EGU22-10525
https://doi.org/10.5194/egusphere-egu22-10525
EGU General Assembly 2022

Studying the effect of scarab beetle larvae on soil greenhouse gas fluxes in a mesocosm experiment

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The arthropod family Scarabaeidae is estimated to consist of over 30,000 species worldwide, including important pests. Their larvae – commonly known as white grubs – are often part of the soil decomposer community feeding on living plant roots, plant residues as well as faeces. As a result, scarab beetle larvae have the potential to directly and indirectly affect the spatial and temporal variability of soil greenhouse gas (GHG) fluxes, especially through their capability to emit significant amounts of CH_4. However, due to a lack of field data (Görres & Kammann 2020), little is known about their quantitative impact on soil GHG budgets. We conducted a mesocosm experiment with common cockchafer larvae (*Melolontha melolontha*) with the twofold aim to better understand their effect on soil CO_2, CH_4 and N_2O fluxes as well as the methodological challenges associated with studying this soil fauna group under field conditions. The experiment was conducted in Germany (temperate zone) over an entire vegetation period in mesocosms with three different vegetation types (grassland, grassland + carrots, and carrots, respectively) and three different larval infestation rates (0, 8, and 16 larvae m^{-2}, respectively). Greenhouse gas flux measurements were conducted with the static chamber method on a monthly basis, including the use of isotopic labels to focus especially on gross soil CH_4 fluxes. In this presentation, we will focus on the methodological difficulties encountered during the experiment and the potential of field-based isotope pool dilution techniques for non-invasive studies of scarab beetle larval CH_4 emissions.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 703107.

Reference

Görres, C.-M., Kammann, C. (2020). First field estimation of greenhouse gas release from European soil-dwelling Scarabaeidae larvae targeting the genus Melolontha. PLoS ONE 15(8): e0238057, doi 10.1371/journal.pone.0238057.