Forest soil microhabitats characterisation and relationships with ground-dwelling predatory arthropod communities (carabid beetles and spiders)

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Résumé

In forest, the complexity and spatio-temporal heterogeneity of stands provide habitats for many arthropods, including soil arthropods known to play a key role in numerous ecosystem processes. The heterogeneity of forest habitats provides different ecological niches, and, consequently, a heterogeneous distribution of species. Arthropod abundance, for example, has been found to be higher in deciduous stands than in coniferous ones, and the current insect decline is more pronounced in production forest stands, and for insects of the upper stages of the food chain, i.e., predators such as carabid beetles and spiders. Carabid beetles and spiders are often used as bioindicators of habitat quality, since their distribution on a small scale is determined by strict ecological requirements and habitat and microhabitat properties. Numerous studies have highlighted the role of various habitat characteristics and microhabitats on invertebrate communities, but none of them has proposed a synthesis incorporating all the targeted characteristics that could lead to a standardised protocol.
In this study carried out in southwest France along the Ciron river, we aimed to characterise soil microhabitats associated to ground-dwelling arthropods in different forest types and explore their relationships with associated biodiversity, by monitoring carabid beetles and spiders. We studied gradients of forests, from deciduous riparian forest to monospecific plantation forest, with intermediate area with mix forests or coniferous ones. Soil invertebrates were sampled using pitfall traps from March to September in 2021 and 2022. Microhabitats were characterised on the basis of $1m^2$-quadrats around the pitfall traps in spring, summer and autumn. We characterised soil cover (leaf litter, needle litter, grass, bare ground) and micro-structure elements (e.g., vegetation height, litter thickness, deadwood debris). We also measured distances to different local structuring elements (e.g., living tree, dead tree, tree stump), estimated canopy openness using hemispherical pictures and realised vegetation surveys.
Preliminary results first reveal different structuration and composition of invertebrate communities in the different forest stands of the study area. Moreover, they show a significant effect of soil cover (litter type), micro-structure metrics and canopy openness on small-scale

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community structuring for both carabid beetle and spider communities. Finally, our preliminary results also support the importance of riparian forests and the habitats they provide, since they contribute to regional biodiversity by sheltering pools of species that are different from neighbouring environments.

Mots-Clés: Forest, Microhabitats, Community ecology, Invertebrates