

Earthworm diversity and its interaction with soil properties in citrus orchards in the Gharb region, northwestern Morocco

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Introduction

Earthworms constitute an important component of soil macrofauna, They play a significant role in sustaining soil fertility and plant productivity in various agroecosystems.

Despite their importance, these organisms are still poorly studied in Moroccan agricultural soils. The existing knowledge on their diversity is very scarce and mostly limited to natural ecosystems such as forests, grasslands, and wetlands.

Objective

In this study, we assess earthworm species present in cultivated soils of orange orchards and examine its interaction with soil properties at the Gharb region of Morocco.

Materials and Methods

➤ Study area

- This study was conducted in eighteen orange orchards located in the Gharb region, the second largest growing area of oranges in Morocco.
- The climate in this region is characterized by a Mediterranean subhumid type, with a mean annual a mean annual rainfall of 580 mm, concentrated between October and April. The average minimum temperature is 11°C and the maximum 24°C.

➤ Sampling methods

- In each orchard, three points were randomly selected to collect earthworms in a quadrat of 0.16 m² at a depth of 25 cm.
- Earthworms were collected using handsorting and formalin extraction.
- All earthworms were preserved in 5 % formalin, stored at -6 °C, and were then identified to species level, counted and weighed.

Results

➤ Earthworm species

- The collected earthworms were numerically dominated by juveniles with 63%. Mature species (pre-clitellate and adults) were less abundant, representing 39% of recovered individuals.
- Endogeic species were abundant, represented by *A. caliginosa* (56% of total adults), *A. rosea* (28%), *A. molleri* (11%) and *M. dubius* (5%). Anecic and epigeic species were totally absent.
- These results are in accordance with the community composition reported in previous studies for the Maghreb region.
- The totality of recovered species are exotic. Endemic species were not found in the investigated orchards,



➤ Earthworm abundance and biomass

- Earthworm abundance in the studied orange orchards varied from 19 to 175 individual m⁻², with an average of 68 individual m⁻² which is within the range recorded for similar agroecosystems in Algeria, South Africa, and Spain.
- Earthworm biomass was between 17 and 63 g formalin-preserved weight m⁻², with an average of 32 g m⁻².
- The variability recorded in earthworm biomass and density among the studied orchards may be attributed to differences in the intensification level (cultivation, use of agrochemicals, use of organic manure,...) and soil properties.

Results

➤ Earthworm abundance and soil

- Soils of the studied orchards were generally medium to heavy in texture, with silty clay loam and silty loam soils being dominant. Organic matter content was low to moderate.
- Soils in most of these orchards were non saline, moderately to strongly alkaline and calcareous which is common for Mediterranean-type soils prevalent in citrus growing areas of Morocco
- Significant correlation was found between earthworm abundance and total N ($r = 0.47$, $p = 0.001$), which may be indicative of a food supply effect.

Conclusions and future directions

The findings of this study showed that earthworm occurrence in cultivated soils of citrus orchards in the Gharb region may be significant depending on the level of intensification and soil properties.

Therefore, earthworm contributions should be considered to ensure a sustainable functioning of such agroecosystems.

Further investigations are needed to elucidate and quantify these contributions which are still neglected for Moroccan cultivated soils.

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