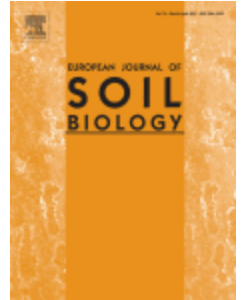




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Trophic interactions among soil arthropods in contrasting land-use systems in Kenya, studied with stable isotopes

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Highlights

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The $^{15}\text{N}/^{14}\text{N}$ ratios in soil arthropods reflected their trophic positions and were similar to results from temperate soils.

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The ratio of $^{13}\text{C}/^{12}\text{C}$ ($\delta^{13}\text{C}$) in soil arthropods was negatively correlated to the C:N ratio in their tissue.

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Increasing $\delta^{13}\text{C}$ with the trophic level of arthropod groups could not be demonstrated.

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Trophic positions of particular taxa were similar in forest and agricultural soil.

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This is one of the first studies of the trophic structure of a soil arthropod community in a tropical ecosystem.

Abstract

Understanding how land use intensification changes organism communities and trophic interactions in soil is important for development of sustainable agriculture and forestry. We analysed the food web of soil arthropods with help of natural $^{13}\text{C}/^{12}\text{C}$ and $^{15}\text{N}/^{14}\text{N}$ ratios ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) in two habitats in the Kenyan Highland – a natural forest and an agricultural site on former forest land. Aims of the study: (1) to describe the structure and feeding relationships in the two systems for major soil arthropod groups, (2) to find differences in feeding strategies within major arthropod groups, (3) to determine if soil arthropod groups have the same trophic positions in forest and agricultural soil, (4) to evaluate if $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ can be explained by additional reasons, e.g. the physiology and C:N ratios of organisms.

This is one of few studies of the trophic structure of soil arthropod communities in tropical ecosystems. It confirms that the structure is similar to comparable systems in the temperate zones. There was a large variation in $\delta^{15}\text{N}$ among families of Oribatida, Mesostigmata and Collembola (the most common groups) indicating great variety in feeding ecology. Collembola and Diplopoda had comparatively high $\delta^{15}\text{N}$, indicating a contribution of animals to the diet. Although lower abundance and diversity of arthropods in the agricultural soil, the trophic positions of particular taxa, indicated as $\delta^{15}\text{N}$ level, were similar to the forest. The $\delta^{13}\text{C}$ values were negatively correlated to the C:N ratio, therefore increasing values of $\delta^{13}\text{C}$ with trophic level could not be demonstrated.

Keywords

Collembola; Oribatida; Mesostigmata; 13-Carbon; 15-Nitrogen; Tropical soil