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Beech trees fuel soil animal food webs via root-derived nitrogen

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Abstract

Root-derived resources are receiving increased attention as basal resources for soil animal food webs. They predominantly function as carbon and energy resources for microbial metabolism in the rhizosphere, however, root-derived nitrogen may also be important. We explored both the role of root-derived carbon (C) and nitrogen (N) for the nutrition of soil animal species. Using ^{13}C and ^{15}N pulse labeling we followed in situ the flux of shoot-derived C and N into the soil animal food web of young beech (*Fagus sylvatica*) and ash (*Fraxinus excelsior*) trees. For labeling with ^{13}C, trees were exposed to increased atmospheric concentrations of $^{13}CO_2$ and for labeling with ^{15}N leaves were immersed in a solution of $Ca^{15}NO_3$. Twenty days after labeling root-derived N was detected in each of the studied soil animal species whereas incorporation of root-derived C was only detected in the ash rhizosphere. More root-derived N was incorporated into soil animals from the beech as compared to the ash rhizosphere, in spite of the higher ^{15}N signatures in fine roots of ash as compared to beech. The results suggest that soil animal food webs not only rely on root C but also on root N with the contribution of root N to soil animal nutrition varying with tree species. This novel pathway of plant N highlights the importance of root-derived resources for soil animal food webs.

Keywords: Basal resources; Mycorrhiza; Pulse labeling; Rhizodeposits; Stable isotopes

Introduction

The close interrelationship between the decomposer system and plants is mediated by leaf litter input and rhizodeposition (Wardle 2002). As up to 90% of net primary plant

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