Insect Biodiversity Across Cropping Systems on Marginal Lands

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Farming for Bio-based Materials and Biodiversity Webinar

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MARGINAL LANDS, INDUSTRIAL CROPS AND INNOVATIVE BIO-BASED VALUE CHAINS

Funded by the European Union

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Why insect biodiversity?

- Insects are key to ecosystem functioning and food webs
  - pollination
  - pest control
  - decomposition.
- Biodiversity is a sensitive indicator of land-use change and farming practices.
- Declines in insect diversity = early warning for ecosystem health and resilience.

Research questions

- How do cropping systems (strip intercropping vs. conventional) shape insect communities?
- Do effects vary across countries and types of marginality?

Cropping systems

Strip intercropping:

Rows included (slightly different combinations per site): Miscanthus, Safflower, Crambe, Hemp, Melilotus, Lavender, White Mustard, Sorghum or Castor

Monocultural:

Each country had it's own monocultural field for comparison: wheat (Spain), alfalfa (Italy) and maize (Serbia)

Sampling methods

- Malaise trap (flying insect catch)
- Pitfall trap (ground dwellers)
- Sweep net (vegetation dweller catch)
- Flower counting and identification (resource availability)

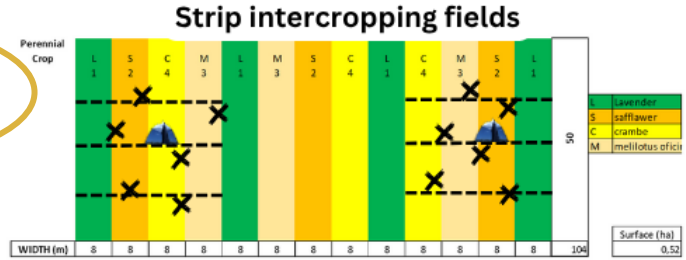
Study design 2023-2024

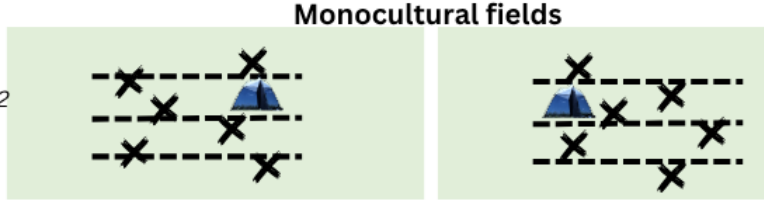
all sampling done during week of peak safflower flowering

total sweepnet samples: 12

total malaise samples: 4

total flower counts: 12



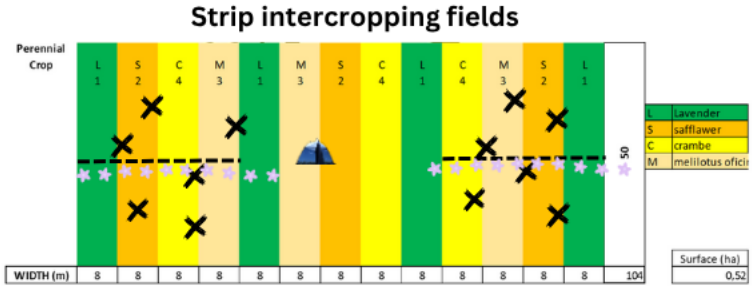


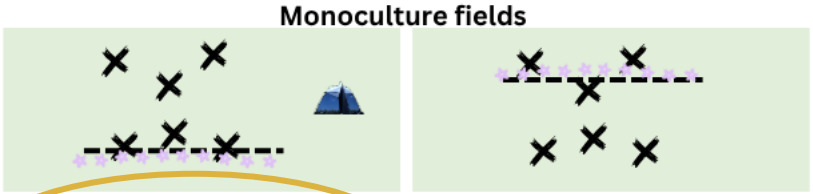
malaise trap

sweep and flower count transect

pitfall trap

Study design 2025





*Sweep transects done **AT FOUR TIMEPOINTS**:*
1. *peak crambe flowering*
2. *peak safflower flowering*
3. *peak lavender flowering*
4. *peak melilotus flowering*

flower counts for one transect per field per timepoint
If possible: malaise traps also set up for TWO WEEKS:
ONE week peak crambe flowering
ONE week peak safflower flowering
total sweep samples: 16
total malaise samples: 8
total flower counts: 16

Collected data

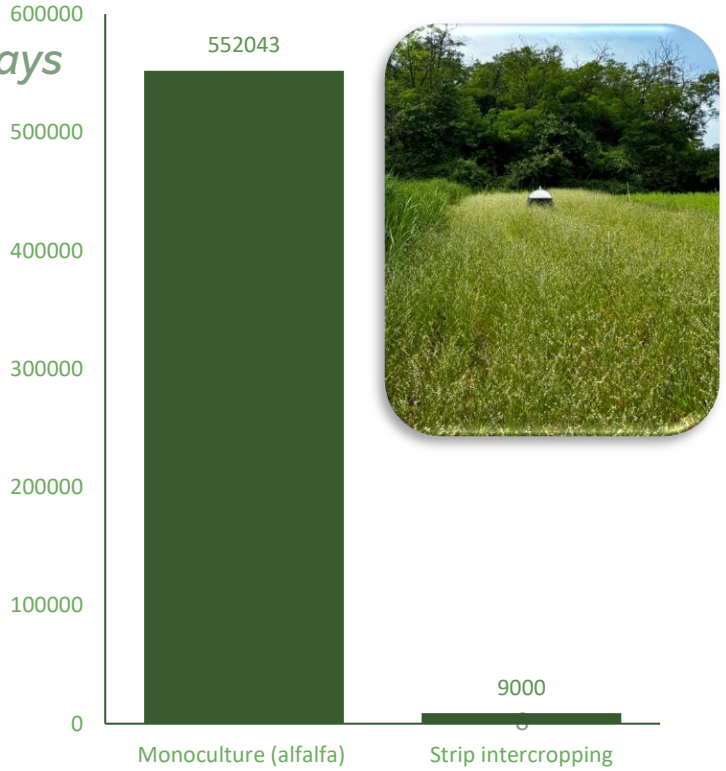
- Insect biomass, eDNA species identification, numbers of species for 3 trap types:
  - Sweep
  - Pitfall
  - Malaise
- Flower identification and counts

Flower resources

More flowers at strip-intercropping sites ? … not always

Flower counts at the Spanish site 2024

Flowers at Italian site (2023 during alfalafa bloom)



Numbers of taxa- (a measure of species richness)

Sweep net results: 2023

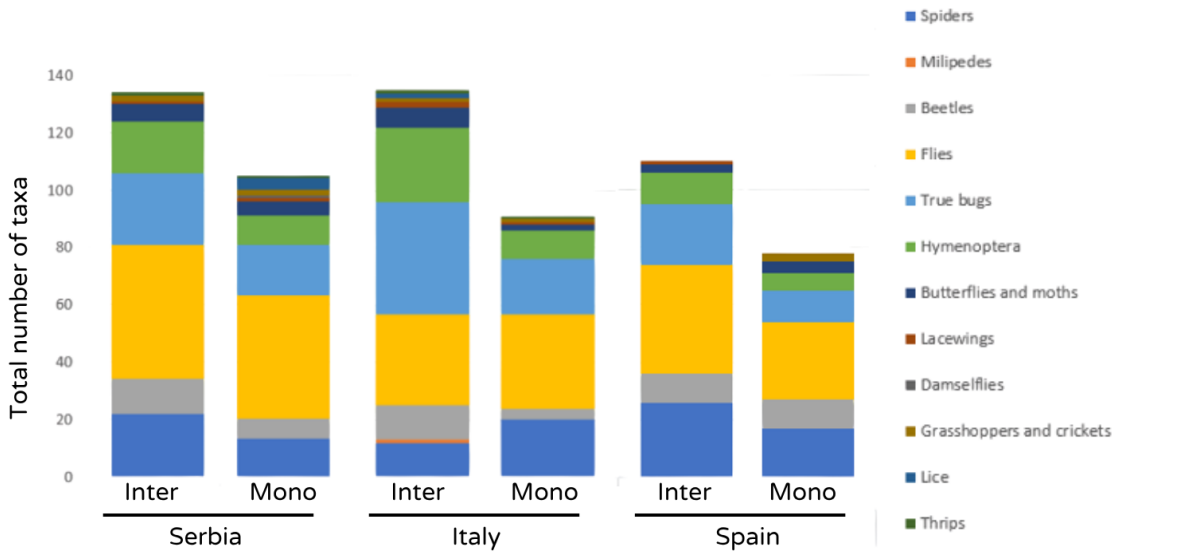


Figure 1. Number of insect taxa in sweep net collections in strip intercropping compared to monocultural cropping systems in three countries in 2023

Sweep net results: 2024 (2025 coming soon)

In general: more taxa are found in sweep net catches at *strip-intercropping sites*

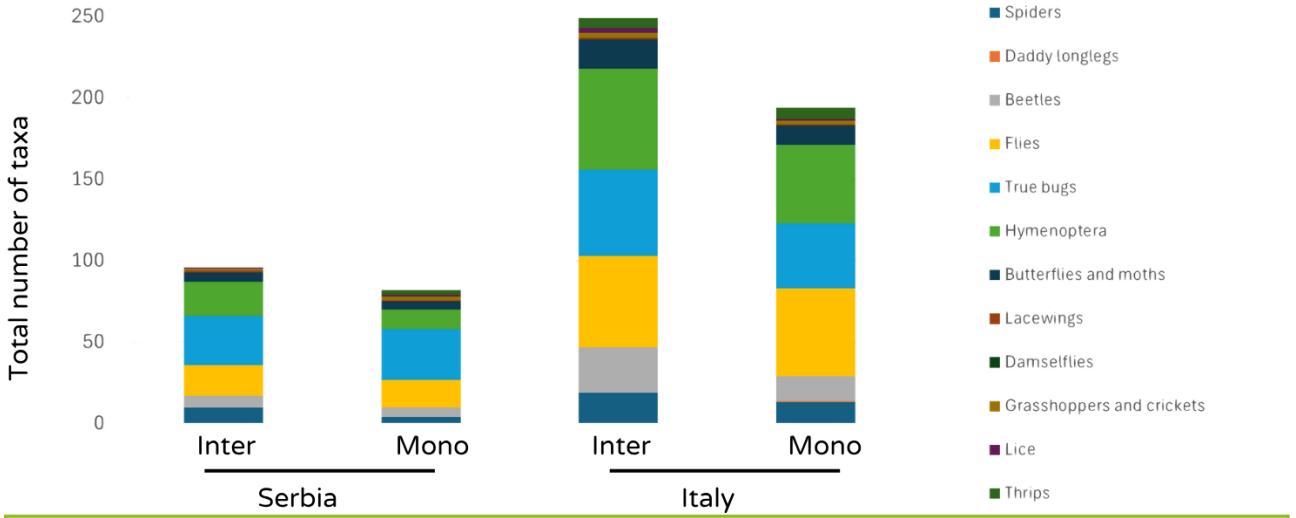


Figure 2. Number of insect taxa in sweep net collections in strip intercropping compared to monocultural cropping systems in three countries in 2024 (Spanish results not yet available)

Community analysis: results in 2023, 2024

In general: each country site has a very unique species community

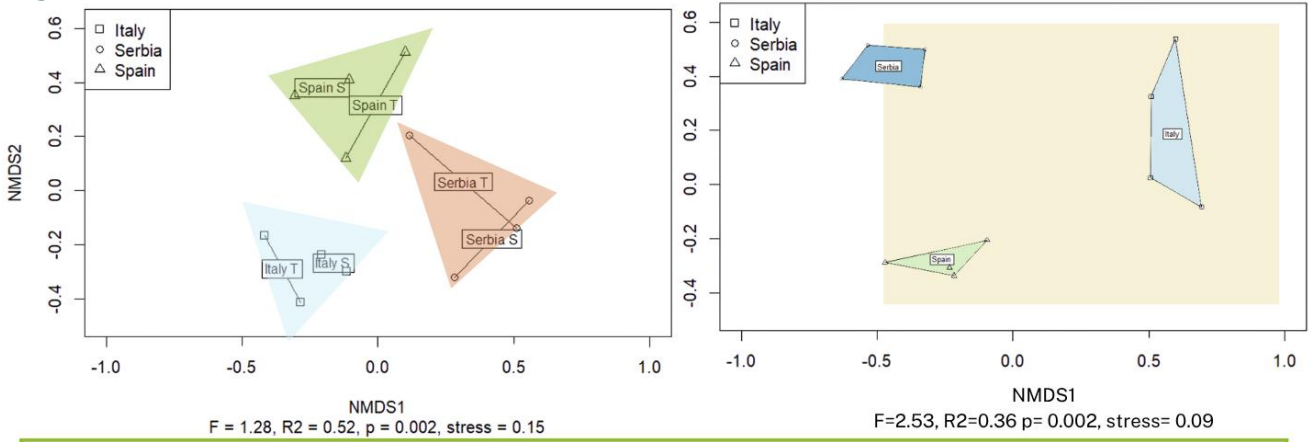


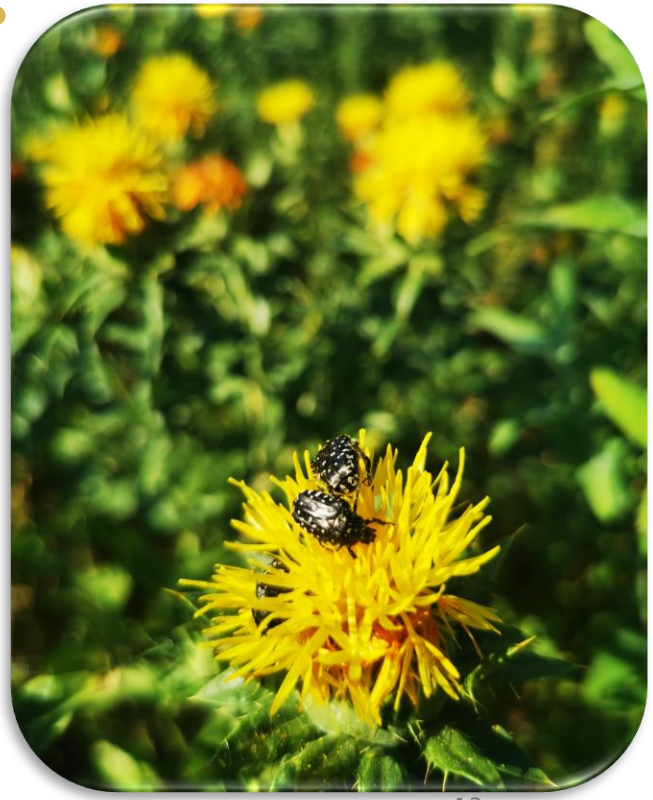
Figure 3. Insect communities in Malaise traps in three different countries in 2023 (left) and 2024 (right)

What we've learned so far…

- Each region with it's own marginality conditions has unique insect community
- Cropping system matters: strip intercropping often supports higher insect richness and more functional groups, especially at flowering stages
- **Temporal sampling is essential:** single timepoints miss major shifts in diversity and activity.

Beyond biomass: what does this mean?

- Insects respond not only to crop type but to **habitat complexity and resource continuity**.
- Strip intercropping creates a **mosaic of microhabitats** → supports more taxa and functional diversity.
- The high regional variability shows that **"one-size-fits-all" biodiversity strategies don't always work** across Europe's marginal lands.



Why this matters for farming and policy

- **Ecology:** Multi-method, multi-timepoint sampling reveals a fuller picture of insect communities.
- **Farming:** Crop diversification through strip intercropping can support a broader range of insects, including pollinators and natural enemies.
- **Policy:** Marginal lands offer opportunities to link biodiversity goals with bio-based crop production.
- **Take-home:** Diversifying crops on marginal landscapes helps embed biodiversity into productive farming.

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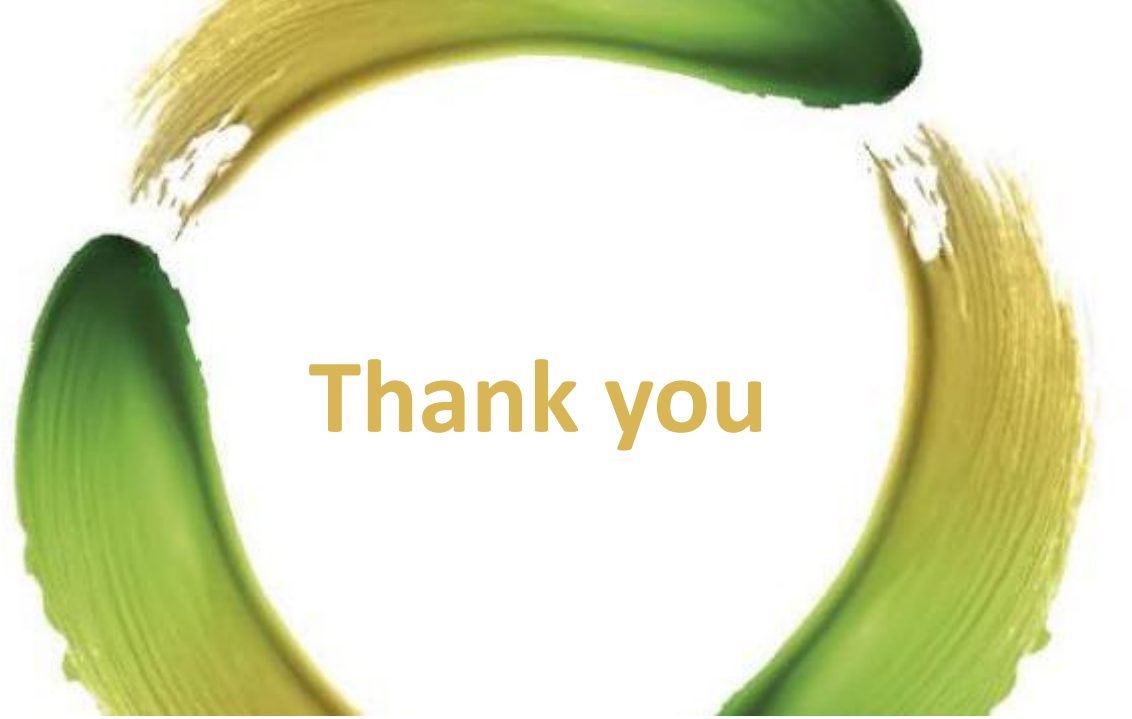

Thank you

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