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Soil Microarthropod Assemblage under Vegetation Cover: A Bioindicator Approach in Agriculture

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Abstract : Healthy soils are crucial for sustainable agriculture, supporting plant productivity, air and water quality, and overall - public health. Soils are dynamic ecosystems that host diverse organisms that facilitate key processes such as nutrient cycling and soil formation. Soil biodiversity, especially microarthropods, plays a vital role in these functions. Despite their importance, the link between soil biodiversity and agricultural practices is not fully understood. Soil management practices such as cover cropping can enhance soil biodiversity and quality. However, specific impacts on microarthropod diversity and function require further investigation. This study aims to evaluate how vegetation cover in agriculture modifies soil microarthropod assemblage in three Mediterranean agroecosystems. The practices included mixed cover crops in almonds, single crop intercropped in olives, and local vegetation retention in vineyards. Samples were taken from soils with vegetation and from bare soil within the same system and analyzed for microarthropod adaptation, diversity, and differences in community composition using the Soil Biological Quality index for arthropods (QBS-ar), Shannon diversity index, and non-metric multidimensional scaling (NMDS). Our result suggested that areas with vegetation cover had higher QBS-ar values and differed in community composition compared to no-vegetative-covered areas. An Indicator Species Analysis (ISA) identified Acari, Coleoptera, and Diplura as indicators of cover crop habitat in an almond orchard, while Collembola was prominent in plots with vegetation in olive groves and vineyards. Chilopoda and Symphyla were also indicators of vegetation cover in the vineyard. On the contrary, no indicator groups were found in non-covered areas in all agroecosystems. These findings suggest that soil microarthropod diversity and community structure are positively linked to vegetation cover, highlighting its potential benefits for soil health and sustainability as agricultural practices. However, since the experimental design of this study was limited to specific sites, more research with replicated independent sites would be necessary to extend these findings and to generalize the effect of vegetation cover on soil fauna in agroecosystems. Furthermore, studying the long-term impacts of cover cropping practices on soil biodiversity and ecosystem services is suggested for future research.

Keywords : agriculture, biological index, cover crop, microarthropods, soil functioning
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