarium* fungi.

Talk Session III:

Physiology and ecophysiology of fungi



Trichoderma fungi ability to degrade PBAT

Volha Rusetskaya, Przemysław Bernat

Department of Industrial Microbiology and Biotechnology, Faculty of Biology and Environmental Protection, Doctoral School of Exact and Natural Sciences, University of Lodz, Lodz, Poland

Poly(butylene adipate-co-terephthalate) (PBAT) is an aliphatic-aromatic copolyester material used as an alternative material to reduce the negative effects of conventional plastics. It is petroleum-based but is biodegradable. It is known that 90% of PBAT is degraded in the compost already within 6 months, however, PBAT degradation in soil is time-consuming (about 2 years), and effective PBAT-degrading microorganisms are rarely described. This study uncovered the potential of soil fungi of the genus *Trichoderma* to biodegrade PBAT. These fungi are widespread throughout the whole world, have high tolerance to pollutants, produce a large number of various secondary metabolites, and are used in bioremediation of xenobiotics and as plant protection agents. Fungi were cultured on substrates of three types: solid, liquid media and soil, with the addition of plastic microparticles (MPs) at concentrations ranging from 0.5 to 2% and in film form. On solid medium, the growth of mycelia on PBAT film was observed in culture with nutrient-poor medium, whereas on rich medium mycelia grew first on the surface of the medium. In the next step, PBAT degradation was confirmed in liquid medium and soil based on the detection by LC-MS/MS technique of terephthalic acid (TPA) derivative formed in the process of breaking ester bonds in PBAT. Internal and external proteins of fungi cultured in the presence of MPs and without were studied. Differences in the proteome were discovered between the control and the test samples. A decrease in the amount of TPA formed in the medium with the addition of 1-aminobenzotriazole, a cytochrome p450 inhibitor was observed, indicating its probable involvement in PBAT degradation.

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Ecophysiology of *Entomortierella ferrotolerans*

Beniamin Abramczyk[1], Maksymilian Nowak[1], Dorota Wiktorowicz[1], Łukasz Słowik[1], Anna Majerowicz[1], Amelia Ploch[1], Zorza Ruczaj[2], Julia Pawłowska[2]

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Entomortierella ferrotolerans (Mortierellales) is a recently described fungus recorded only from extremely iron-rich environments. To explain this phenomenon, iron demand, iron mobilization capacity, heavy-metal defense mechanisms, and competitiveness of *E. ferrotolerans* in different iron concentrations were examined. Four strains of the fungus were cultivated in liquid media of different iron concentrations and sources. Iron concentration changes in medium and mycelia were measured using FAAS. Organic compounds were extracted from the liquid media and studied using GC-MS. Competition tests with *Mortierella pulchella* were performed on solid media with 3 different iron concentrations. Even though *E. ferrotolerans* has low iron demand, it is able to mobilize iron from steel wire. The iron is not accumulated. Instead *E. ferrotolerans* secretes organic acids, which could chelate the metal ions reducing their toxicity. What is more, in high iron concentration *E. ferrotolerans* produces a fungicidal agent - caryophyllene, which could be one of the causes for the fungus' higher competitiveness in such an environment (as revealed by competition tests). These results suggest that competition dynamics play a major role in iron-rich environment colonization by *E. ferrotolerans*.

The project was financed from state budget funds granted by Polish Ministry of Education and Science as part of the program "Studenckie Koła Naukowe Tworzą Innowacje" (grant no SKN/SP/570335/2023).

Iron release mechanism of *Entomortierella ferrotolerans*

Łukasz Słowik[1], Agnieszka Brojanowska[2], Beniamin Abramczyk[1], Maksymilian Nowak[1], Dorota Wiktorowicz[1], Anna Majerowicz[1], Amelia Ploch[1], Zorza Ruczaj[1], Julia Pawłowska[3]

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Entomortierella ferrotolerans is a *Mucoromycota* representative, thus far known only from highly ferrous soils. Since iron is crucial for various metabolic processes, we aimed to verify whether this fungus can stimulate the release of iron from solid form into its habitat. To verify the hypothesis, 4 strains of *E. ferrotolerans* were cultured in liquid medium with addition of iron wire fragments. Iron concentration changes in medium were measured using FAAS. Carboxylic acids were extracted from media samples and then analyzed using GC-MS. Additionally, one strain was cultivated in a liquid medium with class A steel construction rod fragments. After three weeks the surface of steel rod was analyzed using a scanning electron microscope (SEM). *E. ferrotolerans* released carboxylic acids. Concentration of iron dissolved in the medium increased during incubation compared to control. SEM photos showed that presence of *E. ferrotolerans* causes the dissolution of oxides and phosphates found on the iron surface. To conclude, carboxylic acids produced by *E. ferrotolerans* strip iron surface of a corrosion layer making it more exposed to corroding factors which increases speed of iron release to the environment. Iron wire and construction steel were obtained courtesy of Stal-Service Sp.z.o.o.

The project was financed from state budget funds granted by Polish Ministry of Education and Science as part of the program “Studenckie Koła Naukowe Tworzą Innowacje” (grant no SKN/SP/570335/2023).

LCR in fungi display functional groups and are depleted in positively charged amino-acids

Aleksander Kossakowski, Kamil Steczkiewicz, Stanisław Janik, Anna Muszewska

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Reports on the diversity and occurrence of low complexity regions (LCR) in Eukaryota are limited. Some studies have provided a more extensive characterisation of LCR proteins in prokaryotes. There is a growing body of knowledge about a plethora of biological functions attributable to LCRs. However, it is hard to determine to what extent observed phenomena apply to fungi since most studies of fungal LCRs were limited to model yeasts. To fill this gap, we performed a survey of LCR regions in proteins across all Fungal Tree of Life branches. We show that the abundance of LCR regions and the abundance of proteins with LCR are positively correlated with proteome size. We observed that most LCRs are present in proteins with protein domains but do not overlap with the domain region. LCR are associated with many duplicated protein domains. The quantity of particular amino acids in LCR deviates from the background frequency with a clear overrepresentation of amino acids with functional groups and a negative charge. Moreover, we discovered that each lineage of fungi favors distinct LCR expansions. Early diverging lineages differ in LCR abundance and composition pointing at a different evolutionary trajectory of each fungal group.

Non-Dikarya fungi have mTOR instead of ScTOR pathway

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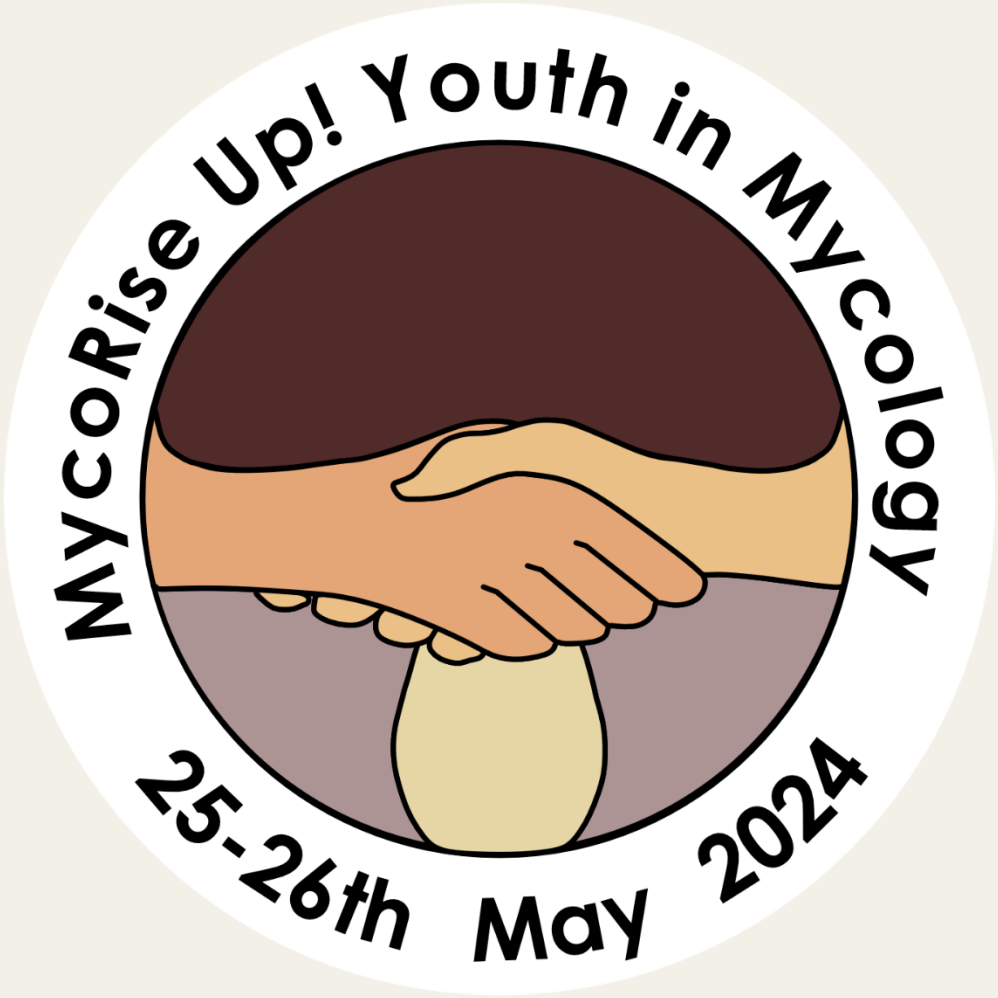
Target of rapamycin (TOR), first discovered in *Saccharomyces cerevisiae*, is a highly conserved serine/threonine kinase acting as a regulatory hub between the cell and its environment. While the activation of TOR is similar in yeasts and humans, the inhibition of TOR is more complex in the latter. This divergent evolution of TOR regulation opens up the question of how common are either pathway variants in the fungal tree of life. We approached this question by tracing the evolutionary history of the genes involved in TOR regulation. We also checked the transcriptional response of TOR genes to anaerobic conditions. We found that TOR activation components are conserved across fungi. Early diverging fungi (EDF) have homologs of the TSC complex, suggesting that presence of the Rheb-TSC system could be the ancestral state and its loss happened in *Saccharomycotina*. Inhibition of TOR pathway in EDF looks similar to mammals, including the presence of KICSTOR complex required for GATOR1-mediated repression of mTORC1, as well as serine, arginine and methionine sensors important for starvation assessment. Moreover, these genes are overexpressed in response to growth in anaerobic conditions. Our results indicate that the TOR pathway in most fungal lineages resembles the mTOR. *Saccharomycotina* apparently lost many of the inhibitory components and have alternative regulatory mechanisms. Our findings point at different sensing of starvation in EDF and this observation may have implications for the design of fungal biomass production.

Talk Session IV:

Fungal interactions with environment



Does tree encroachment and mowing impact arbuscular mycorrhizal fungal communities in fen peatlands?

Nina Trochanowska, Olsza Borys, Łukasz Kozub, Aleksandra Kukułka, Alicja Okrasińska, Julia Pawłowska, Mateusz Wilk

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Fens are the most common type of peatland in temperate Europe. They are important carbon sinks and provide numerous ecosystem services. Because of anthropogenic disturbances, like draining for agriculture, many of them are not in their natural state. Draining leads to transformation of vegetation, including shrub and tree encroachment (STE). In order to prevent this process, most often mowing is implemented. Although this method is successful in restoring plant communities, it is unknown how it impacts arbuscular mycorrhizal fungi (AMF), which form obligatory symbioses with many of fen inhabiting plant taxa. In this study, we examined the effects of STE and mowing on the diversity and community composition of AMF. The peat samples were collected from open and wooded patches in 24 fens, including 10 disturbed by mowing. The isolation of environmental DNA from peat samples was followed by the amplification of 18S rDNA fragments in nested PCR with *Glomeromycota*-specific primers. The amplicons were sequenced on the Illumina NovaSeq platform. Bioinformatic analysis in QIIME2 allowed for detection of 1345 OTUs of AMF. The highest number of OTUs belonged to *Glomus*, *Paraglomus* and *Archaeospora*. We did not observe any significant differences in diversity or community composition of AMF between fens with different management status or patches with different tree cover. Therefore, we conclude that AMF are relatively resilient towards both mowing and STE.

How changes in structure of peat-inhabiting fungal communities reflect disturbances in fens

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Peatlands are arguably the most important terrestrial ecosystem type for planetary carbon cycling dynamics. Nonetheless, many have been transformed by draining and agricultural usage, turning them into significant carbon sources. Anthropogenic pressure lead to intensified tree encroachment, further accelerating the degradation. One of the most important conservation strategies is mowing, proven to be successful in restoring plant communities. Nonetheless, the effects of such treatment on belowground microbial communities remain unstudied. Therefore, our main goal was to assess how tree encroachment and mowing affect structure and functions of peat-inhabiting fungal communities. To answer this, we sampled peat from open and wooded patches of 24 fens across northern Poland. We analysed soil and vegetation, and combined obtained data with results from Illumina NovaSeq amplicon sequencing of ITS2 rDNA. We found that neither tree encroachment on natural fens nor mowing on disturbed fens affect total diversity indices. However, the dissimilarity between naturally open and wooded patches is relatively smaller than on patches with mowing, indicating the existence of a legacy effect, possibly linked to a degradation of peat. Additionally, wooded patches of all management histories show higher share of ectomycorrhizal fungi (mainly *Cortinariaceae* and *Inocybaceae*). We conclude that while mowing has little effect on the overall fungal diversity, it suppresses ectomycorrhizal fungi.

The influence of fungi on the decomposition of *Solidago canadensis*

Kamil Kisło, Patryk Czortek, Marcin Tomasz Mazurkiewicz, Barbara Kusińska, Łukasz Kuberski, Agnieszka Adamska, Katarzyna Rawlik, Maercin Krzysztof Dyderski, Marta Wrzosek

Botanic Garden, Faculty of Biology, University of Warsaw, Warsaw, Poland

The canadian goldenrod (*Solidago canadensis* L.), a plant species originating from North America but now widespread in Europe, Asia, and Australia, poses a significant threat to the biodiversity of native plants, insects, and birds. While some extensive studies on its decomposition were conducted in water environments, our knowledge on mechanisms of *S. canadensis* biomass decomposition in terrestrial ecosystems in situ is poor. To fill this gap, we performed a litterbag experiment in mesic grasslands surrounding the Białowieża Primeval Forest in NE Poland, across a gradient of *S. canadensis* invasion levels (ranging from 0% to over 51% cover of plots). We placed the litterbags containing dry *S. canadensis* leaves in 40 plots (ten plots per invasion level) in three replications for each of the four sampling dates, spaced approximately 45 days apart. We examined fungal communities inhabiting the collected material for each date using the light microscopy. We revealed that fungal taxonomic diversity accounted for 20% of the mass loss during decomposition. Certain fungal taxa, such as *Orbiliales, Cladosporiales, Mortierellales*, and *Sordariales* positively influenced mass loss, while *Pleosporales* had a negative impact on the pace of decomposition processes. We found that higher proportions of patotrophic-saprotrophic and patotrophic-saprotrophic-symbiotrophic fungi decelerated the decomposition of *S. canadensis* leaves (i.e. 11% and 30% of mass loss inhibition respectively).

Plastic eaters from Arctic rubbish

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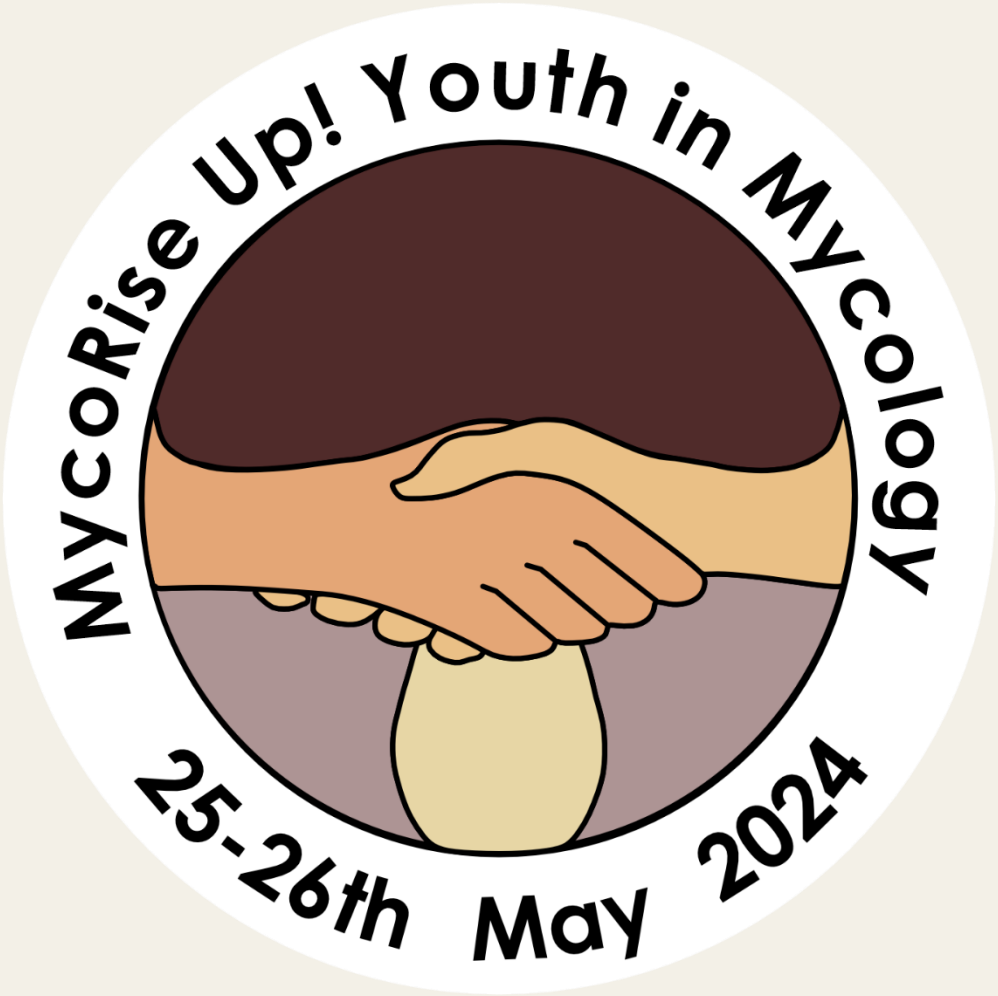
Only in 2022, 400 million tons of plastic were produced and over 25% of it was dumped into landfills. Plastic pollution is - and will be - one of the major global problems. Ecosystems that emerge on plastic are called plastisphere and are known as a promising source of plastic biodegraders, such as fungi. This study aimed to isolate fungi from the Arctic plastisphere and examine their plastic degradation abilities. Plastic debris collected from Longyearbyen beach in Svalbard (Norway) were placed on three different culture media and incubated for 6 weeks at 22 °C. Fungi were isolated and identified based on ITS rDNA sequencing. 41 strains representing 17 taxa were obtained. Colonization of polypropylene (PP) fragments for *Trichoderma* sp. and *Alternaria* sp. strains were examined, as well as their ability to grow with PP and polystyrene (PS) as a main carbon source. For the colonization experiment, PP discs were placed on 3-day-old colonies on MEA. For a growth test, PS and PP fragments were inoculated with fungi and placed on WA. After 5 weeks, colonization and growth were characterized with the use of optical microscopy. Both *Alternaria* and *Trichoderma* strains were efficient in colonization when another carbon source was present, and were able to grow with PP and PS as a carbon source. *Alternaria* grew better on plastic than *Trichoderma* and showed a preference toward PP. In further study, ATR-FTIR and Raman spectroscopy will be used to prove the degradation of plastics.

Poster Session



Assessing activity of benzenediol lactones biosynthetic gene clusters in diverse ascomycetes

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Benzenediol lactones (BDLs) are bioactive fungal polyketides conferring an advantage in competition for ecological niches due to documented antifungal and/or antimicrobial activities. Biosynthetic gene clusters (BGCs) of BDLs are strictly regulated, often remain silent and can undergo rearrangements during evolution, resulting in extensive diversity among final products. Our previous studies employed degenerate primer-based screening to identify 15 novel candidate ascomycete isolates, possessing characteristic signatures of the core highly reducing polyketide synthase for BDL production. Subsequent analysis of whole genome sequencing results confirmed both the presence and completeness of BDL BGCs in these strains. Initially, a stress experiment with chemical stimuli followed by qRT-PCR profiling confirmed that most of the clusters are transcriptionally active. However, follow-up chemical analysis detected significant amounts of BDLs only in a small subset of isolates: *Curvularia inaequalis, Diaporthe toxica, Penicillium sanguifluum* (curvularin), and *Fusarium cerealis* (zearalenone). For this reason, UHPLC-HRMS untargeted analysis was applied for the detection of BDL-related compounds, including results of 'derailed' BDL biosynthesis. We present an overview of significant, metabolomic changes in response to stressors stimuli as well as caveats arising from cultures prepared on plant-derived media and bacterial presence.

Assessment of fungal sensitivity: *Neofabraea* spp. response to plant protection products

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Understanding the sensitivity of fungi belonging to the *Neofabraea* (syn. *Pezicula*, *Phlyctema*) genus towards plant protection products is important for effective disease management in apple orchards. The goal of this study was the sensitivity assessments of 9 representative isolates of *Neofabraea* in response to 10 fungicides in laboratory experiment. The fungicides were as follows: Bellis, Delan, Zato, Captan, Unix, Siarkol, Miedzian, Luna Experience, Geoxe, Switch. The sensitivity testing involved the application of 100 µl of homogenized *Neofabraea* isolates (60% transmitancy) onto Potato Dextrose Agar (PDA), followed by the cut of holes in the plates, into which 50 µl of fungicides solutions were introduced. Through this test, we observed varied responses among the *Neofabraea* isolates to the tested fungicides. Particularly noteworthy was the high sensitivity exhibited by *Neofabraea* spp. towards Captan 50 WP and Bellis 38 WG. These findings underscore the effectiveness of Captan 50 WP and Bellis 38 WG in managing fungal pathogens belonging to the *Neofabraea* group. This aligns with field observations reported by apple producers, further emphasizing their practical applicability and relevance in agricultural settings.

This study was financed by the National Centre for Research and Development within the framework of the project LIDER XII (acronym: APPAT(f)REE), contract number LIDER/7/0054/L-12/20/NCBR/2021.

Characteristics of *Sporothrix schenckii* as a saprotroph and pathogen

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Sporothrix schenckii Hektoen & C.F. Perkins, belongs to the family *Ophiostomataceae* from phyllum *Ascomycota*. It is mainly found in tropical and subtropical countries, but can be found all over the Earth. What makes it extremely unusual is that it is generally a saprotroph and decomposes dead organic matter until the ambient temperature reaches 35-37°C. Once this temperature is reached, the fungus takes the form of a yeast, able to cause the disease in animals, including humans, which is sporotrichosis. The range of temperatures responsible for changing the morphology of the fungus corresponds to the temperature of the human body, making it potentially dangerous for humans. Sporotrichosis is referred to as the Rose Gardener's Disease, due to the fact that they are the ones most likely to be infected. *Sporothrix scheckii* lives in the soil, so it can enter the human body through injury and, in the case of a weakened host, cause a disease process. The infection can take different forms, depending on the site of infection; cutaneous sporotrichosis is the most common, although pulmonary and disseminated sporotrichosis also occurs. The disease can affect not only gardeners, but also cat owners, among others. The purpose of this poster is to introduce the species of *S. schenckii*, making it possible to get acquainted with this rather little-known, but present in Europe, pathogen of humans and animals, its occurrence, routes of infection, the threat it poses and ways of treatment.

Eat or not to eat? - Mucoromycota diversity of *Formica polyctena* infrabuccal pellets

Izabela Bąk, Igor Siedlecki, Marta Wrzosek

Botanic Garden, University of Warsaw

The interactions between fungi and ants have been extensively studied in the tropical fungus-growing ants. It is known that they consume and cultivate fungi in their nest. The queen carries fungal inoculum in her infrabuccal pocket (IP). Red wood ants (RWA) of temperate climates have IP serving as a filter, but its exact role is not fully understood. It is unclear whether they store fungi as a dietary supplement or collect them as a waste. The question of the function of the IP is particularly relevant as our previous studies have identified a new species of fungus from the *Mucoromycota* group, *Mortierella formicae*, that was isolated exclusively from the RWA. The aim of our study was to investigate the diversity of *Mucoromycota* from the IP of *Formica polyctena* ants (RWA) to determine the ant-associated fungi. The infrabuccal pellets from ants: 30 nurses and 30 foragers, were plated on Petri dishes. Half of them were plated after capturing the ants, and the other half after long-term freezing. Then we analyzed cultures' morphology and obtained molecular data to identify them. *Mucoromycota* fungi were found in 53% of fresh pellets and in 6% of frozen ones. In total, we found 150 colonies of 18 species of *Mucoromycota*, and four morphotypes that are likely new species to science. Representatives of *Entomortierella* were the most prevalent (37% of fresh pellets). The results suggest that fungi belonging to the *Entomortierella* are indeed symbionts of red wood ants.

Effect of culture conditions on the composition of the *Nacaseomyces glabratus* proteome

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Nacaseomyces glabratus, previously known as *Candida glabrata*, is closely related to the baker's yeast *Saccharomyces cerevisiae*. Unlike *S. cerevisiae, N. glabratus* has a high potential to infect the host organism and currently ranks as the second most common cause of mucosal and systemic infections. This study aimed to identify cell wall-associated and secreted proteins in the wild-type strain BG2 grown under various culture conditions. These conditions included standard YPD medium and chemically defined Lee synthetic medium, as well as media designed to mimic the host environment, such as artificial saliva (AS) and vagina-simulative medium (VS). Protein analysis was conducted using surface shaving and SDS-PAGE for the proteome and secretome, respectively. Peptides released by trypsin digestion were identified through liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS), revealing groups involved in adhesion/pathogenesis, metabolism, cell wall maintenance, and stress response. The considerable variability in the identified protein repertoire under host-mimicking conditions underscores the yeast's strong adaptation to infect cells across diverse niches within the host organism.

This work was in part financially supported by the National Science Centre, Poland (grant number 2020/39/D/NZ6/00854 awarded to D.S.).

Exploring Fungal Biotechnology: Past, Present, and Future Prospects

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Even before the formal definition of "biotechnology" emerged, fungi played integral roles in processes now recognized as traditional biotechnology. Ancient civilizations such as the Egyptians and Chinese utilized fungi for the production of essentials like beer, wine, and bread. Today, the biochemical prowess of fungi drives industrial biotechnology, facilitating the production of vital compounds such as enzymes, polysaccharides, and vitamins. Specifically, selected strains of *Saccharomyces* species are instrumental in alcoholic fermentation, yielding the alcohol crucial for beer and wine production. Moreover, *Aspergillus niger* stands out as a primary industrial producer of citric acid. Fungal expression systems have also revolutionized biotechnology, with fungal cell lines serving as expression vectors for generating recombinant proteins, which hold promise as therapeutic agents. Given the continuous evolution of biotechnology, fungi present untapped potential awaiting exploration. This overview delves into the diverse applications of fungi across various biotechnological domains and highlights promising future prospects.

High concentration of iron stimulates bioemulsifiers production in *Entomortierella ferrotolerans*

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Biosurfactants are amphiphilic biomolecules, whose wide range of use includes optimization of bioremediation processes. Many fungi of the subkingdom *Dikarya* have been shown to produce biosurfactants, however there is still a lot to uncover regarding capabilities of *Mucoromycota* in this area, especially ones from the *Mortierellales* order. *Entomortierella ferrotolerans* (*Mortierellaceae*) is often found in iron-rich environments such as post-mining sites. Four strains of *E. ferrotolerans* have been cultivated in Czapek-Dox Broth mediums of four different FeCl3 concentrations and in BSF5 medium typically used for stimulating biosurfactant production in *Mucoromycota*. Parafilm M, emulsification index (EI24), and oil spreading (OST) tests have been conducted on cell-free supernatants of each medium to evaluate surface activity and emulsion forming. Results from the parafilm M test and OST were all negative, while EI24 results revealed that addition of 2 mM FeCl3 stimulates production of agents causing emulsion forming. Further research is required to optimize this process and characterize emulsifier molecules produced by said species.

The project was financed from state budget funds granted by Polish Ministry of Education and Science as part of the program "Studenckie Koła Naukowe Tworzą Innowacje" (grant no SKN/SP/570335/2023).

Insight into proteolytic activity of extracellular vesicles released by *Nakaseomyces glabratus*

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Nakaseomyces glabratus, formerly known as *Candida glabrata*, is a haploid yeast species belonging to the *Nakaseomyces* genus. It is an opportunistic pathogen that can cause infections in humans, particularly in individuals with compromised immune system or underlying medical conditions. Extracellular vesicles (EVs) released by *N. glabratus* play an important role in pathogenesis and host-pathogen interactions. With the use of various analytical techniques, including nanoparticle tracking analysis, transmission electron microscopy, and proteomic profiling, we characterized the size, concentration, and cargo of *N. glabratus* EVs. Mass spectrometry analyses confirmed the presence of yapsin 3 in EVs as the main source of proteolytic activity, although the presence of other members of the yapsin family could also be assumed. The pH-dependent assay of proteolytic activity revealed two maxima for EVs-associated proteinases. These maxima were then used to investigate substrate specificity and several host proteins, including extracellular matrix proteins, coagulation cascade components and proteins involved in the activity of the immune system, were considered as potential substrates in further research. Understanding the composition and functional significance of *N. glabratus* EVs provides valuable insights into fungal pathogenesis and may also help in the development of novel therapeutic strategies against fungal infections, based on the inhibition of proteases activity.

This work was in part financially supported by the National Science Centre, Poland (grant number 2021/43/D/NZ6/01464 awarded to J.K.-K.).

NATIONAL SCIENCE CENTRE POLAND

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Photobionts of *Loxospora* species

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The lichen genus *Loxospora* A. Massal. belongs to the Ascomycota and its species associate with unknown unicellular chlorococcoid photobionts. The aim of this work was to study photobionts of four *Loxospora* species (*L. cismonica* (Beltr.) Hafellner, the recently described *L. cristinae* Guzow-Krzemińska, Łubek, Kubiak & Kukwa, *L. elatina* (Ach.) A. Massal., and *L. ochrophaea* (Tuck.) R.C. Harris) and try to unravel their taxonomic position. The study was based on specimens deposited in the New York Botanical Garden Herbarium (NY) and Herbarium of University of Gdańsk (UGDA). Newly obtained and GenBank sequences of rbcL marker were used to perform phylogenetic analyses. *Loxospora* photobionts associate with new phylogenetic lineage closely related to *Dictyochloropsis* and *Symbiochloris*. Some sequences form a clade with representatives of the genus *Coccomyxa*. Single sequences are found in clades represented by the genera *Asterochloris, Chlorodium,* and *Trebouxia.*

Potential threat of *Cryptosporiopsis tarraconensis* to hazel (*Corylus*) in Poland

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Cryptosporiopsis tarraconensis has been reported only five times worldwide. It has previously been reported in Spain, Italy, Turkey as well as Iran, and more recently in Poland. For Central Europe, it is a newly reported species. *Cryptosporiopsis tarraconensis* is the causal agent of leaf damage, shriveling of smaller branches and the leaves growing on them, and sometimes dry bud rot, leading to bud dieback. It causes significant damage in natural populations of hazel (*Corylus avellana*), but also in hazel plantations. *C. tarraconensis* has not previously been described in natural hazel populations or outside temperate climates. Climate change is affecting the range of pathogens in hazel and many other species. More dry and hot periods may favor the emergence of species not previously considered a threat to hazel. This may lead to a change of approach in hazel protection in the coming years and an evaluation of standard hazel pathogens in Poland.

Remember about the fungi! A case of a neglected group in nature conservation

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Students' Naturalist Association of the Jagiellonian University, Cracow, Poland

Degradation of natural environment and habitat loss led to conservation efforts concerning a significant number of animal and plant species. Despite the fact that fungi are facing similar threats, until 2015 there were only three species present on the IUCN Red List - one non-lichenized and two lichenized. Since then, awareness about fungal conservation has been raised – in the IUCN 2023-1 assessment 781 fungi species have been examined, 41% of them were classified as threatened. Most of these species belong to Basidiomycota and Ascomycota divisions, leaving other important groups underrepresented. Main threats for assessed fungi are land development, agriculture and logging. Effective in situ and ex situ conservation methods are discussed and further actions are suggested.

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Response of lichen *Cetraria aculeata* to simulated extraterrestrial conditions

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Lichens, as symbiotic organisms, have the ability to live in harsh conditions, which is determined by their poikilohydry, specific thallus structure and physiological adaptations. *Cetraria aculeata* (Schreber) Fr. has a three-layered cortex and high melanin content, which may constitute a protective attribute. We determined the effect of vacuum and X-rays on the physiology of *C. aculeata* to verify whether strongly melanised thalli are more resistant than poorly melanised. We also compared the response of thalli in a metabolically active and dry state. We exposed lichens to high vacuum (ca. 3×10-2 mbar) and X-rays (total dose: 50 Gy) for 3h. We observed a decrease of chlorophyll integrity in strongly and poorly melanised thalli; however, the lowest values were observed in poorly melanised, metabolically active thalli. The differences in carotenoid content between the control and particular groups were more distinct and significantly the lowest values were observed in strongly melanised, dry lichens. The highest level of oxidative stress was found in strongly melanised thalli in dry state. Similarly, ergosterol content decreased after exposition reaching the lowest level in melanised but wet thalli. We conclude that lichens in an active state are most susceptible to damage, especially melanised ones, which do not support the role of melanins as protective agents. This could result from differences in morphological structure and the greater ability of melanins to absorb X-rays.

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Species richness and genetic divergence of Carpathian nivicolous myxomycetes against the large-scale diversity of the group

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Nivicolous myxomycetes are one of the most intriguing ecological groups of slime moulds. They occur at the edge of spring-melting snow in mountainous areas of the world. Data from different geographical regions have accumulated over last 30 years, but the overall diversity and biogeography of this group remains poorly understood. The aim of our work was to study the diversity of the Carpathian populations of nivicolous myxomycetes against the diversity of the group from Europe, North and South Americas and Australia for estimating the taxonomic distinctiveness of Carpathian myxomycetes. We analyzed 300 collections from the Western and Eastern Carpathians (Poland, Slovakia and Ukraine) based on morphological and molecular data. Species belonging to eight genera were identified. About 300 sequences of partial 18S rDNA gene were obtained and used in the phylogenetic analyses. Our preliminary results revealed that Carpathian specimens formed phylogenetic clades characterized by high intraspecific genetic similarity within the analyzed species. Some species from the Carpathians were genetically different than those from the Americas or Australia, whereas other species were genetically identical or very similar to those from other regions. These results suggest a pronounced regional genetic differentiation for some species. Studies such as these contribute to better understanding of diversity and biogeographical relationships and allow the improved monitoring of biodiversity.

Sporobolomyces yeasts – allies for plants in fighting metal toxicity

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Sporobolomyces is a genus of yeast presented by both cellular and hyphal stages all over the world. They exist in different ecological form – endophytes, pathogens and saprotrophs and can be used in many different sectors of live – starting from food industries to enhancing plant growth. This review will mainly focus on its effect on vitality of plants grown under pressure from different environmental factors. Researchers show that *Sporobolomyces ruberrimus*, an endophyte isolated from *Arabidopsis arenosa* can help plants combatting with metal stress and toxicity. Experiments mainly focused on Fe, Pb, Zn and Cd. The fungal agent was shown to supress metal accumulation in plant tissues and in the medium. *S. ruberrimus* also seemed to reduce symptoms of plant stress. Another research showed that in order to supress toxic metal accumulation the fungus needs to interfere with plants metabolism – in ethylene homeostasis. Such findings can be useful in agriculture. In the current landscape where heavy metal contamination threatens economically important crops using bioagents like *Sporobolomyces* emerges a promising strategy to prevent crop yield decrease.

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Study of antibiotics influence on *Neosartorya* (*Aspergillus*) spp. via the Biolog™ PM21-25 microplate method

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Neosartorya spp. are fungal food contaminants of high heat-resistance and ability to produce dangerous mycotoxins. This study explores the response of *Neosartorya* spp. to antibiotics and elaborates on individual isolates' metabolic responses when in contact with these substances. Ten fungal isolates with varying sensitivity to natural extracts and food preservatives were cultured on Potato Dextrose Agar (PDA) for 10 days at 30°C. Spores and mycelium were then diluted to 62% transmittance using a sterile inoculating solution (FF-IF, Biolog™) and added to PM21-25 plates (Biolog™) for a 192-hour incubation at 30°C, with optical density measurements taken at 24-hour intervals to assess Average Fungal Respiration Intensity and Average Fungal Growth Intensity. Growth hindrance initially observed transitioned to stimulation, notably with neomycin, tobramycin, kanamycin monosulfate polymyxin B, cephalotin, paromomycin, apramycin sulfate, dequalinium chloride and amphotericin B at 144 hours. These antibiotics, widely used in husbandry and agriculture, underscore the necessity for caution in antibiotherapy implementation due to potential fungal overgrowth risks. Diverse metabolic responses within the isolate population were observed, emphasizing the complexity of fungal responses to antibiotic exposure and offering insights for improved food safety strategies.

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NATIONAL SCIENCE CENTRE POLAND

Surfactin and capric acid affect the posaconazole susceptibility of selected strains of *Candida albicans*

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Candida albicans is an opportunistic fungal pathogen that normally exists as a harmless commensal in most individuals. When host immunity is suppressed (e.g. in AIDS patients) *C. albicans* can cause life-threatening disseminated candidiasis with mortality rate of around 40% in Europe. High prevalence of resistant strains no longer responding to commonly used antifungal drugs (e.g. azoles) pose a serious public health problem. Therefore, there is a considerable interest in discovering new, natural compounds that can be used in combination therapy with conventional antibiotics. Our study aimed to investigate effects of surfactin (lipopeptide) and capric acid (short-chain fatty acid), in combination with posaconazole, on *C. albicans* strains with alterations in sterols and the sphingolipids biosynthesis pathway. We demonstrate that both surfactin and capric acid enhance the antifungal activity of posaconazole. Moreover, surfactin and capric acid can independently contribute to the reduced adhesion of *C. albicans* strains with altered ergosterol biosynthesis to abiotic surfaces (up to 90% reduction in adhesion). However, combination of those compounds does not correspond with the increased permeabilization of the plasma membrane when compared to cells treated with posaconazole alone. This suggests that the fungistatic effect of posaconazole in combination with surfactin or capric acid is related to the reduction in adhesion of *C. albicans*.

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NATIONAL SCIENCE CENTRE POLAND

Surviving nitrogen excess: do excessive nitrates affect lichen physiology?

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Lichens are known for being symbiotic associations between fungi and green algae however, more often they are presented as miniature ecosystems with multiple intraspecific interactions. Due to their simple anatomical structure, lichens are highly sensitive to air pollution, but some species have specialized in growing in disturbed urban environments where they are constantly exposed to various environmental pollutants including nitrogen oxides. While the influence of another nitrogen-related substance – ammonia – on lichen thalli is widely studied, there is a lack of research concerning oxidized forms of nitrogen on lichen physiology. This study aimed to assess the physiological response of N-tolerant *Xanthoria parietina* to nitrate ions. Lichen thalli were sprayed with different KNO_3 solutions 10 times during the three-week experiment. Cell membrane integrity, photosynthetic efficiency and membrane lipid peroxidation were analyzed. No decrease in photosynthetic efficiency was recorded, except for the highest nitrate concentration. While the lowest nitrate concentrations did not affect cell membrane integrity, the moderate and the highest doses resulted in profound damage. No differences in oxidative stress levels between the control and experimental groups were found, indicating an overall good physiological condition of *Xanthoria parietina* to excessive nitrates-related stress.

The CRISPR/Cas9 genome-editing method in edible fungi - present state and recent applications

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The application of CRISPR/Cas9 genome editing technology has revolutionized genetic manipulation across diverse organisms. Edible mushrooms, due to their cellular peculiarities characterized by the heterokaryotic phase, have long been a hindrance to researchers in the application of this method. Due to increasing market demand and the desire to improve the quality of cultured mushrooms, the use of genetic modification methods is a potential solution to remedy these problems. In this review poster, we will try to provide an overview of the specifics of the application of the CRISPR/Cas9 method in edible mushrooms, possible modifications to this method, as well as recent reports from the scientific world on successes in genetic modification of edible mushrooms.

The effect of high intensity of light and UVA radiation on the photosystem II (PSII) efficiency in lichen photobionts

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The stable symbiotic association of the algal and fungal components allows lichens to grow in a variety of habitats, including extremely stressful environments. Lichens that inhabit open sites, such as deserts, poor grasslands, polar and high mountain regions, are exposed to high insolation and UV radiation. These factors can strongly limit photosynthesis in photobionts, which in turn may reduce the production of precursors for the fungus metabolism. Dark pigmentation of the outer cortical layer and/or the synthesis of secondary metabolites are fungal traits that can protect the photosynthetic apparatus of photobionts against irreversible damage.

Fruticose lichens *Cetraria aculeata* and *Cladonia uncialis* often co-occur on soils in sun-exposed sites; the first species has a cortex with the light-absorbing melanin-like pigment, the latter produces the light-reflecting usnic acid. We exposed (for 1 hour) metabolically active thalli to intense light (~1800 μmol photons m^{-2} s^{-1}), UVA radiation (~18 W m^{-2}) and combination of both factors to determine their sensitivity to radiation-related stress. Based on Chl *a* fluorescence, we determined the recovery of photosynthetic activity at subsequent time intervals after the stress exposure (1/2, 2, 6 and 18 hrs). Photosystem II (PSII) was more affected by intense light and UV radiation in photobionts of *C. aculeata*. Both species regained high efficiency of PSII after about 6 hours, but in the case of *C. uncialis* recovery proceeded faster.

The Garden of Enzymes – symbiotic relationship between *Leucoagaricus gongylophorus* and leaf-cutter Ants

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Leucoagaricus gongylophorus (Moeller 1893) is well-known fungus that forms symbiotic relationships with leaf-cutter ants belonging to the tribe *Attini*, including the genus *Atta* and *Acromyrmex*. The ants are responsible for the maintenance of a fungal population within their nests, as well as the provision of leaf biomass for the decomposition process. Fungi employ a variety of enzymes to decompose organic matter and provide nutrients for ants. The degradation process is possible due to the action of enzymes such as lignocellulases, maltase, α-amylase, pectinases, laccases, glycoside hydrolases, proteases and others.

The possible use of spent mushroom substrate (SMS) in urban gardening

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In recent times, agriculture has increasingly relied on monocultures, leading to issues in waste management and storage. The cultivation of mushrooms (*Agaricus* spp.) is no exception. After the production cycle, a nutrient-rich substrate is typically discarded. Improper storage of such waste can pose ecological risks, as it may harbour pathogenic microorganisms in its raw state, while its decomposition can further contribute to greenhouse gas emissions. In Poland alone, approximately 1.5-2 million tonnes of spent mushroom substrate (SMS) are generated annually. One of the more favourable methods for managing this post-production waste is its utilization as organic fertilizer. Given its high organic matter content and additional beneficial properties, SMS can enhance soil conditions in both field crops and community gardens within urban areas. Vegetables and fruits cultivated in cities face additional challenges due to the highly urbanized environment. These factors include soil and air pollution, contaminated water resources, and the urban heat island effect. However, the advantages of SMS fertilizer can mitigate these challenges by improving the growth conditions of vegetables. Its high calcium content aids in soil deacidification, while its rich organic matter enhances soil substrate's water-holding capacity, partly owing to its peat content. This study aims to showcase the potential of utilizing post-production mushroom substrate in urban horticulture.

What killed the flies in Greenland? - the diversity and host-specificity of *Entomophthora muscae*

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While conducting surveys of insect communities in South Greenland, we consistently observed deceased flies affixed to leaves and stems in a characteristic posture, often exhibiting spread wings and abdomens swollen with fungal hyphae. Inspired by this finding, we decided to explore the topic of interactions between hosts, their pathogens, and protective symbionts. These diverse microorganisms are critical to insect biology, essential for shaping their community composition and function. However, many aspects of such insect-microbial associations remain poorly understood, especially in natural communities, and studying them presents methodological challenges. In this study, we aim to address this issue by validating broad sampling and multi-target amplicon sequencing as a cost-effective tool for characterizing host-pathogen interactions. Then, we use said tool to describe the strain diversity of pathogenic fungi: Entomophthora, infecting dipteran hosts in the Narsarsuaq region of South Greenland. Finally, we compare bacterial diversity within fungus-infected Diptera across species and sites. To achieve these aims, we employed high-throughput sequencing to amplify and characterize marker regions for insects, fungi, and bacteria from a collection of dead and infected insects found in various sites. Our results demonstrate successful amplification of different target types, revealing a vast pathogen and symbiont diversity across samples. Preliminary data also indicate intriguing patterns of host-specificity within the fungus-infected Diptera populations.

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