Geophysical Research Abstracts
Vol. 20, EGU2018-16475, 2018
EGU General Assembly 2018

Greenhouse gas emissions of soil-dwelling cockchafer larvae

Carolyn-Monika Görres and Claudia Kammann
Hochschule Geisenheim University, Geisenheim, Germany (carolyn.goerres@hs-gm.de)

Soil macrofauna contributes directly and indirectly to soil greenhouse gas (GHG) fluxes, however, the magnitude of their contribution remains poorly quantified. The majority of our current knowledge comes from laboratory experiments while field data remains scarce. Here we present the first field GHG emission data for soil-dwelling Scarabaeidae larvae – *Melolontha melolontha* (Common cockchafer) and *Melolontha hippocastani* (Forest cockchafer). Scarabaeidae larvae are qualitatively known to emit methane (CH_4) due to CH_4-producing microorganisms in their gut system, but have thus far been neglected in the soil CH_4 cycle. Between April and November 2017, we excavated *Melolontha* larvae at six different locations in Central and Southern Germany covering forests and grasslands. Soil plots with an area of 50 cm x 50 cm were excavated to a depth of at least 30 cm and each located larva was directly incubated for an hour in an air-tight sealed glass test tube (110 ml). At the end of the incubation period, 25 ml of air were extracted from each test tube with a syringe for gas chromatographic analysis of carbon dioxide (CO_2), CH_4 and nitrous oxide (N_2O) concentrations. In total, 158 larvae were incubated in the field. In addition to the GHG emissions, weight, larval stage, and soil depth were recorded for each larva. Average CH_4 emissions were 1.32 μg CH_4 h^{-1} $larva^{-1}$, but there was a large variability within and between the different sampling sites. The highest CH_4 emissions with up to 7.08 μg CH_4 h^{-1} $larva^{-1}$ were observed in a grassland in May where *M. melolontha* larvae had reached their final larval stage with weights ranging between 2.0 and 2.7 g. *For M. hippocastani*, CH_4 emissions were mostly below 0.5 μg CH_4 h^{-1} $larva^{-1}$. However, Melolontha spp. are pest insects and can easily reach abundance levels of more than 50 individuals m^{-2}, thus upscaled fluxes can reach values of more than 10 μg CH_4 h^{-1} m^{-2}. Analysis of CO_2 and N_2O emission data is still on going, but preliminary results show CO_2 emissions of up to about 2000 μg CO_2 h^{-1} $larva^{-1}$. Regarding N_2O, the majority of larvae did not show any emissions, however, more than 5 μg N_2O h^{-1} $larva^{-1}$ were measured for a few individuals. Overall, our data shows that cockchafer larvae produce significant amounts of GHG which seem to vary with larval size, larval fitness and food supply. It still has to be determined at which abundances scarab beetle larvae exert a significant effect on the total soil GHG balance. With respect to CH_4, it has already be shown that the presence of scarab beetle larvae can enhance the soil CH_4 oxidation capacity of soils.

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.