Joint International Conference of

mikrobio kosmos & CEESME

Central and Eastern Europe Symposium on Microbial Ecology

22-24 September 2025

Concert Hall of Thessaloniki

Greece

ABSTRACT BOOK

Funded by the European Union

Under the auspices:
ARISTOTLE UNIVERSITY of THESSALONIKI
FACULTY OF AGRICULTURE, FORESTRY AND NATURAL ENVIRONMENT

AFEA CONGRESS
www.afeacongress.gr

S1_OP07 (FT)

DISRUPTING SOIL NITRIFICATION: AMMONIA-OXIDIZER PHYSIOLOGICAL RESPONSES TO SYNTHETIC AND BIOLOGICAL NITRIFICATION INHIBITORS

Dimitrios Dalkidis[1], Logan H. Hodgskiss[2], Melina Kerou[2], Christa Schleper[2], Dimitrios G. Karpouzas[3], Evangelia S. Papadopoulou[1]

[1]Laboratory of Environmental Microbiology and Virology, Department of Environmental Sciences, University Of Thessaly, [2]Archaea Biology and Ecogenomics Unit, Department of Functional and Evolutionary Ecology, University of Vienna, [3]Laboratory of Plant and Environmental Biotechnology, Department of Biochemistry and Biotechnology, University of Thessaly

Nitrification is a crucial process within the global nitrogen cycle but also a major contributor to nitrogen loss and environmental degradation in intensively managed agroecosystems. To mitigate these impacts, nitrification inhibitors (NIs) are employed to target ammonia-oxidizing microorganisms (AOM); however, the molecular mechanisms underlying their action remain poorly understood. Here, we investigate the physiological responses of key soil AOM groups, such as ammonia-oxidizing archaea (AOA) and bacteria (AOB), to both synthetic (SNIs) and biological (BNIs) nitrification inhibitors, with a particular focus on the model soil AOA Nitrososphaera viennensis. We developed and optimized dual RNA-protein extraction protocols and established species-specific time-of-harvest methods, based on the species generation time, to capture microbial responses at both transcriptional and translational levels. Time-series experiments revealed rapid gene expression shifts within 0.5 hours and delayed proteomic changes after 6 hours of NI exposure. Following this, we investigated the physiological and molecular responses of N. viennensis to seven NIs, including the SNIs DMPP and ethoxyquin and the BNIs zeanone, sakuranetin, MHPP, and 1,9-decanediol, along with allylthiourea serving as a positive control. Our findings revealed that NIs triggered distinct physiological and molecular responses in N. viennensis, suggesting variable and potentially overlapping biochemical targets among AOM. By integrating transcriptomic and proteomic data, we provide a clearer understanding of how NIs influence microbial function and nitrifier resilience under chemical stress. This work advances our understanding of microbial nitrogen cycling and informs targeted strategies for managing soil nitrifying communities to enhance nitrogen retention and promote ecosystem sustainability.

Acknowledgements

This work is part of the project ACTIONr that has received funding from the European Union's Horizon 2021-2027 research and innovation programme under grant agreement No 101079299