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PhD Programme in “Models and Methods for Material and Environmental Sciences” (XXXVIII cycle)

Investigate the fate of microplastics in terrestrial ecosystems and their impact on soil microarthropods biodiversity

Micro- (< 5 mm) and nanoplastics (< 1 µm) are emerging contaminants that have recently drawn considerable attention because of the threat they pose to ecosystems worldwide. While their impact on marine biodiversity has been extensively studied, our understanding of the distribution and effects of microplastics on soil ecosystems is still limited (Guo et al., 2020). Microplastics have been found to cause deleterious effects to soil health and function (de Souza Machado et al., 2018; Liu et al., 2017), and, due to their widespread occurrence in soils, they are likely to interact with soil organisms. A recent study provided the first *in situ* evidence of polystyrene fragments inside an Antarctic collembolan species, suggesting that these contaminants have deeply entered the soil food webs (Bergami et al., 2020). Preliminary laboratory data further showed that microplastics can negatively impact growth, reproduction, and survival of soil fauna as single exposure or in combination with other contaminants (Wang et al., 2022).

My PhD project aims to: i) investigate the occurrence and distribution of microplastics in relation to soil microarthropods within Italian terrestrial environments; ii) evaluate the effects of the most abundant microplastic types as well as their degradation products on soil fauna; iii) determine the fate of micro- and nanoplastics in soil ecosystems through their adsorption, ingestion and accumulation in soil microarthropods.

To reach these objectives I will carry out the following activities: i) Field surveys. Sampling of soils will be carried out in sites representative of Italian terrestrial environments characterised by different anthropogenic pressures to determine microplastic concentrations and physico-chemical features as well as soil biodiversity (e.g., through QBS-ar index, Menta et al., 2018). ii) Laboratory studies. Bench-scale tests will be set up to investigate the effects of selected microplastics and their degradation products on key soil microarthropod species. iii) Plastic-bio interactions. To study the role of soil biota in determining the fate of micro- and nanoplastics in soil ecosystems, pecimens of microarthropods, including collembolans will be analysed to determine micro/nanoplastics adsorption, ingestion and accumulation within their intestinal tracts.

References

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