# Impact of microplastics aerial deposition on rhizosphere soil ecology: the case study of tomato (Solanum lycopersicum) exposed to polyethylene

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**Abstract**

In agroecosystems, a considerable amount of microplastics (MPs) reach the crop plants through aerial depositions. Here, we investigated the impact of MPs aerial depositions on the growth, root metabolome, and bacterial and fungal communities associated with the rhizosphere of tomato (*Solanum lycopersicum* L.). Tomato plants were treated with three concentrations (10, 100, and 1000 mg L-1) of a solution composed of polyethylene microspheres (PE-MS) and distilled water. Control plants were supplemented only with distilled water. The leaves were sprayed with the solutions after 15 and 21 days of growth. After 31 days of growth, shoots, roots, and rhizosphere soils were collected. The plant material was used to measure shoot biomass, shoot water content, and root metabolomic profiling through high-resolution gas-chromatography/mass-spectrometry. Rhizosphere microbial diversity was investigated via DNA metabarcoding of the bacterial 16S rRNA gene and fungal ITS2 region. Tomato shoots did not show differences in dry and fresh weight, but a significant reduction in water content was observed at 100 and 1000 mg L-1. PE-MS aerial depositions increased the roots relative abundance of amino acids but also of carbohydrates and their conjugates. PE-MS significantly decreased the relative content of a pyrimidine derivative (5,6-Dihydrouracil), organic acids (lactic acid and tartaric acid), and fatty acids (palmitic acid and stearic acid). Further, the microbial analysis revealed that PE-MS affected bacterial but not fungal beta diversity. In conclusion, exposure of tomato leaves to PE-MS showed no effect on plant growth. Oppositely, PE-MS significantly altered the root metabolome and the bacterial diversity in the rhizosphere.

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**Keywords:** Microplastics, Rhizosphere, Microbial community, Plant, Metabolomics.