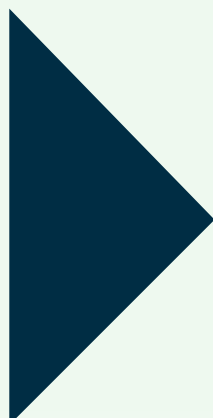


**WEEK OF MICROBIAL  
TECHNOLOGIES**

# **ABSTRACTS BOOK**

**7-11 NOVEMBER, 2022  
LJUBLJANA, SLOVENIA**





# BOOK OF ABSTRACTS

WEEK OF MICROBIAL TECHNOLOGIES

Ljubljana, Slovenia

November 7 – 11, 2022





**Book of Abstracts: Week of Microbial Technologies**

**7 – 11 November, 2022 - Ljubljana, Slovenia**

Organising committee: Jožef Stefan Institute, ICCRAM University of Burgos, AXIA Innovation, Wageningen University and Research, Ghent University, Helmholtz-Zentrum Dresden-Rossendorf.

Editors: Prof. Dr. Aleš Lapanje, Jožef Stefan Institute; Beatriz Lapuente, University of Burgos; Daniel Canas, University of Burgos; Dr. Tomaž Rijavec, Jožef Stefan Institute.

Published by: Jožef Stefan Institute Press.

Issued by: Jožef Stefan Institute.

For the issuer: Prof. Dr. Boštjan Zalar, director.

Design: SurfBio Project - ICCRAM University of Burgos

Ljubljana, 2023

First edition

This publication is free of charge.

---

Katalogni zapis o publikaciji (CIP) pripravili v Narodni in univerzitetni knjižnici v Ljubljani

COBISS.SI-ID 158775043

ISBN 978-961-264-272-3 (PDF)



# CONTENT

<b>PREFACE</b> .....	6
ORGANISING COMMITTEE .....	6
<b>ABSTRACTS INDUSTRIAL WORKSHOP</b> .....	7
LEGO MICROBES: THE COLLOID BIOLOGY APPROACH TO BUILDING A MICROBIAL COMMUNITY FOR SUCCESSFUL REMEDIATION OF THE ENVIRONMENT .....	8
BIOREMEDIATION SYSTEMS EXPLOITING SYNERGIES FOR IMPROVED REMOVAL OF MIXED POLLUTANTS .....	9
ACTIVE AND INTELLIGENT FOOD PACKAGING .....	10
NATURE-BASED SOLUTIONS: TREATMENT WETLANDS FOR DIFFERENT TYPES OF WASTEWATER .....	11
SERS: PUSHING THE LIMITS OF RAMAN DETECTION .....	13
VERDEQUANT: SUSTAINABLE MANUFACTURING OF HIGH PERFORMANCE NANOMATERIALS AND THEIR APPLICATIONS .....	14
MANUFACTURING ASPECTS OF PHAGE-BASED PRODUCT DEVELOPMENT FROM EARLY STEPS TO PRODUCTION OF CLINICAL TRIAL MATERIAL .....	15
ECOTOXICOLOGY ASSESSMENTS IN THE DIAGONAL PROJECT: NANOPARTICLES TOXICOKINETICS AND TOXICODYNAMICS IN BIOFILMS .....	16
PARTICIPATORY ENVIRONMENTAL MONITORING AND SMART CITIES - ROOM FOR MICROBIAL TECHNOLOGIES?.....	17
MICROBIAL SOLUTIONS FOR SUSTAINABLE AGRICULTURE .....	18
BIODIVERSITY FROM OUR FOOD DISH TO AGRO-FIELDS: THE BIOVALUE PROJECT .....	19
PROOF-OF-CONCEPT FOR BIOAUGMENTATION OF WHITEWATER FROM WOOD-FREE PAPER MILLS WITH ADAPTED BACTERIA.....	21
GROUP CHAT OR PERSONAL MESSAGE: THE ROLE OF DIFFUSION IN MICROBIAL INTERACTIONS .....	22
CA-CASEINATE-ENHANCED REMINERALISATION OF DENTAL APATITE .....	23
INTELLECTUAL PROPERTY MANAGEMENT AND FERMENTATION PRODUCT MARKET.....	24
ESTABLISHING NEW VALUE CHAINS IN THE CITIES - EXAMPLE OF THE APPLAUSE PROJECT .....	25
<b>ABSTRACTS POSTER SESSION</b> .....	27
BIOAUGMENTATION IMPROVEMENT USING EDAPHIC MICROBIAL CONSORTIA AND ORGANIC AMENDMENTS .....	28
STUDY OF THE TOXICITY AND THE ANTIMICROBIAL ACTIVITY OF DIFFERENT FORMS OF ZNO NANOPARTICLES: ZNO NANOPARTICLES LINKED TO GRAPHENE, PRISTINE ZNO NANOPARTICLES AND ZNO NANOPARTICLES DOPED WITH MN .....	31
INVESTIGATING THE FUNCTION, PERSISTENCE, AND BIOSAFETY OF CONSTRUCTED MICROBIOMES FOR IMPROVED BIOREMEDIATION OF PETROLEUM-IMPACTED SOIL.....	33





INSIGHT INTO GENOMIC DNA OF THE SELECTED STRAINS FROM ORAL CAVITY WITH ANTIMICROBIAL ACTIVITY AGAINST PARODONTAL PATHOGEN USING THE NANOPORE TECHNOLOGY .....	35
METAGENOMIC CHARACTERISATION OF AN ENRICHED MICROBIAL COMMUNITY CARRYING OUT SIMULTANEOUS BIOELECTROCHEMICAL REMOVAL OF AZO DYE AND CHROMIUM FROM DYEING PROCESS EFFLUENT.....	37
METAL(LIOD)S REMOVAL FROM POLLUTED GROUNDWATER WITH BIOELECTROCHEMICAL SYSTEM AND PHYTOREMEDIATION .....	39
TOXICOLOGICAL ANALYSIS OF VIOLOGEN DERIVATIVES FOR APPLICATION IN REDOX FLOW BATTERIES .....	41
PHYTOREMEDIATION AND ANALYSIS OF SOIL CONTAMINATED WITH PETROLEUM HYDROCARBONS .....	42
PHYSIOLOGICAL AND TRANSCRIPTOME PROFILING OF CHLORELLA SOROKINIANA: AN AZO DYE WASTEWATER DECOLORIZATION STUDY.....	45
AN ELECTROSTATIC APPROACH FOR CONSTRUCTING BIOREMEDIATION EFFICIENT CONSORTIA BY RANDOM COMBINATION OF UNCULTIVATED MICROBIAL CELLS.....	47
LAB-ON-A-CHIP FOR THE EASY AND VISUAL DETECTION OF SARS-COV-2 IN SALIVA BASED ON SENSORY POLYMERS .....	49
INFLUENCE OF MICROBIAL AND ORGANIC FERTILIZERS ON BACTERIAL COMMUNITIES COMPOSITION DURING KEY GROWTH PHENOPHASES OF MAIZE.....	50
PARTICULATE MATTER CLEANING THROUGH SELF-ASSEMBLED CALCIUM CARBONATE PARTICLE ARRAYS .....	53
NATURAL FRACTIONATION OF MICROALGAE AND CYANOBACTERIA AS A METHOD FOR HYDROGEN ISOTOPE SEPARATION .....	55
ORGANOMERCURIAL LYASE (MERB) ENABLED METHYLMERCURY DETECTION .....	57
RADIOLABELLING OF NANOPARTICLES FOR COLLOID TRACING AS A VERSATILE TOOL IN NANOSAFETY RESEARCH.....	58
ISOLATION OF MCPA-DEGRADING ENDOPHYTIC BACTERIA FROM CUCURBITS.....	60
INVESTIGATION OF URANIUM(VI) REDUCTION BY THE REPOSITORY-RELEVANT BACTERIUM DESULFOSPOROSINUS HIPPEI DSM 8344T.....	63
PSEUDOMONAS SPP. IN BIOCONTROL OF CROWN GALL DISEASE: NEW APPROACHES .....	65
GREEN SOLUTION FOR THE HEAVY PROBLEM: SPATIALLY-ORIENTED ARTIFICIAL STRUCTURES MADE OF DISSIMILATORY METAL-REDUCING BACTERIA ARE ABLE TO PRECIPITATE VANADIUM AEROBICALLY.....	68
ISOLATION, DIVERSITY AND CHARACTERIZATION OF PLANT GROWTH-PROMOTING BACTERIA FROM FIVE DIFFERENT SUGAR BEET HYBRIDS .....	70
NEW ALL-NANOPARTICLE MICROCAPSULES FOR REMOTE RELEASE AND SENSING .....	73
LC-MS/MS DETERMINATION OF THE PRODUCTS OF BACTERIAL LIGNIN DEGRADATION .....	74
INCORPORATION OF NONCANONICAL AMINO ACIDS INTO PROTEINS USING GENETIC CODE EXPANSION.....	76
CERAMIC-BASED CARRIERS AS A BIOFILMS INTERFACE: DESIGN AND MEDICAL APPLICATIONS	79



## PREFACE

The Week of Microbial Technologies –MicroTechWeek– was a five-day summit full of project meetings and open public events, such as an industrial workshop, a poster session and a hands-on training, aimed at gaining knowledge on the applications of surface and colloid biology in different industrial sectors. It was jointly organised by the European projects SURFBIO and GREENER.

The main goal of this event was networking between EU projects and stakeholders, sharing applications of surface and colloid biology and planning new initiatives based on microbiology technologies.

This book gathers the contents generated in the SURFBIO industrial workshop and in the poster session. Professionals from international companies and organisations contributed knowledge from different perspectives, creating very fruitful roundtables for the project partners.

SURFBIO Project has received funding under the European Union's Horizon 2020 research & innovation programme under grant agreement N° 952379.

## ORGANISING COMMITTEE

**Aleš Lapanje**, Jožef Stefan Institute.

**María Suárez Díez**, Wageningen University and Research.

**Tomaž Rijavec**, Jožef Stefan Institute.

**Cristina Furlan**, Wageningen University and Research.

**Beatriz Lapuente**, Universidad de Burgos.

**Andre Skirtach**, Ghent University.

**Rocío Barros**, Universidad de Burgos.

**Bogdan Parakhonskiy**, Ghent University.

**Raquel Moreno**, AXIA Innovation.

**Stefan Schymura**, Helmholtz-Zentrum Dresden-Rossendorf.

**Ioanna Katsavou**, AXIA Innovation/Exelisis.



Surfbio project has received funding under the European Union's Horizon 2020 research & Innovation programme under grant agreement N° 952379



# ABSTRACTS INDUSTRIAL WORKSHOP





# INFLUENCE OF MICROBIAL AND ORGANIC FERTILIZERS ON BACTERIAL COMMUNITIES COMPOSITION DURING KEY GROWTH PHENOPHASES OF MAIZE

Aleksandra Jelušić<sup>1</sup>, Matjaž Hladnik<sup>2</sup>, Tamara Janakiev<sup>3</sup>, Dunja Bandelj<sup>2</sup>, Ivica Dimkić<sup>3</sup>

<sup>1</sup>*University of Belgrade, Institute for Multidisciplinary Research, Belgrade, Serbia*

<sup>2</sup>*University of Primorska, Faculty of Mathematics, Natural Sciences and Information Technologies (FAMNIT), Koper, Slovenia*

<sup>3</sup>*University of Belgrade, Faculty of Biology, Belgrade, Serbia*

Contact: [jelusic.aleksandra@gmail.com](mailto:jelusic.aleksandra@gmail.com)

## INTRODUCTION

Maize is among the three world's most important and widely grown cereals (Seyi-Amole & Onilude, 2021). The excessive and long-term application of agrochemicals for providing maize with essential nutrients, required for the development of all growth phenophases and for yield enhancement, leaves adverse consequences for human health and the environment (Khaliq et al., 2004). Although their use is inevitable to meet the increasing demand of the growing human population for a healthy food supply, organic fertilizers and biofertilizers (microbial fertilizers) are becoming recognized as effective, economically feasible, and environmentally sound alternatives for sustainable agriculture (Lawal & Babalola, 2014; Hui et al., 2017; Mahanty et al., 2017). The main objective of this study was to evaluate the influence of the microbial inoculant Phytobiotic (PHY), containing a consortium of *Bacillus subtilis* sp. *subtilis* and *Microbacterium* sp., on native maize microbiome during key growth phenophases (seedling, flowering, and harvesting) under field conditions, as well as to compare whether differences in efficacy between PHY, poultry manure (PM) and their combination (PHY\_PM) exist, based on yield parameters.

## STATE OF THE ART

Seeds, roots, and soil samples were taken for metabarcoding analysis during four growth phenophases (I-IV). Samples of uninoculated seeds and soil, poultry manure, and seeds inoculated with PHY were primarily taken before sowing (phenophase I). Further, during the growing season [phenophases II (seedling), III (flowering), and IV (harvesting)] the effect of PHY, PM, and PHY\_PM on maize seeds, roots, and soil microbiome was evaluated in relation to concurrently sampled negative controls. A total DNA from the collected samples was isolated, amplified with primers 515F/ 806R targeting the V4 region of the 16S rRNA, and subjected to next-generation sequencing (NGS). The obtained sequence data were bioinformatically processed and used for the evaluation of alpha and beta diversity. Yield and associated parameters (number of grown and fallen/broken plants, rating fence, plant vigor, the occurrence of *Ustilago* sp., and grain moisture) were evaluated after harvest.

## RESULTS

Seeds exhibited lower bacterial diversity compared to the soil, root, and manure samples. The most abundant taxon in uninoculated seeds pre-harvest was *Pantoea*, while in seeds treated with PHY the most abundant was *Acinetobacter*, followed by *Pantoea*, *Pseudomonas*, and *Bacillus*. After harvest, *Pantoea* and *Pseudomonas* prevailed in seeds. Soil bacterial communities mostly remained unchanged, regardless of the treatment (PHY, PM, and PHY\_PM) applied or the tested phenophase, with uncultured *Gaiellales* and *Bacillus* being the most abundant. Contrarily, root bacterial communities differed in distribution and relative abundance





of different taxa between phenophases and between treatments. The most abundant taxa in roots during the initial phenophase (II) was *Pseudomonas*. In the flowering phenophase (III), *Bacillus* prevailed with two to three times higher relative abundance in treatments with PHY or PM compared to the negative control, while *Lechevalieria* dominated in harvesting phenophase (IV). A statistically significant increase in maize yield was obtained in the treatment with PHY, with an average value of 650 kg/ha compared to the negative control. The lowest yield was obtained in the treatment with PM.

## DISCUSSION

The prevalence of *Acinetobacter*, *Pantoea*, *Pseudomonas*, and *Bacillus* in seeds treated with PHY pre-harvest, indicates that treatment with PHY is highly beneficial considering the known plant growth promoting potential of these genera, that were also previously confirmed as core maize inhabitants (Mehta et al., 2021). As core members, *Pantoea* and *Pseudomonas* remained present after harvest. The benefit of the application of *Bacillus*-based fertilizers to soil is the enhancement of the plant-available forms of nutrients and the inducement of pest and pathogens defense systems (Radhakrishnan, et al., 2017). It is of crucial importance that none of the three treatments applied in this study affected the composition of the indigenous soil bacterial communities during four tested phenophases, which is highly important when selecting suitable agricultural practices. Shifts in root microbiome over maize growth could be related to the production of different root metabolites over the growing season (Bourceret et al., 2022). Roots were especially rich with genera (*Pseudomonas*, *Stenotrophomonas*, *Sphingobacterium*, *Achromobacter*) known as phosphate solubilizers (Mehta et al., 2021). Furthermore, *Bacillus* was dominant in roots in flowering phenophase. This genus is known for its wide spectrum of beneficial effects on plants, like phosphate solubilization, biosynthesis of growth hormones, antimicrobial activity, induction of systemic resistance, etc. (Dimkic et al., 2022).

## CONCLUSIONS

Considering the above-mentioned effect of PHY on maize yield incensement, its non-disruption effect on the core microbiome, and the positive effect on enhancing the presence of beneficial bacterial genera, this microbial inoculant could be proposed as a promising alternative to chemicals and organic fertilizers in maize cultivation.

## REFERENCES

1. Hui, L.I., Feng, W.T., He, X.H., Ping, Z.H.U., Gao, H.J., Nan, S.U.N., Xu, M.G. (2017). Chemical fertilizers could be completely replaced by manure to maintain high maize yield and soil organic carbon (SOC) when SOC reaches a threshold in the Northeast China Plain. *Journal of integrative agriculture*, 16, 937-946. Doi: 10.1016/S2095-3119(16)61559-9.
2. Khaliq, T.A.S.N.E.E.M., Mahmood, T.A.R.I.Q., Kamal, J.A.V. E.D., Masood, A.M.I.R. (2004). Effectiveness of farmyard manure, poultry manure and nitrogen for corn (*Zea mays* L.) productivity. *International Journal of Agriculture and Biology*, 2, 260-263. Doi: 1560-8530/2004/06-2-260-263.
3. Mahanty, T., Bhattacharjee, S., Goswami, M., Bhattacharyya, P., Das, B., Ghosh, A., & Tribedi, P. (2017). Biofertilizers: a potential approach for sustainable agriculture development. *Environmental Science and Pollution Research*, 24, 3315-3335. Doi: 10.1007/s11356-016-8104-0.



4. Lawal, T. E., Babalola, O.O. (2014). Relevance of biofertilizers to agriculture. *Journal of Human Ecology*, 47, 35-43. Doi: 10.1080/09709274.2014.11906737.
5. Seyi-Amole, D. O., & Onilude, A. A. (2021). Microbiological Control: A New Age of Maize Production. In (Ed.), *Cereal Grains - Volume 2*. IntechOpen. Doi: 10.5772/intechopen.97464.
6. Mehta, S., Singh, B., Patra, A., Tripathi, A., Easwaran, M., Choudhary, J. R., Aggarwal, S. K. (2021). Maize microbiome: current insights for the sustainable agriculture. In *Microbiomes and plant health* (pp. 267-297). Academic Press. Doi: 10.1016/B978-0-12-819715-8.00009-4.
7. Radhakrishnan, R., Hashem, A., Abd\_Allah, E.F. (2017). Bacillus: A biological tool for crop improvement through bio-molecular changes in adverse environments. *Frontiers in physiology*, 8, 667. Doi: 10.3389/fphys.2017.00667.
8. Bourceret, A., Guan, R., Dorau, K., Mansfeldt, T., Omidbakhshfard, A., Medeiros, D. B., Schulze-Lefert, P. (2022). Maize Field Study Reveals Covaried Microbiota and Metabolic Changes in Roots over Plant Growth. *Environmental Microbiology*, 13(2), e02584-21. Doi: 10.1128/mbio.02584-21.
9. Dimkić, I., Janakiev, T., Petrović, M., Degrassi, G., & Fira, D. (2022). Plant-associated Bacillus and Pseudomonas antimicrobial activities in plant disease suppression via biological control mechanisms-A review. *Physiological and Molecular Plant Pathology*, 117, 101754. Doi: 10.1016/j.pmpp.2021.101754.