Factors affecting soil invertebrate biodiversity in agroecosystems of the Po Plain area (Italy)

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Abstract

Soil is a fundamental component of the biosphere, whose properties and quality are affected by human activities, such as agriculture. Soil health is fundamental for different ecosystem services and soil biota has a crucial role in maintaining it. Elucidating how different crops and agricultural practices affect soil invertebrates communities is of relevance. In the present study, a DNA metabarcoding approach was adopted to evaluate the effects of different biotic and abiotic factors, including agricultural practices, on the composition and diversity of soil invertebrate communities of different agro-ecosystems (Po Plain-Italy). At this aim, the DNA markers and the more effective primers in retrieving soil metazoan communities were established. Bulk soil samples from different agro-ecosystems (i.e., cornfield, alfalfa, paddy fields, vineyard, stable meadow, woodland) were collected and, processed for obtaining *18S rRNA* and *coi* sequences (raw reads analyzed using QIIME2 and R). Soil physical and chemical parameters were measured for each soil sample (e.g., pH, carbon-nitrogen ratio, texture, porosity) and metadata on farms management were retrieved.

The most efficient primer pairs in recovering soil metazoans were M620F/M1260R for 18S rRNA, and mlCOIintF/jgHCO2198R for *coi* gene. Soil communities resulted dominated by Nematoda, Arthropoda, Annelida, Rotifera and Tardigrada. The most diverse invertebrate communities have been found in the soil of stable meadows and woodlands, while cornfields showed the lowest level of diversity. The diversity of soil invertebrate communities (Hill numbers) was positively correlated with the level of porosity and carbon-nitrogen ratio, while it was negatively correlated with the phosphate abundance. This pattern probably reflects the negative effect of excessive fertilization with phosphates on soil fauna, while the abundance of organic matter and microhabitats were found to enhance the presence of more complex communities. Other soil properties were correlated

only with specific taxa (e.g., pH was negatively correlated with the diversity of Annelida and Rotifera).

Keywords

DNA metabarcoding; soil metazoan communities; agricultural practices effect on biodiversity

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