Innovation in Mediterranean organic greenhouse cultivation: protect the crops and protect soil arthropods

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Introduction

Organic greenhouse (OGH) production

Strategies to improve **functional biodiversity** in OGH are still a challenge.

“Input substitution paradigm”

In contrast with basic principles of organic agriculture

Lack of studies!

Ecologically-based solutions for OGH production

(Altieri, 1999; Best, 2008; De Wit and Verhoog, 2007; Goldberger, 2011)
Introduction

Soil arthropods

- How and where these small organisms could help in assessing environmental status?
- Demonstrated value or strong potential as bioindicators.

- Monitoring environmental changes
- Comparing different farming techniques
- Improving the environmental sustainability of farming systems
- Policies aimed at reducing environmental damage

(Paoletti, 1999; Madzaric et al., 2017)
Materials and Methods

Experimental design

Field II

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Field I

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Crop rotation

May 2016
- Lettuce
- Kohlrabi
- ASC
- Lamb’s lettuce
- Cucumber
- Agro-ecological services crops (ASC)

June 2014
Materials and Methods

Organic greenhouse production systems

**SUBSTITUTION (SB)**

*Input substitution system with off-farm inputs. System that mimics conventional agriculture.*

**AGROCOM (AC)**

*Agroecological system, based on compost application and green manure from agro-ecological services (ASC) providing crops.*

**AGROMAN (AM)**

*Agroecological system, based on manure application and flattening of ASC (dead mulch).*

Pitfall traps

› One trap per plot
› Change each two weeks
› Water and glycol propylene solution
› Weekly control for the level of the liquid
Materials and Methods

**Ground beetles (Carabidae)**
- Generalist predators
- Granivores
- Sensitive reaction to anthropogenic changes

**Rove beetles (Staphylinidae)**
- Generalist predators
- Sensitive to habitat disturbance

**Spiders (Aranea)**
- Pest regulators
- Susceptibility to changes in habitat microclimate

**Harvestman (Opiliones)**
- Polyphagous
- Sensitive to cultivation and crop rotation

**Millipedes (Myriapoda)**
- Detritivores - first step of litter fragmentation
- Effect on soil porosity

**Woodlice (Isopoda)**
- Key system regulators of the decomposition
- Bioindicator for soil pollution

**Springtails (Collembola)**
- Leaf litter decomposers
- Responsive to a variety of environmental factors (changes in soil chemistry)

(Marc et al., 1999; Snyder and Hendrix, 2008; Woodcock et al., 2010)
Results and discussion

1\textsuperscript{st} year relative abundance

ASC 2014

Cucumber 2014

Lamb’s lettuce 2015

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Results and discussion

ASC 2015

Kohlrabi 2015

Lettuce 2016

2nd year relative abundance

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Results and discussion

Pooled activity density (%) per crop

Total abundance of soil arthropods for the rotation - 318 days
Conclusion

✅ High potential of system studies to present “real life” conditions with all complex interactions in agricultural environment, having chosen bioindicators as carriers.
   - Insights on temporal patterns
   - Crop specific effect and vegetation cover variances
   - Food web implications
   - Different agricultural practices

❗ Selected groups with small number of individuals should be further explored based on functional trait approach.
Rising questions

How to relate diversity or abundance of certain taxon or species to sustainability of one agricultural system?

Does high biodiversity have economic implications and if yes how to measure it?

What is a proper methodology to be used over time?

Do we need to consider just “beneficial” groups (predators, parasitoids and detritivores) as bioindicators in agricultural studies?

And finally, if more diverse is equal to more productive system?
Thank You

Get in Touch
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