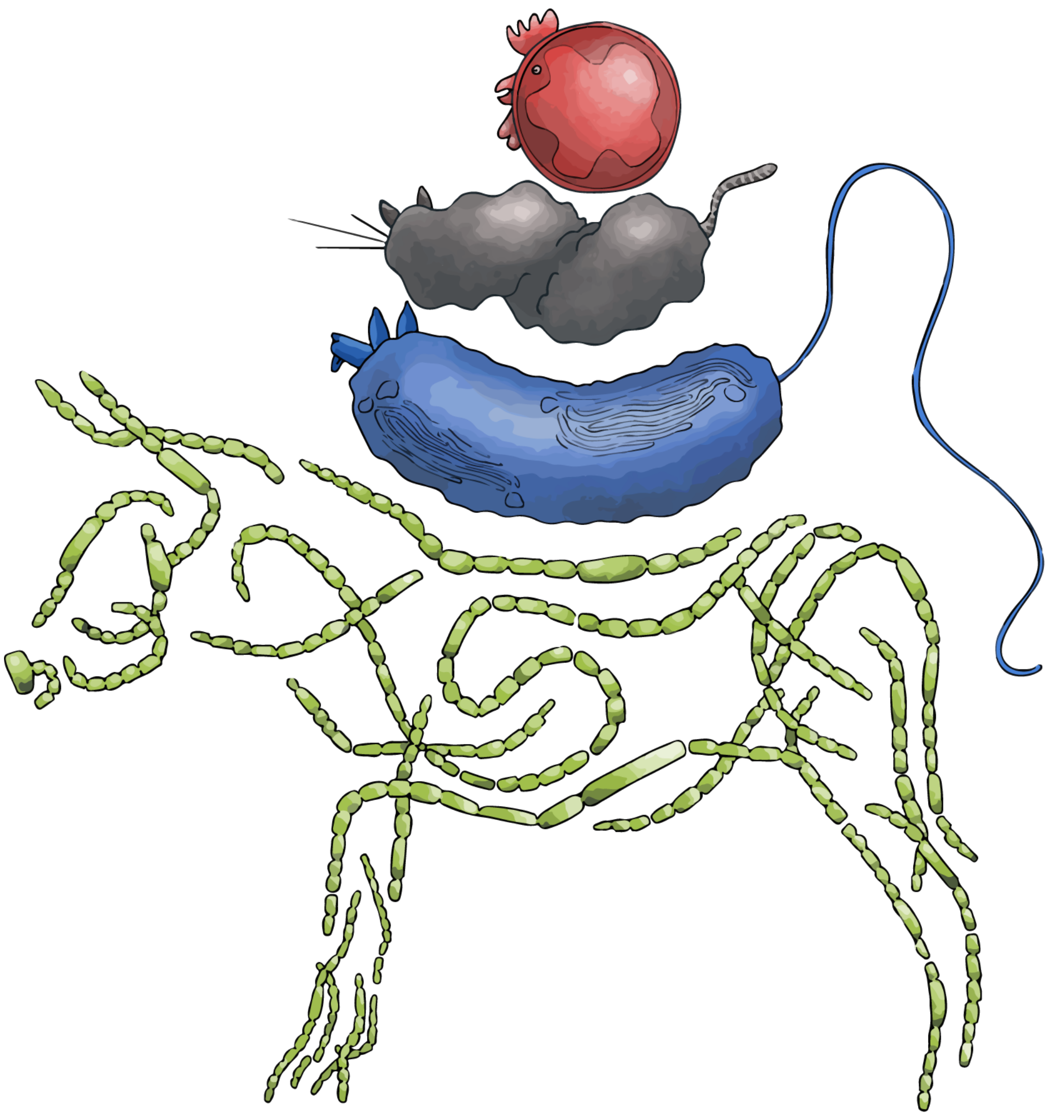
ICoN9

JUNE 22-26 2025
BREMEN, GERMANY



ABSTRACT BOOKLET

Matrix-Dependent Efficacy of BNIs: A Comparative Study Across In Vitro, Slurry, and Soil Systems

Moutzoureli C.,[1] Bachtsevani E., Papadopoulou E. S.,[2] Nicol, G.W.,[3] Hazard C.,[3] Karpouzas D.G.[1],

[1]University of Thessaly, Department of Biochemistry and Biotechnology, Laboratory of Plant and Environmental Biotechnology, Viopolis, 41500, Larissa, Greece.

[2]University of Thessaly, Department of Environmental Sciences, Laboratory of Environmental Microbiology and Virology, Gaiopolis, 41500, Larissa, Greece.

[3]Université Claude Bernard Lyon 1, Laboratoire d'Ecologie Microbienne, 69100, Villeurbanne, France

Biological nitrification inhibition (BNI) has emerged as a promising approach to enhance nitrogen-use efficiency and reduce nitrogen losses via leaching and nitrous oxide emissions. Although various plant-derived BNIs have demonstrated potential, their efficacy under field-relevant conditions remains insufficiently characterized. In this study, we assessed the inhibitory efficacy of six BNI compounds — zeanone, 2-methoxy-1,4-naphthoquinone, sakuranetin, MHPP, 1,9-decanediol, and MBOA — compared to a mixture of two established synthetic nitrification inhibitors, ethoxyquin and DMPP. Evaluations were conducted using three distinct experimental systems: (1) single-strain cultures of ammonia-oxidizing archaea (AOA) and bacteria (AOB), (2) short-term potential nitrification assays using soil slurries, and (3) soil microcosm incubations, with the latter two analyses using two near-neutral agricultural soils from Greece and France. Results show that apparent BNI efficacy was strongly influenced by both the targeted ammonia-oxidizing group (i.e. AOA vs AOB) and the experimental matrix. While robust inhibition was observed with cultures, these effects did not consistently translate to soil systems. Soil incubations displayed the lowest inhibitory activity, likely due to rapid compound degradation. Notably, even the most potent BNIs — MHPP and MBOA — exhibited significantly lower efficacy compared to the SNI mixture. These findings highlight the critical role of biotic and abiotic soil factors in modulating BNI performance. They also underscore a potential disconnect between laboratory-based efficacy and real-world outcomes, reinforcing the importance of evaluating BNI strategies under conditions that closely reflect natural soil environments.