Geophysical Research Abstracts
Vol. 19, EGU2017-917-1, 2017
EGU General Assembly 2017

Priming effect in topsoil and subsoil induced by earthworm burrows

Duyen Hoang Thi Thu
Vietnam Forestry University, Forestry Faculty, Soil Sciences, Hanoi, Viet Nam (duyenhoang42@gmail.com)

Earthworms (Lumbricus terrestris L.) not only affect soil physics, but they also boost microbial activities and consequently important hotspots of microbial mediated carbon and C turnover through their burrowing activity. However, it is still unknown to which extend earthworms affect priming effect in top- and subsoil horizons. More labile C inputs in earthworm burrows were hypothesized to trigger higher priming of soil organic matter (SOM) decomposition compared to rhizosphere and bulk soil. Moreover, this effect was expected to be more pronounced in subsoil due to its greater C and nutrient limitation. To test these hypotheses, biopores and bulk soil were sampled from topsoil (0-30 cm) and two subsoil depths (45-75 and 75-105 cm). Additionally, rhizosphere samples were taken from the topsoil. Total organic C (Corg), total N (TN), total P (TP) and enzyme activities involved in C-, N-, and P-cycling (cellobiohydrolase, β-glucosidase, xylanase, chitinase, leucine aminopeptidase and phosphatase) were measured. Priming effects were calculated as the difference in SOM-derived CO_2 from soil with or without 14C-labelled glucose addition.
Enzyme activities in biopores were positively correlated with Corg, TN and TP, but in bulk soil this correlation was negative. The more frequent fresh and labile C inputs to biopores caused 4 to 20 time higher absolute priming of SOM turnover due to enzyme activities that were one order of magnitude higher than in bulk soil. In subsoil biopores, reduced labile C inputs and lower N availability stimulated priming twofold greater than in topsoil. In contrast, a positive priming effect in bulk soil was only detected at 75-105 cm depth. We conclude that earthworm burrows provide not only the linkage between top- and subsoil for C and nutrients, but strongly increase microbial activities and accelerate SOM turnover in subsoil, contributing to nutrient mobilization for roots and CO_2 emission increase as a greenhouse gas. Additionally, the mechanisms of native SOM decomposition are distinct between topsoil and subsoil, which relies on the fresh C input and nutrient availability.

Keywords: Priming effect; Earthworms; Organic matter decomposition; Biopores; Subsoil; Microbial hotspots.