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Contribution of soil fauna to soil functioning in degraded environments: a multidisciplinary approach

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The restoration of the soil functions is essential for the recovery of highly degraded sites and, consequently, the study of the soil fauna role in the soil development in such environments has great potential from a practical point of view. The soils of the post-mining sites represent unique models for the study of the natural ecological succession because mining creates similar environments characterized by the same substrate, but by different ages according to the year of closure of mines.
The aim of this work was to assess the contribution of different species of macrofauna on the evolution of soil structure and on the composition and activity of the microbial community in soil samples subjected to ecological restoration or characterized by spontaneous ecological succession. For this purpose, an experimental test was carried out in two sites characterized by different post-mining conditions:
1) natural succession,
2) reclamation with planting trees.
These sites are located in the post-mining area of Sokolov (Czech Republic). For the experimental test repacked soil cores were prepared in laboratory with sieved soil sampled from the two sites. The soil cores were prepared maintaining the sequence of soil horizons present in the field. These samples were inoculated separately with two genera of earthworms (Lumbricus and Aporrectodea) and two of centipedes (Julida and Polydesmus). In particular, based on their body size, were inoculated for each cylinder 2 individuals of millipedes, 1 individual of Lumbricus and 4 individuals of Aporrectodea. For each treatment and for control samples 5 replicates were prepared and all samples were incubated in field for 1 month in the two original sampling sites.
After the incubation the samples were removed from the field and transported in laboratory in order to perform the analysis of microbial respiration, of PLFA (phospholipid-derived fatty acids) and ergosterol contents and finally for the characterization of soil structure. All replicates were subjected to soil respiration measurement by means of chemical titration method. Then some replicates were destructively analyzed for PLFA and ergosterol and others were used for the 3D soil image analysis of the soil pore system. The soil cores were imaged using X-ray microtomography and three-dimensional image processing was performed in order to obtain 3D reconstructions and preliminary analysis of the identified biopores.
The experimental approach used in this multidisciplinary study showed a promising potential to provide new useful information about the widely differentiated contribution of many types of macrofauna to the formation of the soil pore system and to the development of the soil microbial functions in different types of environments.