Abstract

Slowdown of plant litter decomposition is one of the many ways how to increase the amount of organic matter in soil and thus contribute to both the restoration of organic matter in soil and reduction of the amount of carbon dioxide in the atmosphere. Here we focused on the long-term effect of soil macrofauna on organic matter decomposition and stabilization. In two long-term microcosm experiments, common isopod (*Armadillidium vulgare*) greatly affected both leaf litter decomposition and organic matter chemistry. Microbial decomposition was lower in excrements than in litter or unconsumed leaf fragments. At the same time, moisture and temperature fluctuations and addition of nutrients increased decomposition much more in litter than in the excrements. Chemical analyses revealed preferential loss of polysaccharide carbon and accumulation of lignin with some modification to aromatic carbon in excrements when compared to litter; the two substrates also differed in lignin quality. Additionally, we observed that phenolics content in leaf litter is considerably affected by both microbial and isopod feeding activities. In the third long-term microcosms experiment, we compared consequence of bioturbation of the epigeic earthworm (*Lumbricus rubellus*) and mechanical mixing of organic matter into soil on carbon storage. We observed that in presence of earthworms carbon storage depends on both soil and litter types and the effect changes over time. Earthworms increased soil respiration shortly after being introduced into the soil but reduced respiration in long term. Earthworms tend to promote carbon loss from young soil with no litter derived organic matter while in older system, which is under fauna effect for some time, and organic matter accumulates here, earthworms tend to promote carbon storage. In the last experiment, we tested the effect of bibionid larvae (*Bibio marci*) feeding on three types of litter and compared it to several artificial treatments that included grinding, coating by kaolinite, alkalinization to pH=11 of litter, and their combinations. The results suggest significant decrease in microbial respiration in bibionid larvae excrements compared to the original leaves. In artificial treatments, alkalinization had a large impact on slowdown of microbial respiration. Our results indicate that consumption of litter by litter-feeding macrofauna represents one of the crucial factors controlling the dynamics of litter decomposition and subsequent carbon sequestration in soil.