Response of soil microbial enzymatic activity to earthworm species (epi-anecic vs strict-anecic)

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Abstract

Earthworms are qualified as soil engineers and play a key role in the degradation of soil organic matter (SOM). Their contribution to this function is either direct, by consuming dead organic matter, or indirect by influencing microbial communities and activities in the soil. Most of the studies evaluating their contribution to this function were conducted at the level of four ecological categories (epigeic, epi-anecic, strict anecic and endogeic).
The aims of this study were to determine and compare the contribution of (1) three separate epi-anecic species, (2) three separate strict anecic species and (3) the mixing effects between these different species (by pairs of two species), on litter mass loss and soil enzymatic activities in their middens (surface casts) and burrows. Enzyme activities measured were FDA, Beta-Glucosidase, Cellulase, Leucine Amino Peptidase and Phosphatase involved in C, N and P cycles.
After 30 days of the experiment, Beta-Glucosidase was significantly higher in middens than in burrows for both epi-anecic and strict anecic species whereas no differences were observed on the others enzymatic activities between middens and burrows. In monoculture, and compared to the control condition (without earthworms), we observed that litter mass loss and enzymatic activities were significantly higher in presence of epi-anecic compared to strict-anecic species. These differences are more pronounced with FDA, Leucine Amino Peptidase and Beta-Glucosidase enzyme activities than with Cellulase and Phosphatase (respectively, +34, +57, +78 and +14, +8 %). Still, in monoculture, no difference was found between species of the same ecological category. Interactions between earthworm species (intra- or inter-ecological category) on litter mass loss and enzyme activity were mainly additive indicating functional redundancy. These initial results on microbial activities confirm the grouping of earthworms species into ecological categories initially based on morphological, physiological and ecological criteria.

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