EGU2020-6080
https://doi.org/10.5194/egusphere-egu2020-6080
EGU General Assembly 2020

Carbon turnover and Turnover rate of enzyme cellobiohydrolase in earthworm biopores

Duyen Hoang Thi Thu
VNU Vietnam-Japan University, Vietnam National University, Hanoi (duyenhoang42@gmail.com)

Earthworm catalyzes soil organic matter (SOM) decomposition through their burrowing activity, gut processing of carbon (C) inputs and microorganism stimulation. Specific enzyme is characterized for the decomposition, which is denoted in enzyme activity, substrate turnover and turnover rate of the decomposition. To demonstrate the interaction between earthworms and microbial activities, ^{14}C-labelled plant litter was placed on a soil surface of a mesocosm (10 x 2 x 50 cm) prior to placing earthworms into soil, control soil was set up in mesocosms without earthworms. After 1 month of earthworm presence, soil materials coated on the biopore walls were excavated for another soil incubation to define C turnover by trapping respired CO_2 in NaOH 1M. While another subsample was used to define activity of cellobiohydrolase (a cellulolytic enzyme) and its turnover rate. The hypotheses were that i) C turnover by incubation is associated with enzymatic turnover rate but ii) these two turnover rates are depth dependent.

Consequently, activity of cellobiohydrolase was higher in earthworm biopores than control soil regardless of soil depth. The difference in enzyme kinetics between biopores and control soil showed a shift of enzyme system toward higher substrate affinity in the topsoil but lower in the subsoil. This finding can be explained by the distinction in microbial community between topsoil and subsoil in both earthworm biopore and control soil. Substrate turnover time calculated based on saturated substrate concentration and maximum reaction rate velocity. The turnover rate of substrate decomposition was faster in biopores than bulk soil. The substrate turnover time is depth dependent. We concluded that earthworm biopores are microbial hotspots with demonstrated interactions between microbial functions and microscale features. The decrease of enzyme activities with depth, accompanied by the decrease of catalytic efficiency, implies the microbial production of more efficient enzymes in the top- than in the subsoil. Bioturbation induced by earthworms leads to localization of microorganisms and litter within biopores and plays a crucial role for organic matter processing, its microbial utilization, and turnover. This has direct consequences for C and nutrient cycling.