UNIVERSITÄT ZU KÖLN

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ÖKOLOGISCHES KOLLOQUIUM

des Instituts für Zoologie in person in room 0.024

Wednesday, 29.11.2023, 01:15 pm

Host: Prof. Dr. Michael Bonkowski

First Talk

Daniela Niedeggen

PhD student, AG Bonkowski, Terrestrial Ecology

Utilization of maize rhizodeposition by the microbiome in an agricultural soil

Rhizodeposition fuels C and nutrient cycling in soil. Still, the exact mineralisation dynamics of rhizodeposition are largely unknown. Their concentration decreases exponentially with increasing distance to the root surface. Microbial growth however requires sufficient C-supply. We therefore hypothesized that microbial growth, but not mineralization dynamics will be restricted at specific threshold concentrations of rhizodeposition.
We measured microbial growth in response to decreasing concentrations of different maize rhizodeposits. These substrates included root-derived mucilage and exudates, as well as their major single components, such as sugars and organic acids. By creating a gradient of substrate concentrations, we simulated reduced microbial access to rhizosphere C with increasing distance to the root surface. The rhizosphere microbiome showed complex temporal growth dynamics depending on both substrate composition and concentration. As hypothesized, microbial assimilation of rhizodeposits did not ultimately stimulate growth; rather, substrate concentrations must exceed a specific C threshold. Below this threshold, the carbon supply merely promoted respiration, but was not sufficient for microbial production. By identifying kinetic parameters of a variety of root-derived substrates, it allows accurate calibration of models that consider microbial uptake and growth on rhizodeposits with increasing distance to the root surface.

Second Talk

Martin-Georg Endress

PhD student, AG Bonkowski, Terrestrial Ecology

Bioenergetics as a modeling tool linking microbial dormancy, maintenance and growth in soil

Soil microorganisms obtain both carbon and energy from the decomposition of organic substrates to fuel their metabolic demands. These matter and energy fluxes are intimately coupled, and their joint dynamics offer a promising way to obtain a mechanistic understanding of microbial growth and maintenance. However, the development of such a bioenergetics perspective is still in its infancy in the context of soils.
In this work, we derive the bioenergetic consequences of different conceptual frameworks and quantitative models of growth, dormancy and maintenance in soil microorganisms. Specifically, we focus on analyzing the consequences of non-growth processes for the overall energy and mass balance using a combination of theoretical considerations and dynamic modeling.
Our analysis shows that the choice of representations of microbial activity and maintenance has a distinct effect on the predicted ratio of heat release to CO_2 release (Calorespirometric Ratio, CR) in both growing and non-growing populations, which can be measured and tested in future experiments. The results also highlight the need for careful consideration of underlying assumptions when interpreting experimental observations of CO_2 and heat release from soil, and our conclusions will provide helpful guidelines for emerging studies aiming to illuminate the general bioenergetics of soil systems.

Gäste sind herzlich willkommen!
Die Mitarbeiter/innen der Ökologie

→ bei Rückfragen: 470-8242 (Niedeggen)