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Effects of olive cultivation characteristics on land snail community patterns in Crete, Greece

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Abstract: Olive agroecosystems are of great agricultural, environmental, cultural and economic importance for the Mediterranean. In the island of Crete (Greece) olive orchards are the most common cultivation, occupying 20% of the total land area. Patterns of invertebrate biodiversity of olive cultivation have been associated with farming systems, the agro-ecological zones of cultivation and landscape attributes. Terrestrial snails of 16 olive orchards under two different farming systems (organic and conventional) located in two different agro-ecological zones (plain and hilly) were studied in the Messara plain, south Crete. Linear models and Mantel tests were used to evaluate the effect of different factors on land snail richness and composition, respectively. Species richness of terrestrial snails was higher in hilly olive orchards regardless of the farming systems. Species richness was explained by landscape attributes (olive orchard area, isolation, slope and anthropogenic impact), while species composition was only partly associated with landscape characteristics. Preliminary results indicate distinct community patterns of terrestrial snails in olive orchards in the Messara plain. Landscape characteristics are important factors affecting snail biodiversity of olive orchards. Terrestrial snails are highlighted as potential indicators for studying the impact of olive orchard management on biodiversity.

Keywords: invertebrate assemblages; olive orchards; species richness; species composition; agroecology

Introduction and Methods

- Olive cultivations are an important part of the Cretan landscape.
- A limited number of studies have been conducted regarding the biodiversity of Mediterranean olive orchards.
- Farming practices and agro-ecological zones of olive cultivation affect environmental performance and biodiversity.
- The present study aims:
 - a) to research and record, for the first time, the land snail biodiversity in selected olive orchards in Crete under different farming systems and distributed in two agroecological zones,
 - b) to evaluate the effect of landscape attributes related to habitat fragmentation, habitat isolation and anthropogenic impact on land snail biodiversity.

Introduction and Methods

- 16 olive orchards in western Messara plain in southern Crete, Greece.
- Seven conventional orchards and nine organic orchards.
- Equally distributed in the two different agro-ecological zones, i.e. plain and hilly.
- Collection of land snails took place between October 2019 and November 2020.
- Linear and linear mixed effects models, diversity dissimilarity analysis, Mantel and partial Mantel tests.

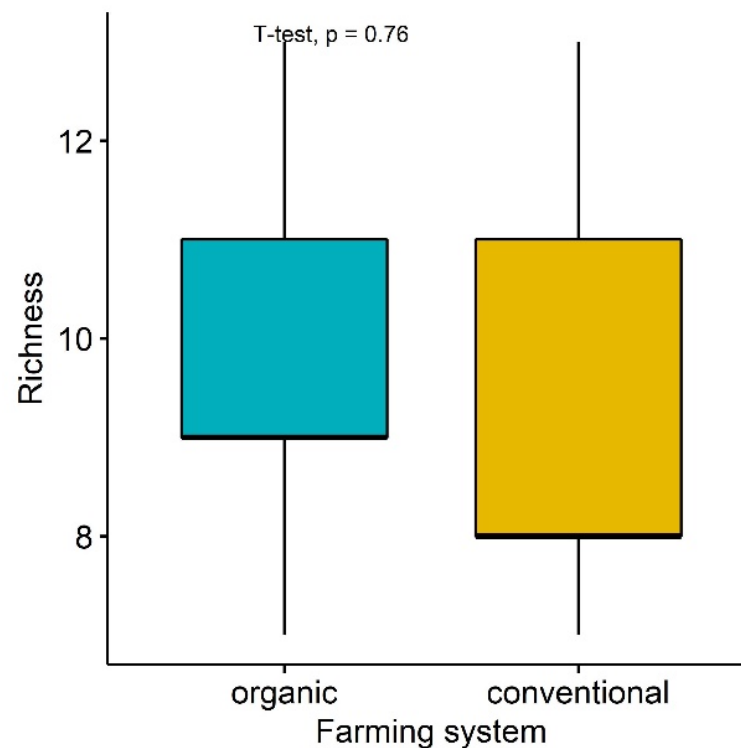
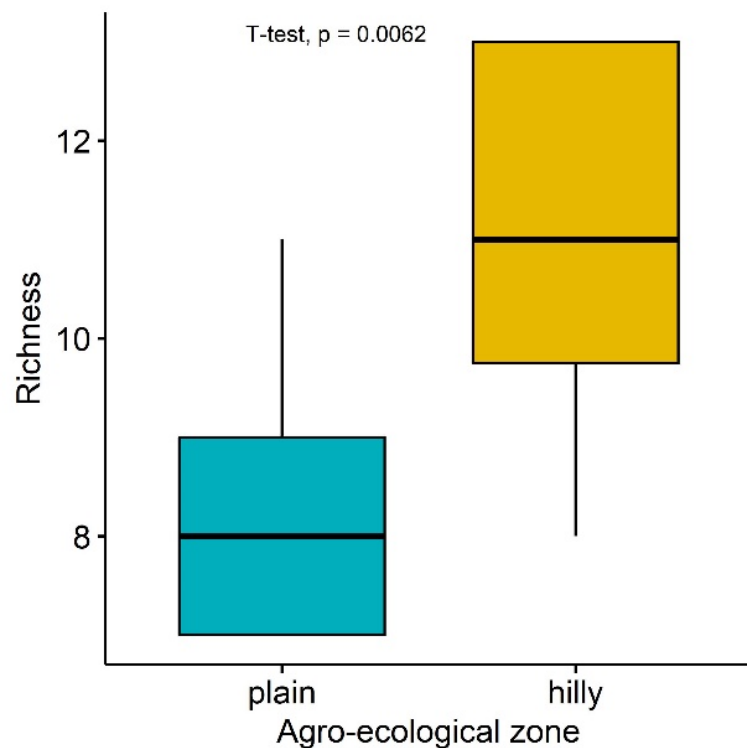


Introduction and Methods



Typical land snails of the olive orchards in the study area.

Results and Discussion



Average species richness varied significantly between agro-ecological zones, i.e. plain and hilly; Average species richness did not vary significantly between farming systems, i.e. organic and conventional.

Results and Discussion

- Variation in land snail richness of olive orchards was explained ($R^2_{adj.} = 0.86$) by a set of predictor including the agro-ecological zone, the orchard area, the altitude, the distance to urban constructions and the distance to natural habitats.
- Environmental factors, i.e. habitat area, isolation and the anthropogenic impact explained only partly species compositional dissimilarity, whereas the geographic distances between the orchards were not significant at all.

	r^1	P^2
Geographic distance	0.1046	0.1702
Environmental distance	0.301	0.007
Effect of environmental distance removed	-0.1048	0.8555
Effect of geographic distance removed	0.3011	0.006

Mantel and partial Mantel tests, showing correlations of species dissimilarity distance with geographical and environmental distance between the olive orchards.

Conclusions

- The agro-ecological zone and not the farming practice is associated with land snail species richness, in agreement with previous findings for invertebrate fauna of Cretan olive orchards in Crete.
- A combination of landscape attributes explains satisfyingly patterns of species richness and only partly associates with species composition patterns.
- More species are found in olive orchards with more available micro-habitats, close to natural habitats and human settlements.
- The scale of the study may explain the medium dissimilarity in species composition.
- This study is a first attempt to evaluate the effect of olive orchard characteristics on land snails.
- Land snails may serve as a potential bio-indicator and should be considered in future biodiversity assessments of olive orchard agroecosystems.

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