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Mapping footprint of nematodes in the rhizosphere

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Nematodes are one of the most important pathogens in agriculture leading to strong decrease of biomass and yield production of crops. The direct effects of nematodes on above and belowground plant parts are well known, but a broad range of indirect effects especially in soil remains unknown. Using zymography, we analyzed indirect effects of Meloidogyne incognita – the common nematode – on the activity, distribution and localization of two enzymes responsible for C and P cycling: cellobiohydrolase and phosphatase in the rhizosphere of lupine (Lupinus polyphyllus L.), a sensitive species to pathogens and P demand. The distribution pattern of enzymes demonstrated that Meloidogyne spp. induced the formation of knots as well as cluster roots, which was corresponded to hotspot locations on zymogram images for both cellobiohydrolase and phosphatase. Increased C release by nematode infected roots into the soil lead to decrease of overall activity of cellobiohydrolase and especially of it hotspots (for $\sim$ 20 times). In contrast, the increased P demand of infected plants, raised the phosphatase activity leading to increase of rhizosphere extend around the roots, and especially of the hotspots' area (for 6 times).
We conclude that nematode infection has not only direct effects by changing the root morphology, but induce a number of subsequent biochemical changes (e.g. enzyme activities and consequently nutrient mobilization) in the rhizosphere affecting C and P cycling.

Keywords: Pathogenic nematodes, Meloidogyne incognita, Rhizosphere processes, Enzyme activity mapping, Zymography, Cluster roots, Nutrient acquisition, Microbial hotspots.