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DECIPHERING THE COMPLEX INTERACTIONS BETWEEN PESTICIDES AND SOIL MICROBIOTA

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ABSTRACT

Pesticides are heavily used worldwide and carefully designed to incapacitate unwanted agricultural pests (i.e. fungi, insects, plants), constituting an integral part of modern agriculture. On the other hand, pesticides may affect ecosystems through their toxicity towards non-target organisms (i.e. aquatic organisms, microorganisms). Regarding soil microbiota, pesticides effect can be detrimental or beneficial. So far pesticide European legislation has largely ignored both aspects, but mostly the possibility of toxicity of pesticides to soil microbes. This is reflected in pesticide European regulation where pesticide soil ecotoxicity assessment relies solely on C and N mineralization assays that do not provide a reliable assessment of pesticide impact on soil microbes and therefore soil functioning.

The main objective of this project was to shed light into the bidirectional interactions between pesticides and soil microbes, and the factors that will determine which way the balance will go. Isoproturon, tebuconazole and chlorpyrifos were chosen as model pesticides for assessing their toxicity to soil microbes. Their impact and fate were studied by utilizing standardized and advanced molecular tools (fingerprinting molecular methods, qPCR, high-throughput sequencing analysis, microarrays) combined with chemical analysis (Q-TOF, LC-MS, GC-MS), which allows high resolution analysis of complex environmental substrates like soil and enables the parallel assessment of the exposure of the soil microflora to the pesticides or possible metabolic products of interest. This assessment was performed following a lab-to-field experimental approach (tiered approach).

Further research is in progress in order to elucidate pesticides microbial degradation mechanisms in soil (beneficial interaction) using functional metagenomic assays and next generation sequencing approaches.



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