Engineering Living Pest Management for Organic Greenhouses and Diversified Farms

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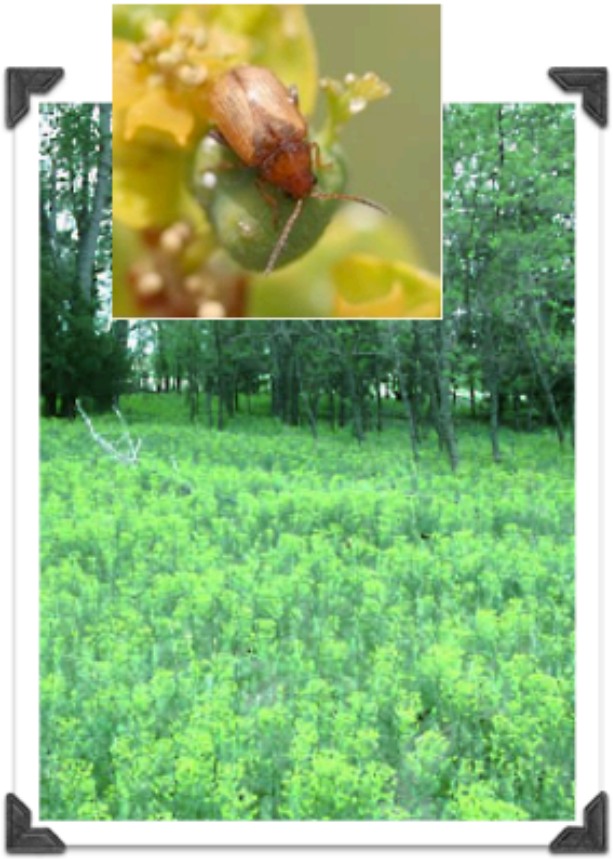
Biological Control

- **Classical**
- Augmentative
- Conservation



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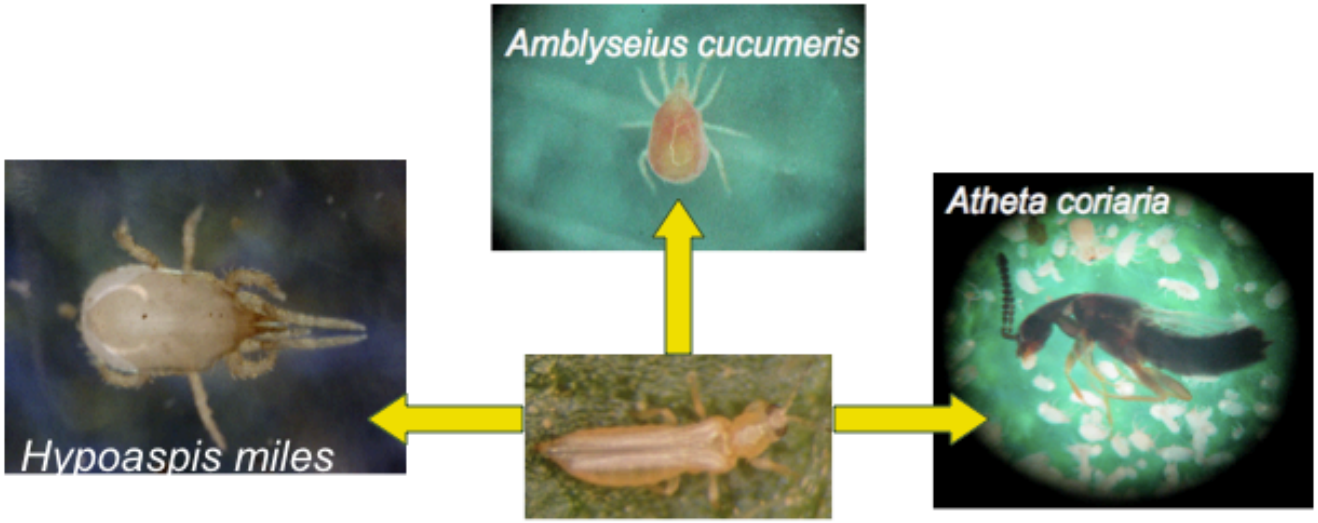
- **Conservation**

Optimization of Augmentative and Conservation BC

- Thrips biological control using predators
- On site rearing of entomopathogenic nematodes (EPN)
- **Our Goal:** Maintaining biological controls on site with minimal number of releases/ outside inputs!

Study system 1: Greenhouse Thrips Control



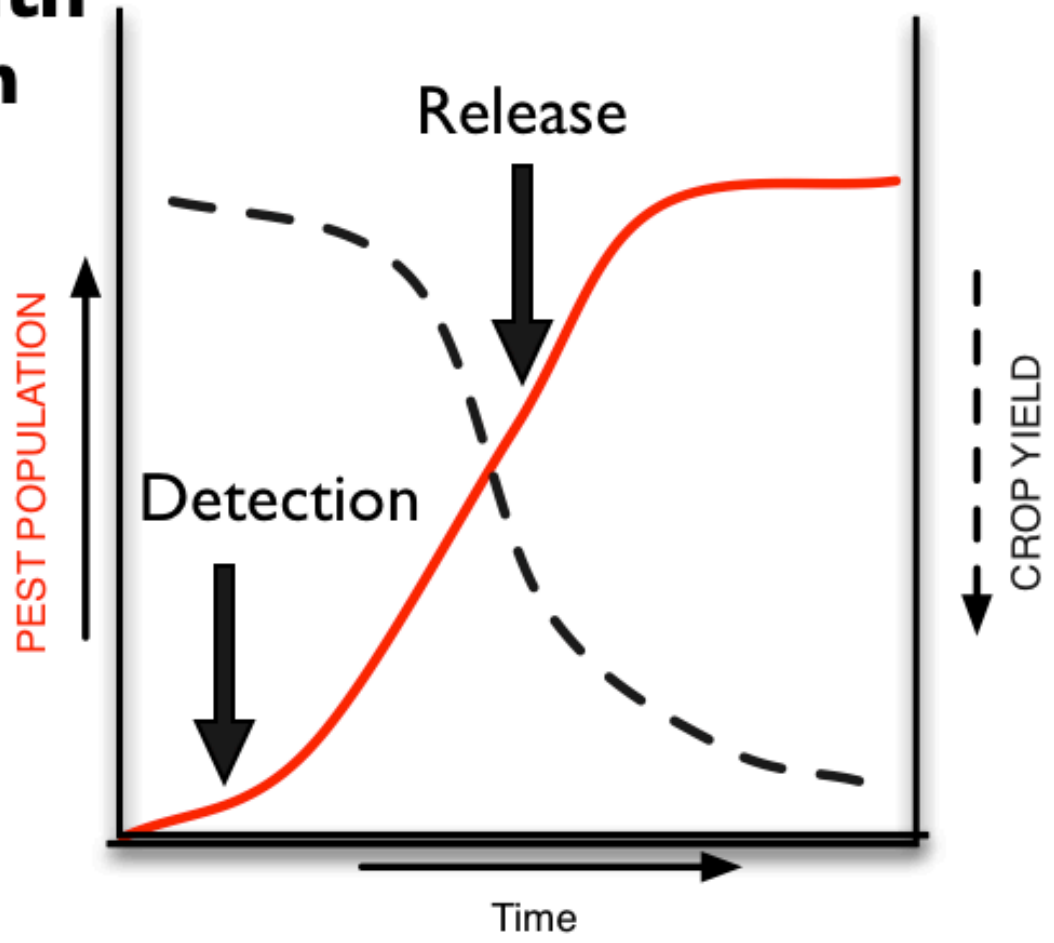
Augmentative Releases:

- *Amblyseius cucumeris*
- *Atheta coriaria*
- *Hypoaspis miles*

Greenhouse Thrips Control

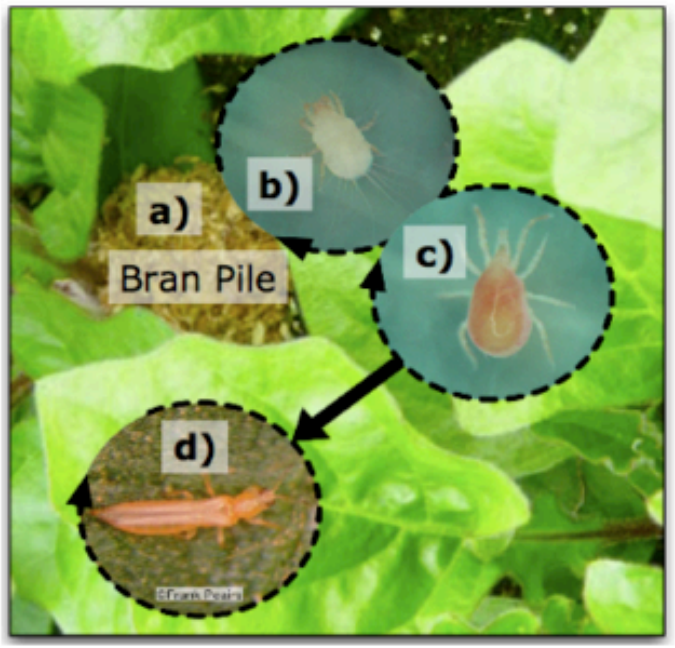
The Problem with Augmentation

- Thrips generate faster than predators
- Time lag for ordering predators
- By release it may be too late!



A Solution: *Open Rearing*

- Combination of augmentative and conservation
- Predators maintained at high levels
- Breeder piles: Bran + Fungus Mites + *A. cucumeris*



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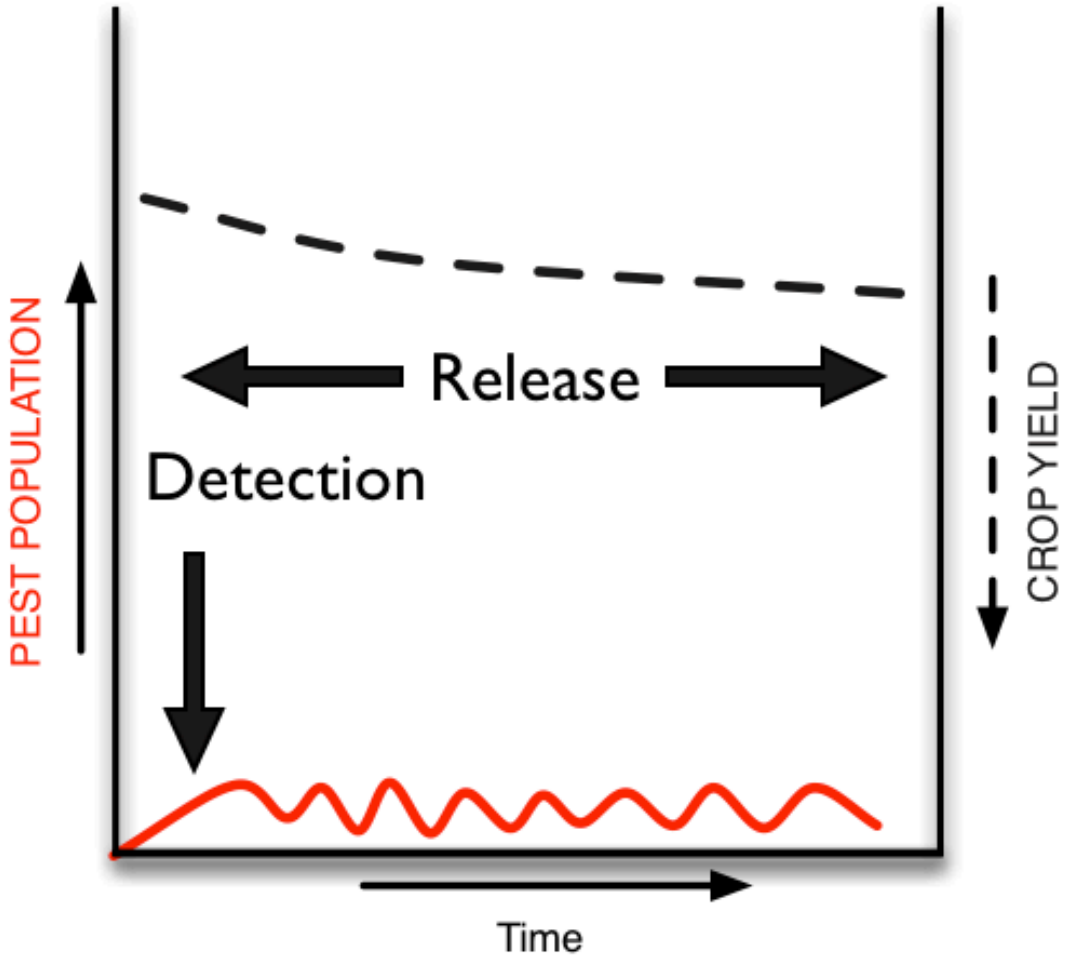

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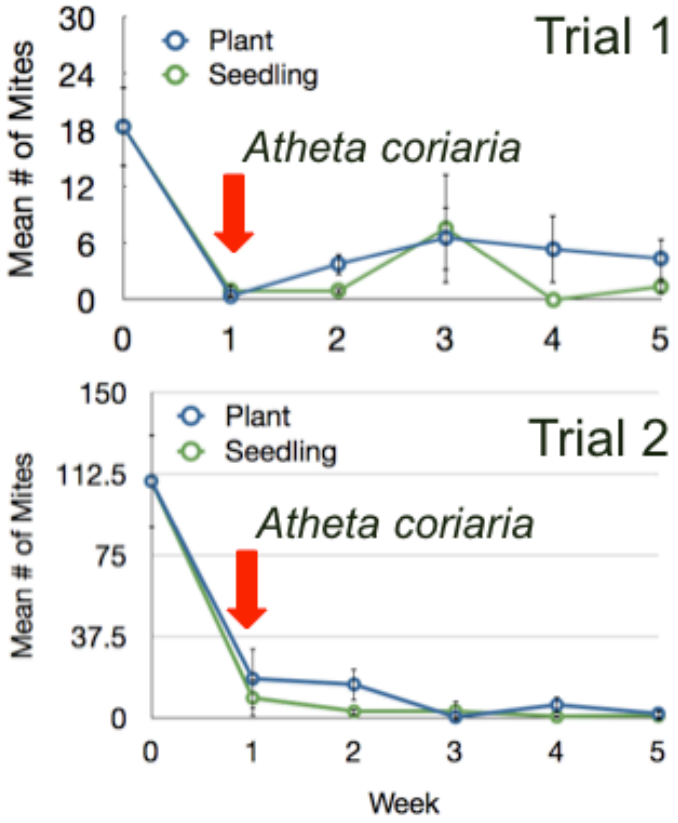
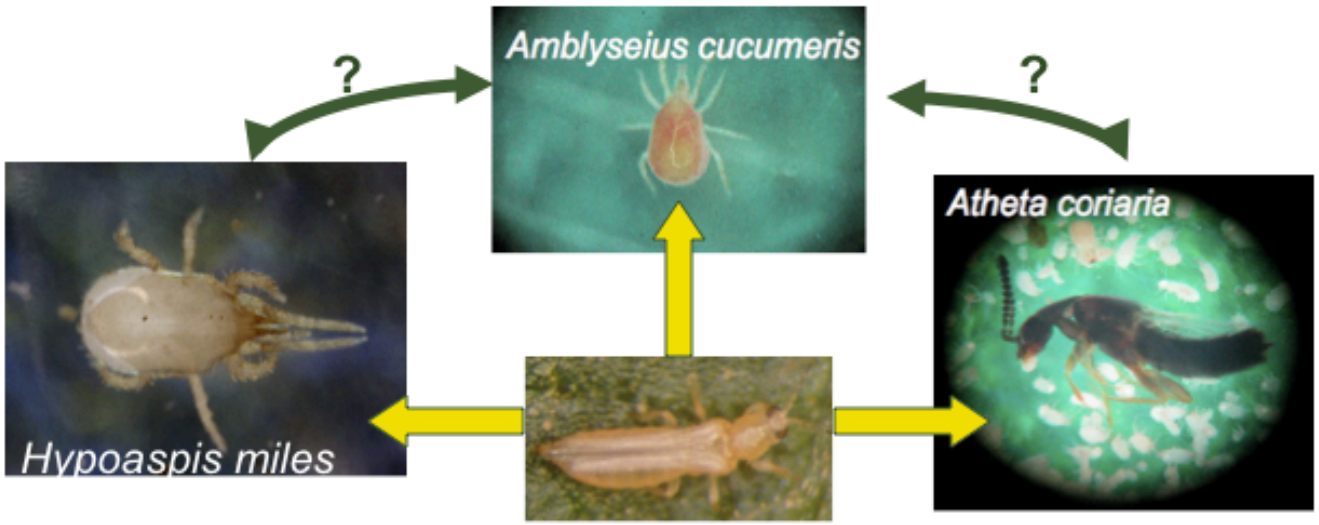
- But....A. cucumeris is a foliar predator
- It's not alone....



A Solution: *Open Rearing*

- Question: Are *A. cucumeris* in breeder piles subject to intraguild predation?



Microcosm Experiment

- Caged bean plants
- Four predator guild treatments:
  - ***Amblyseius cucumeris* breeder piles (ABP)**
  - ABP+*H. miles*
  - ABP+*A. coriaria*
  - ABP+*H. miles*+*A. coriaria*

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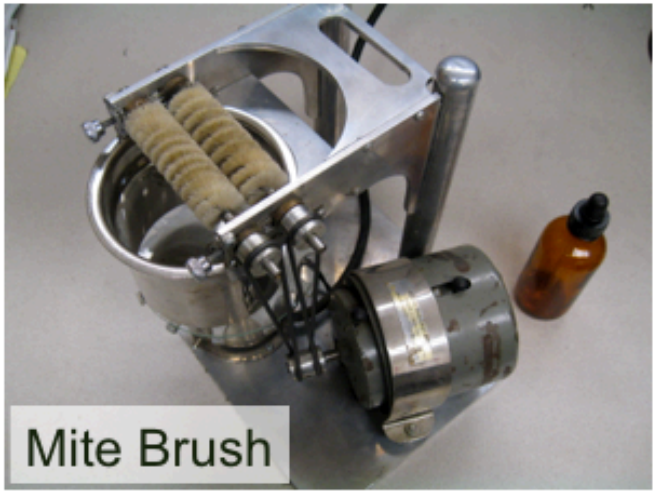
Microcosm Experiment

Berlese funnel

Five samples per treatment per week were destructively sampled

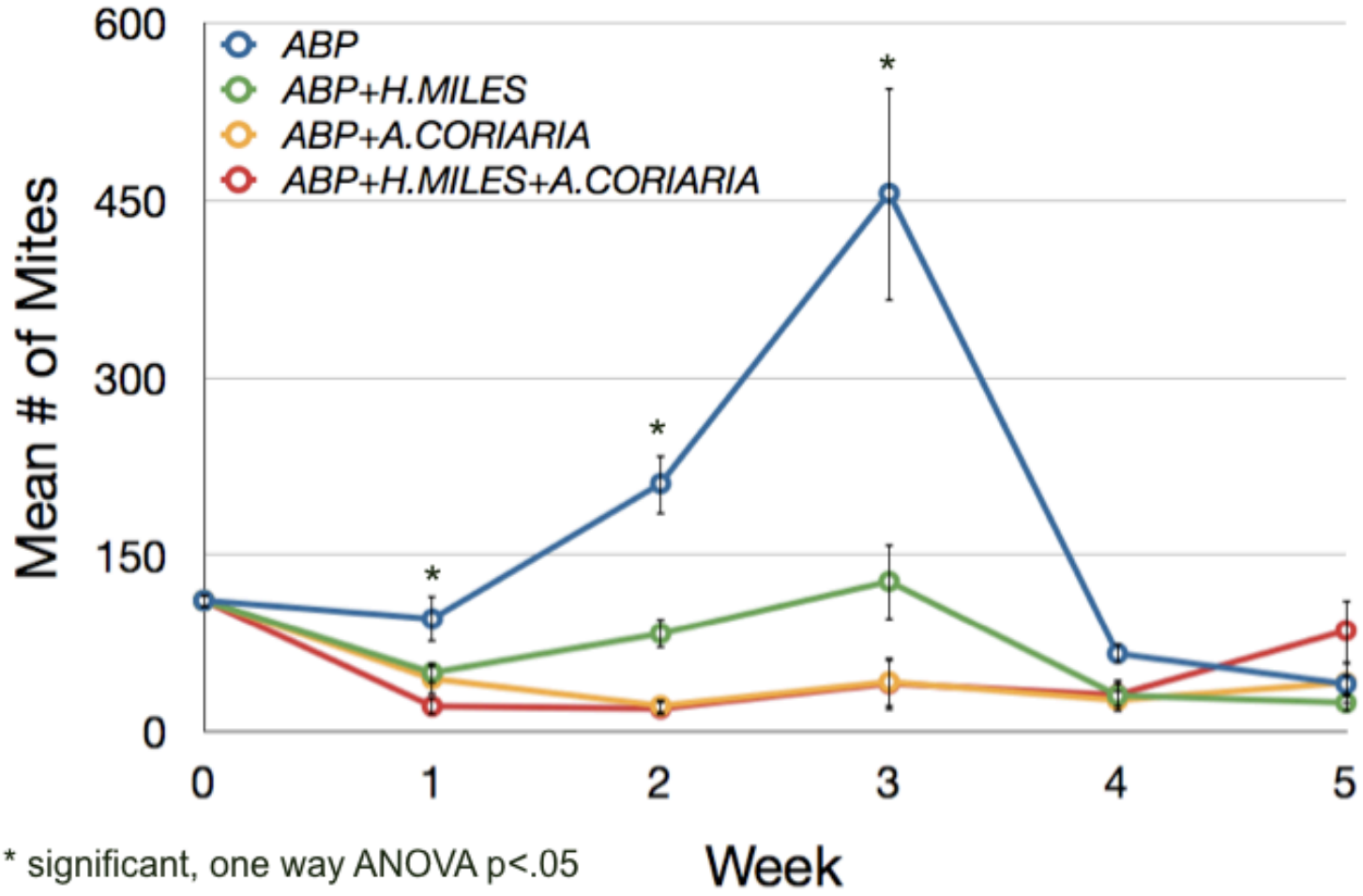


Mite Brush

Organisms were extracted into 95% ethanol solution and counted

Microcosm Experiment

***A. cucumeris* populations in soil and breeder pile**



* significant, one way ANOVA p<.05

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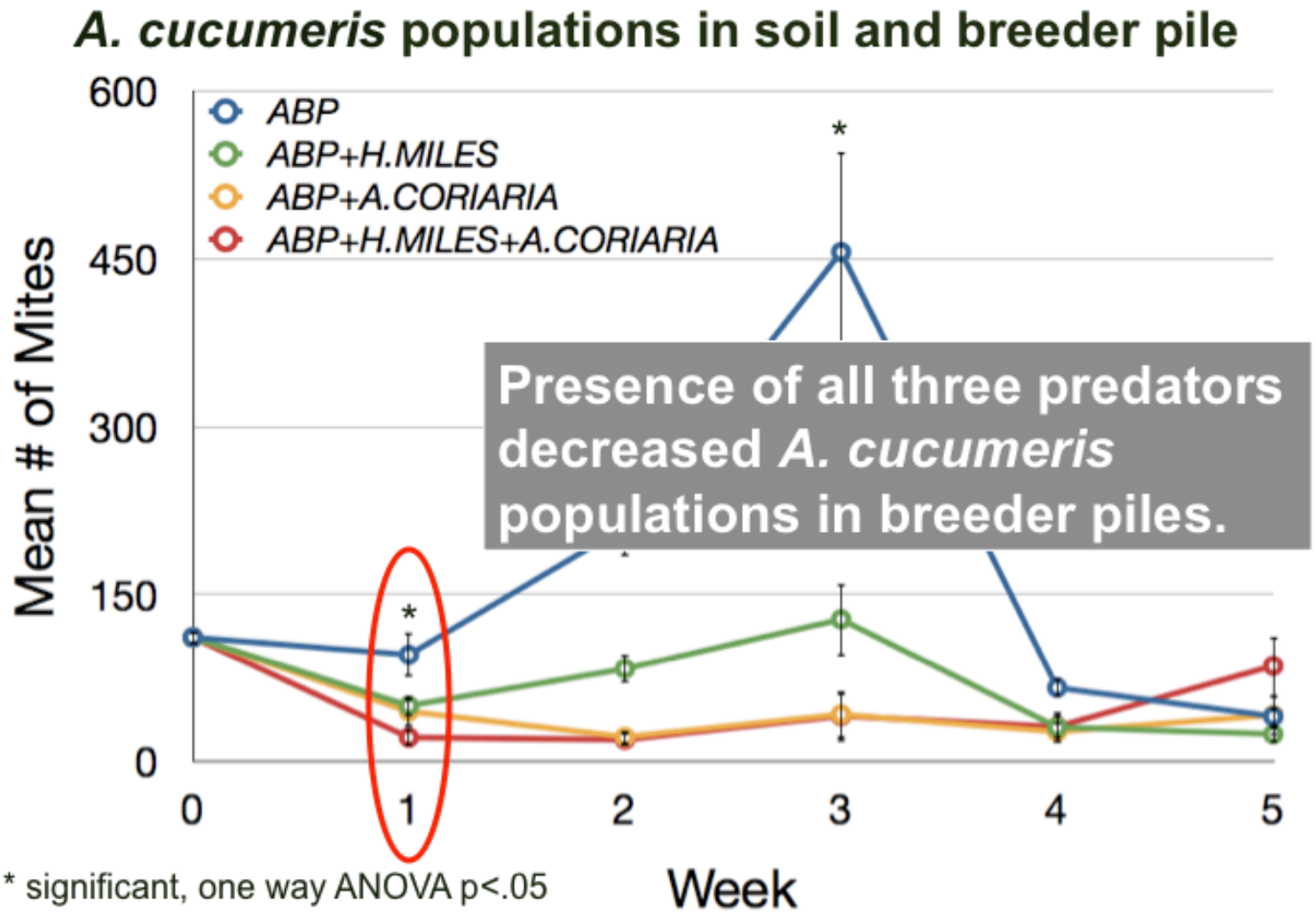

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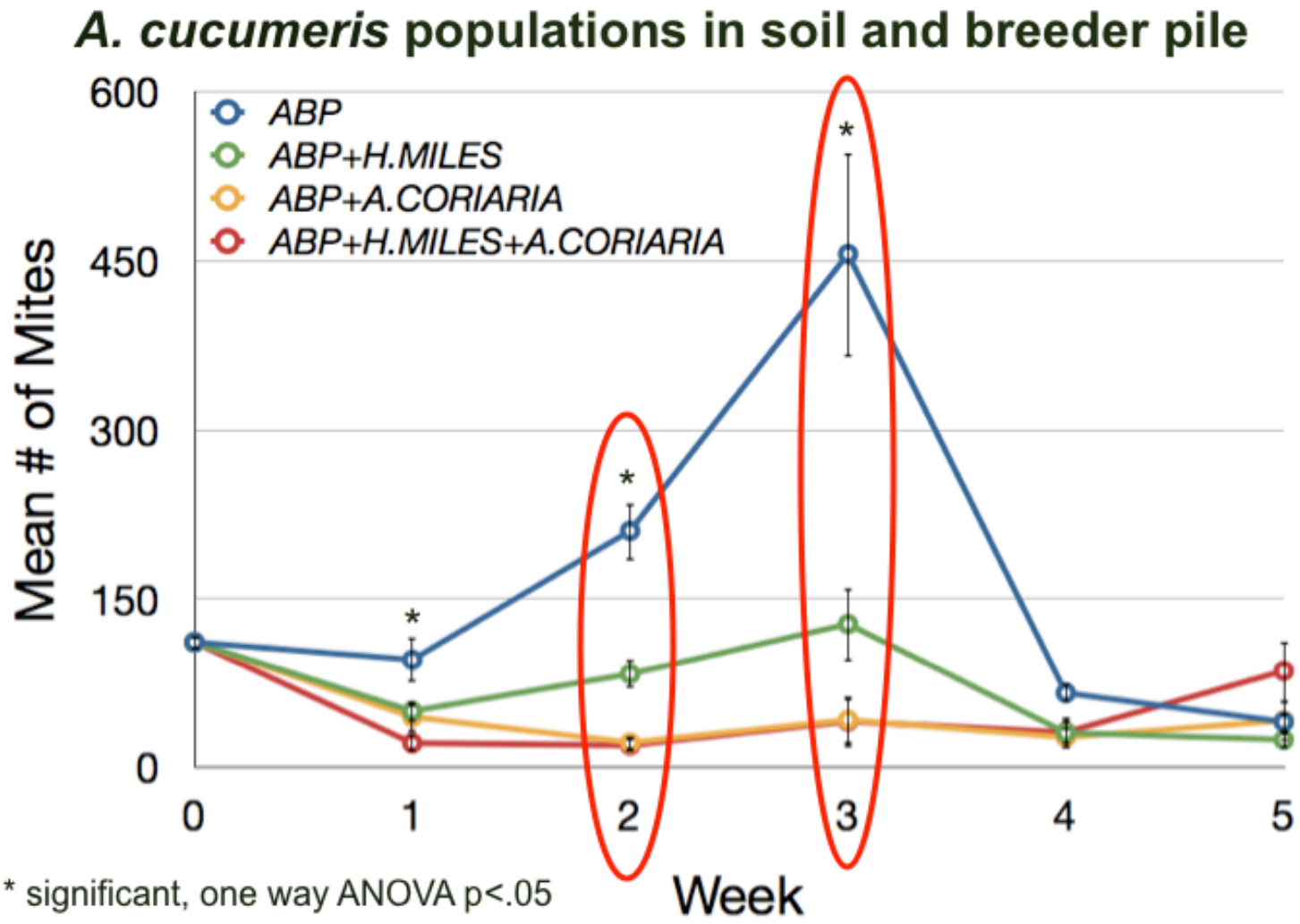

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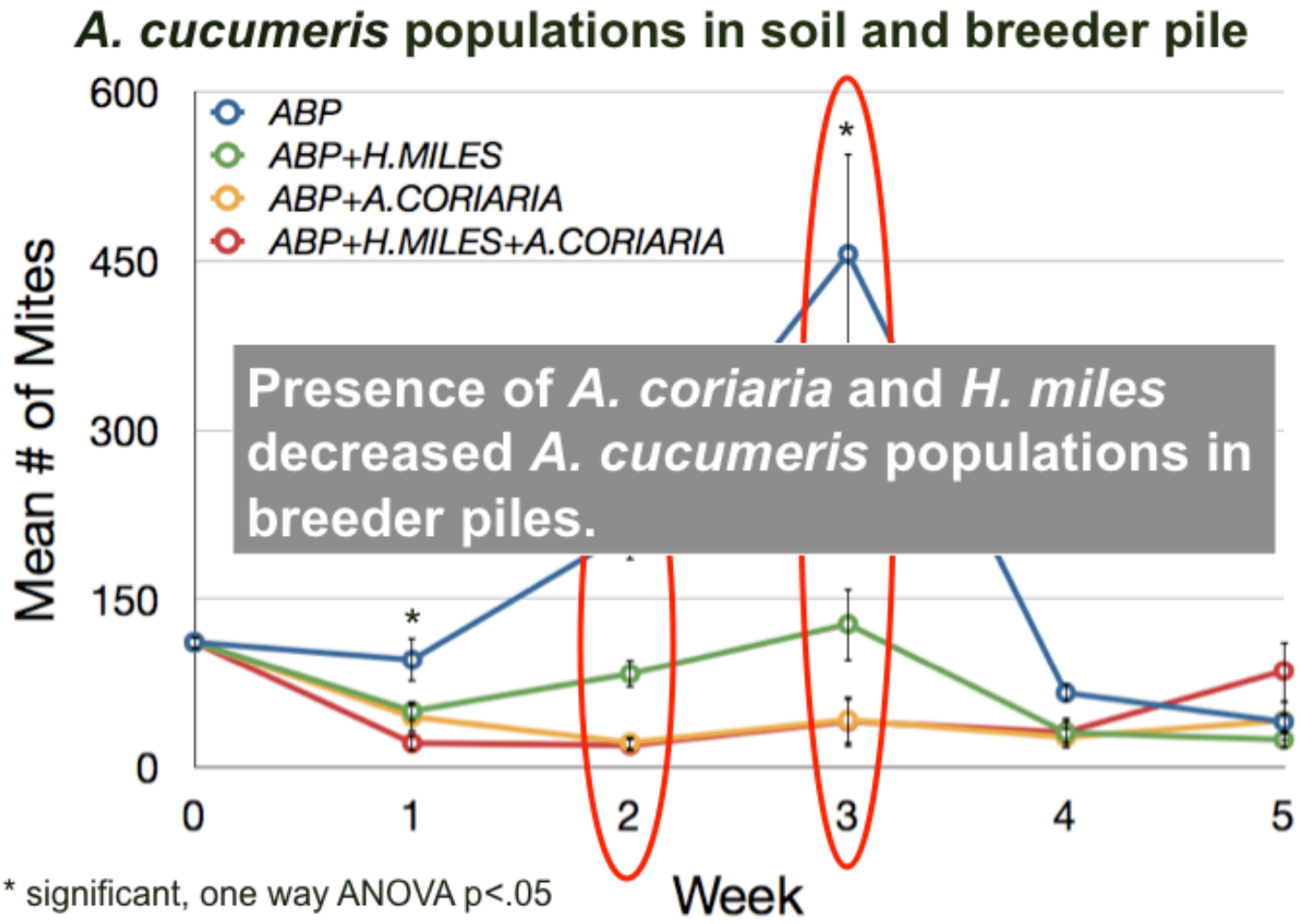

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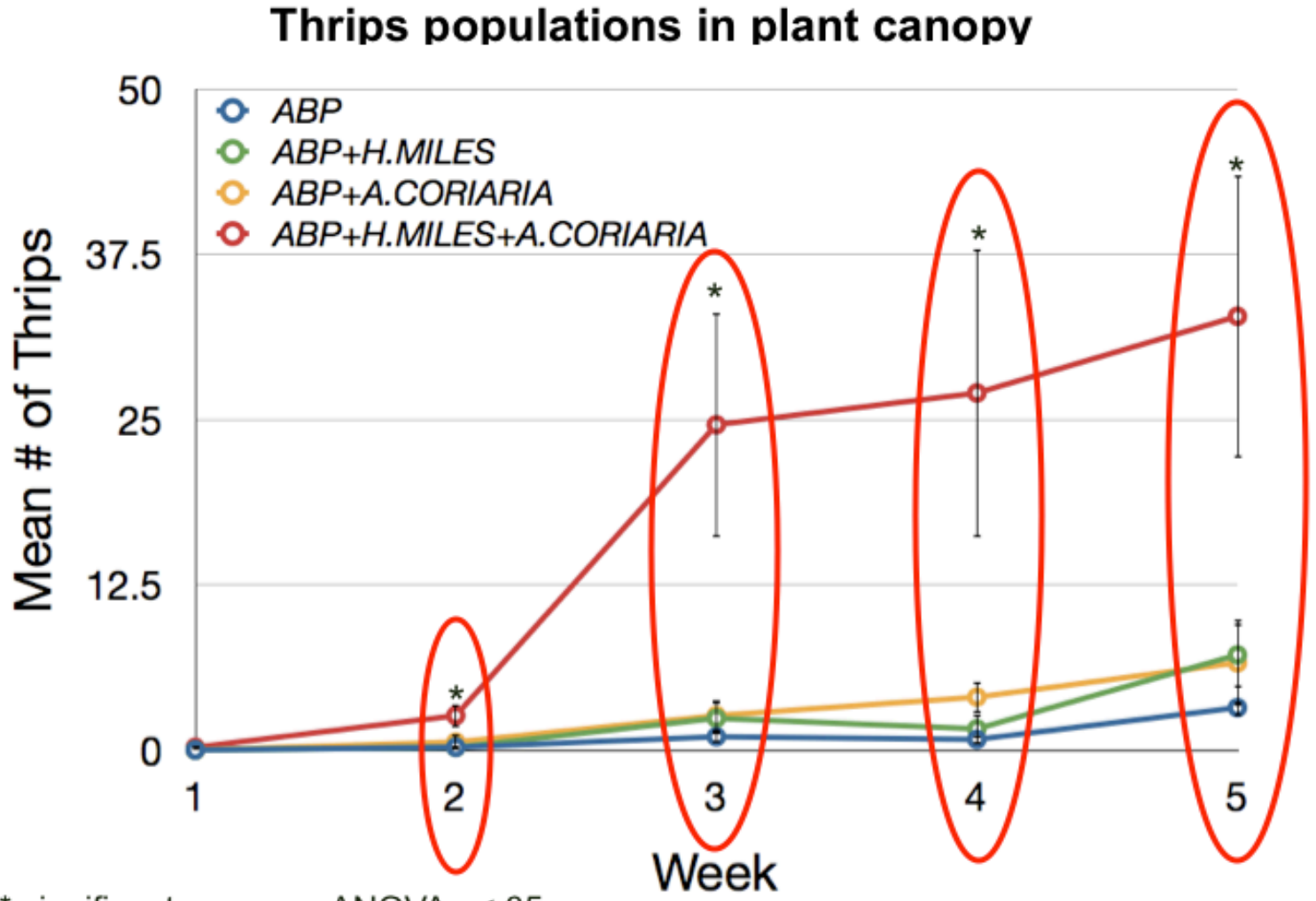

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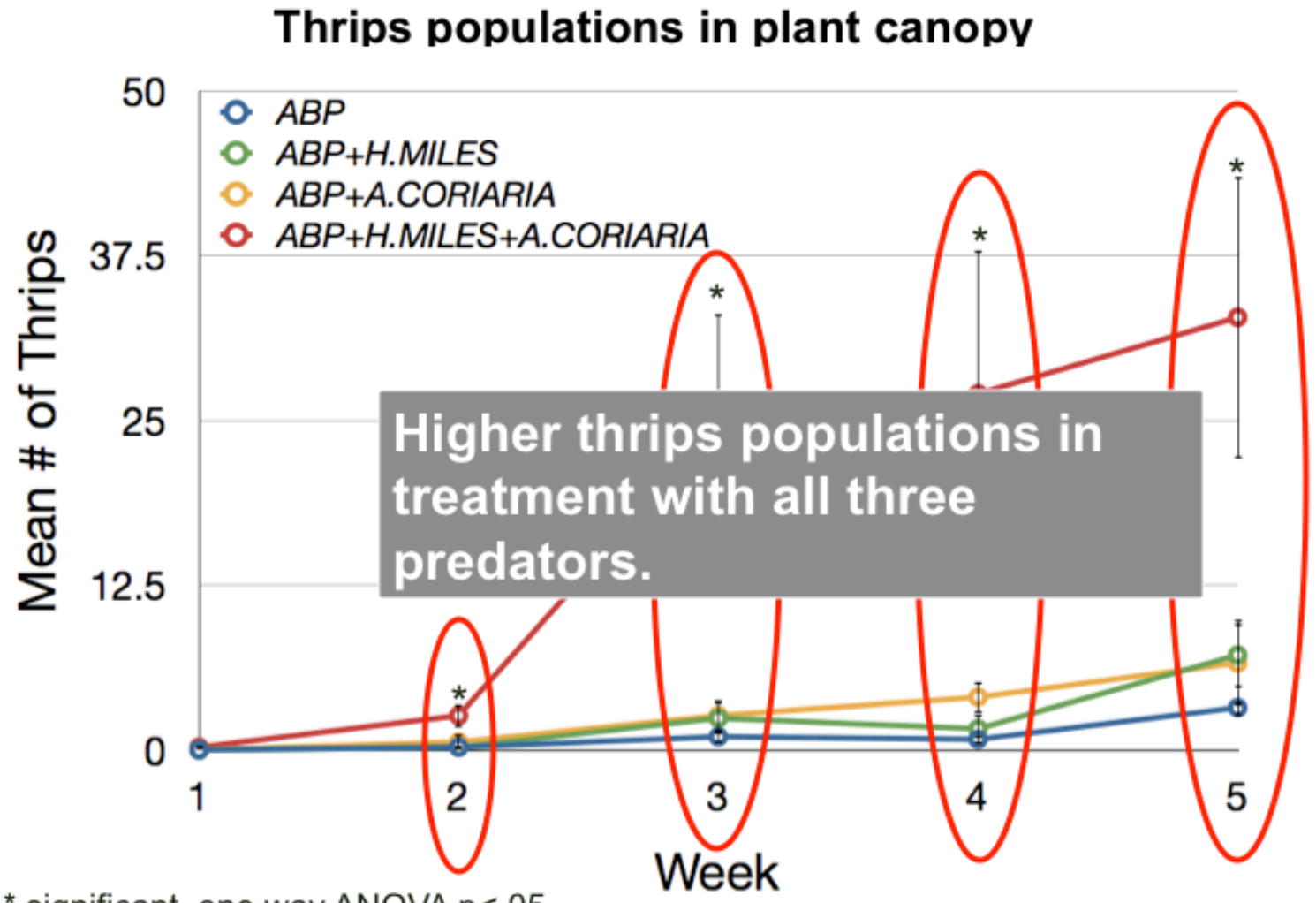

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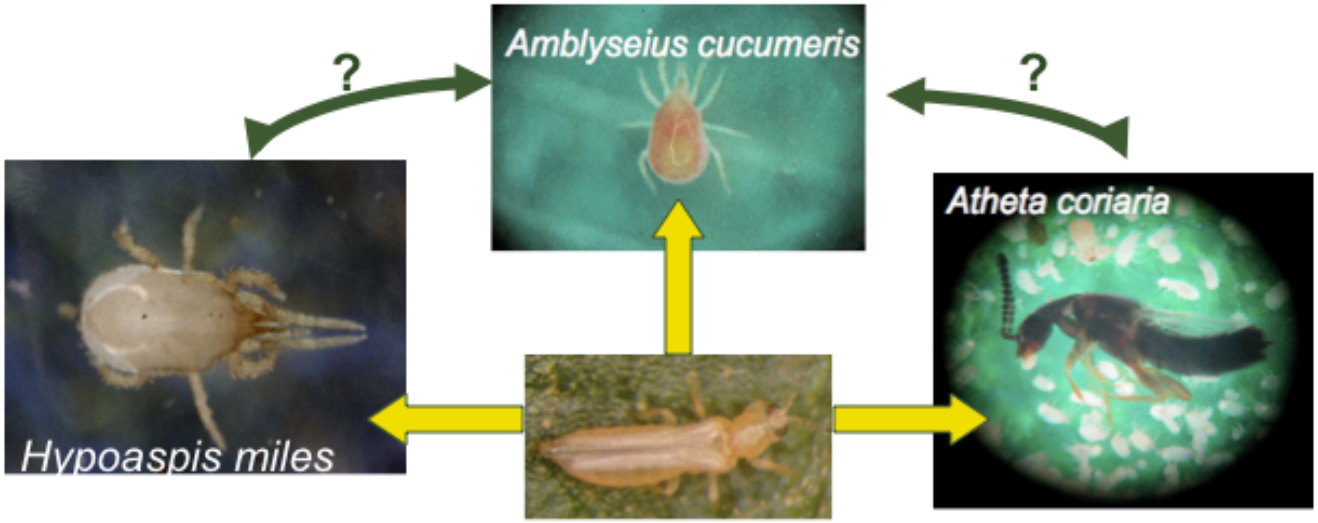

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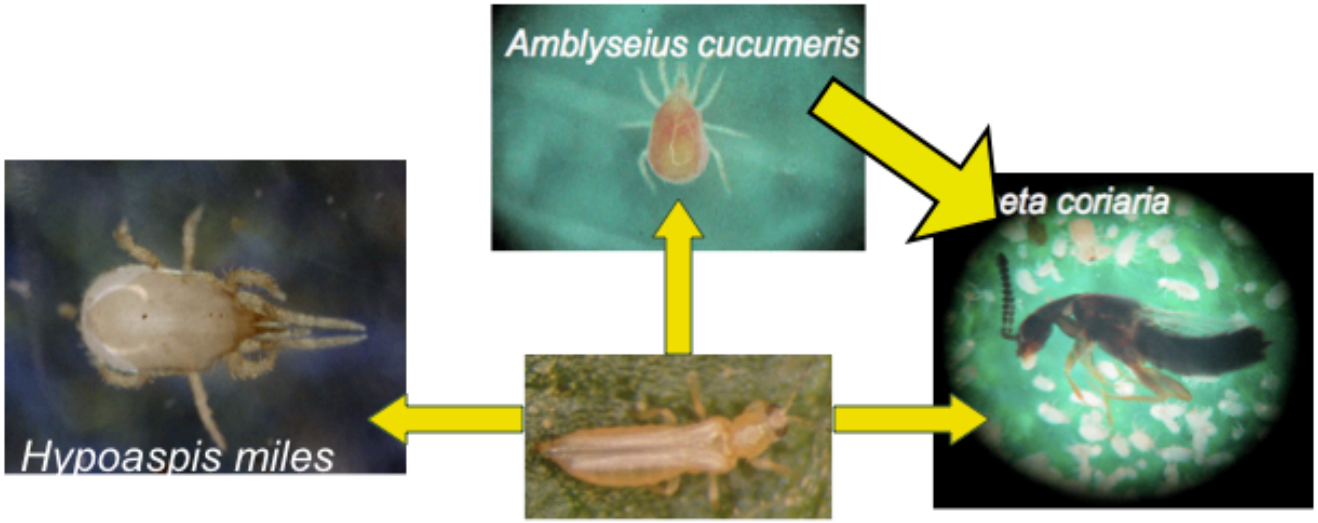

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- *H. miles* has a lesser impact
- Causes thrips BC to break down!

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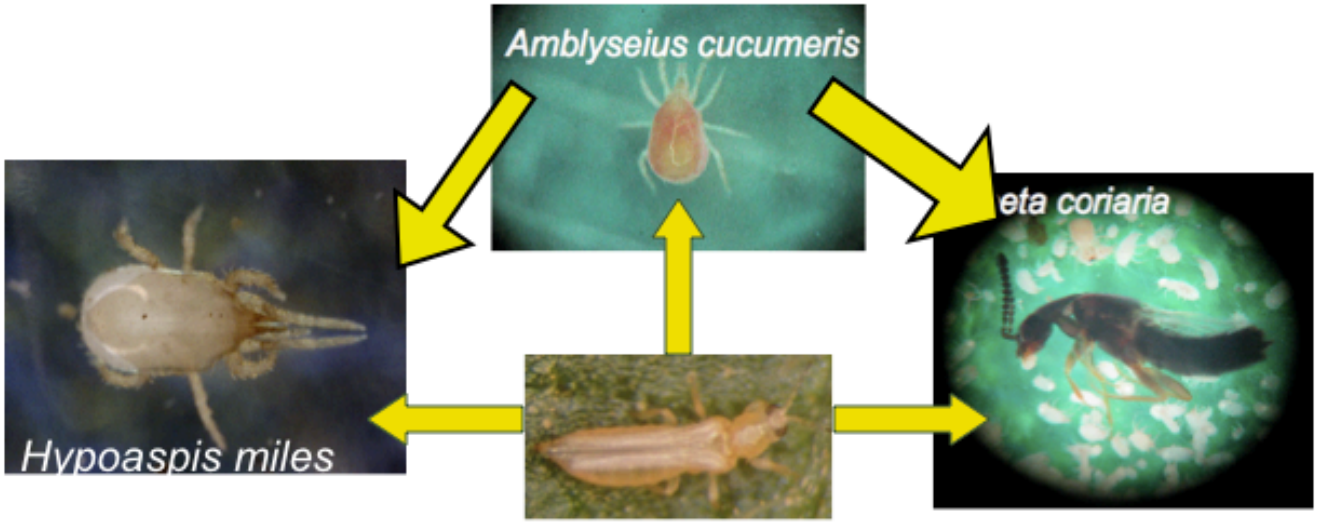

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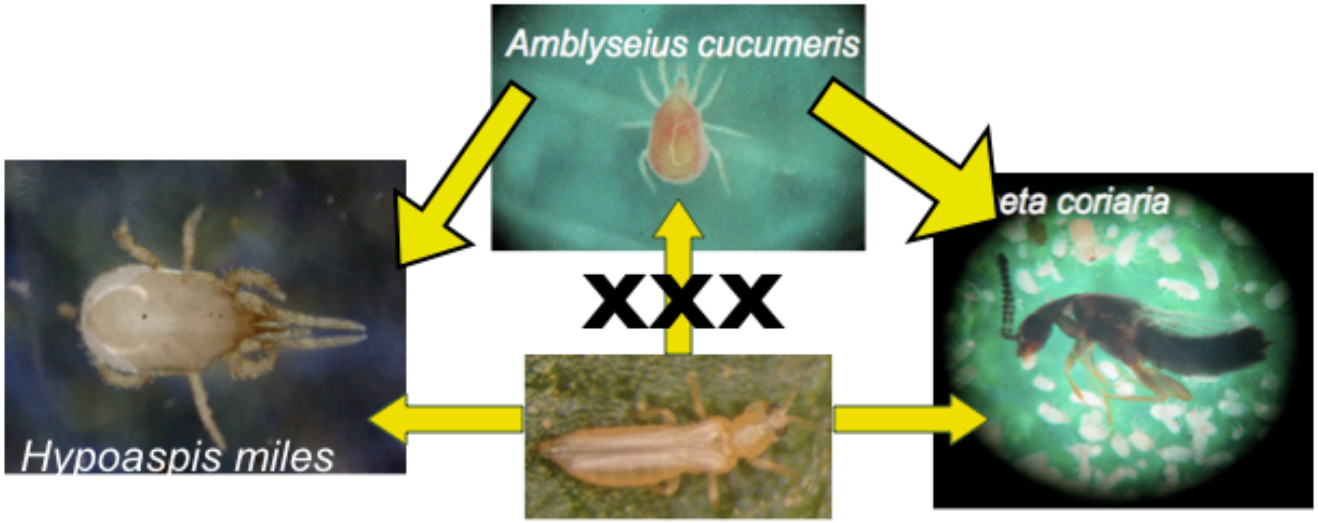

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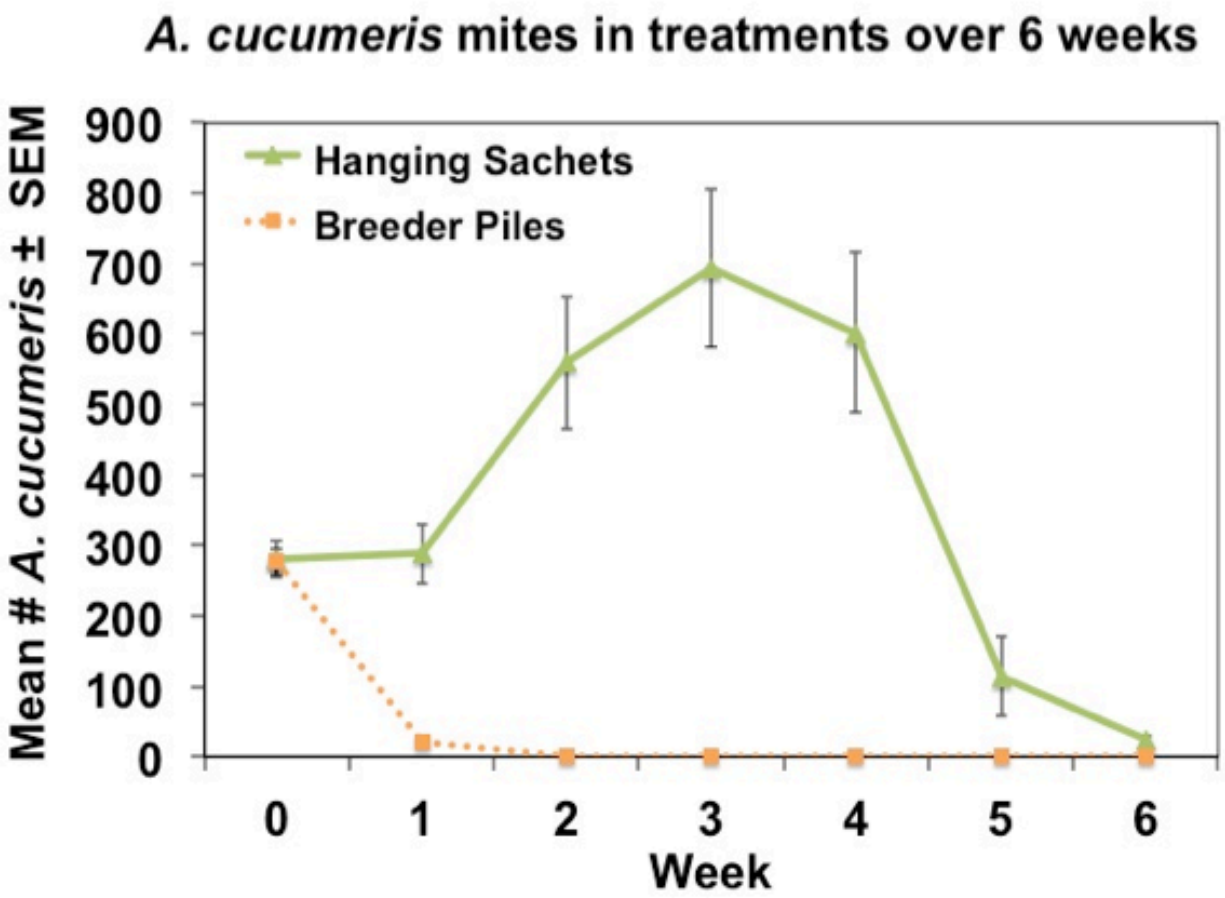
A. cucumeris conclusion

- Protect the foliar predator from *A. coriaria!*
- Sachets

Importance of Protection

- Protect the foliar predator from *A. coriaria!*
- Sachets work!



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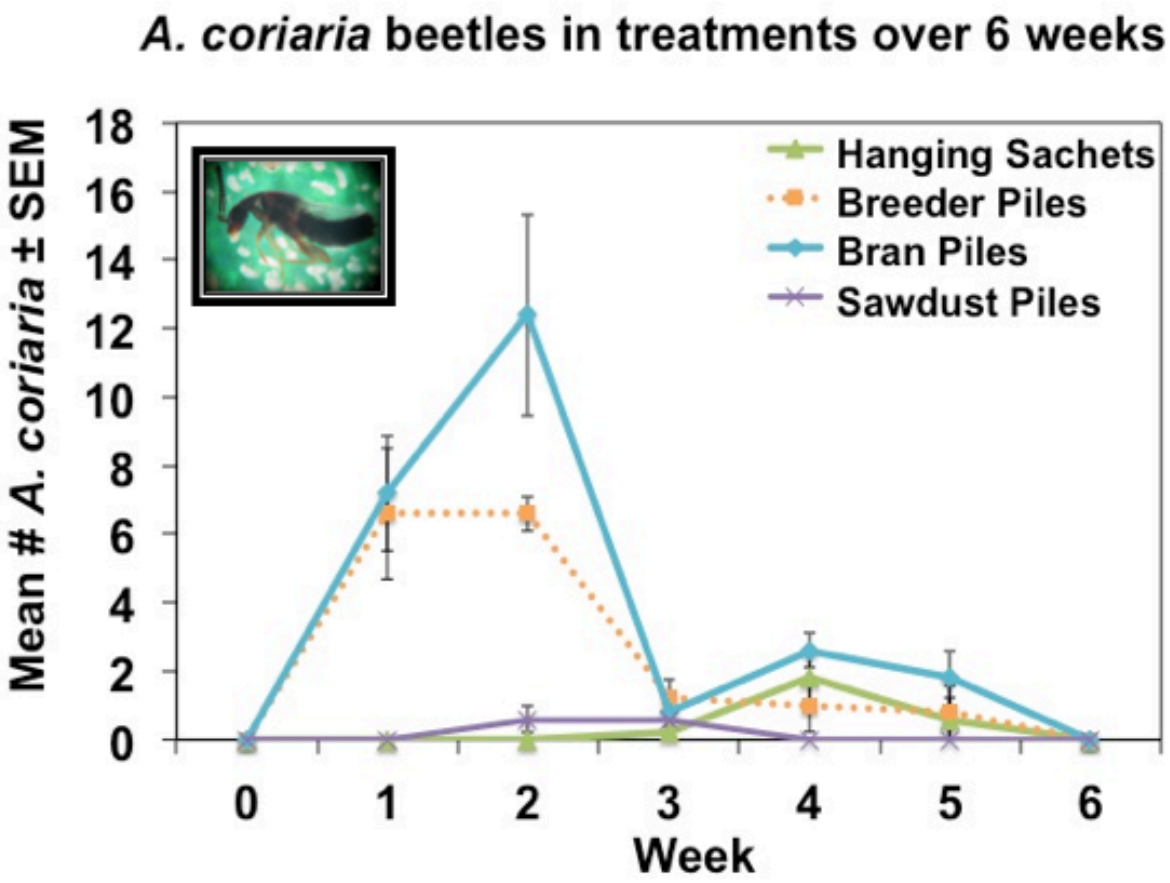

On site rearing of EPN

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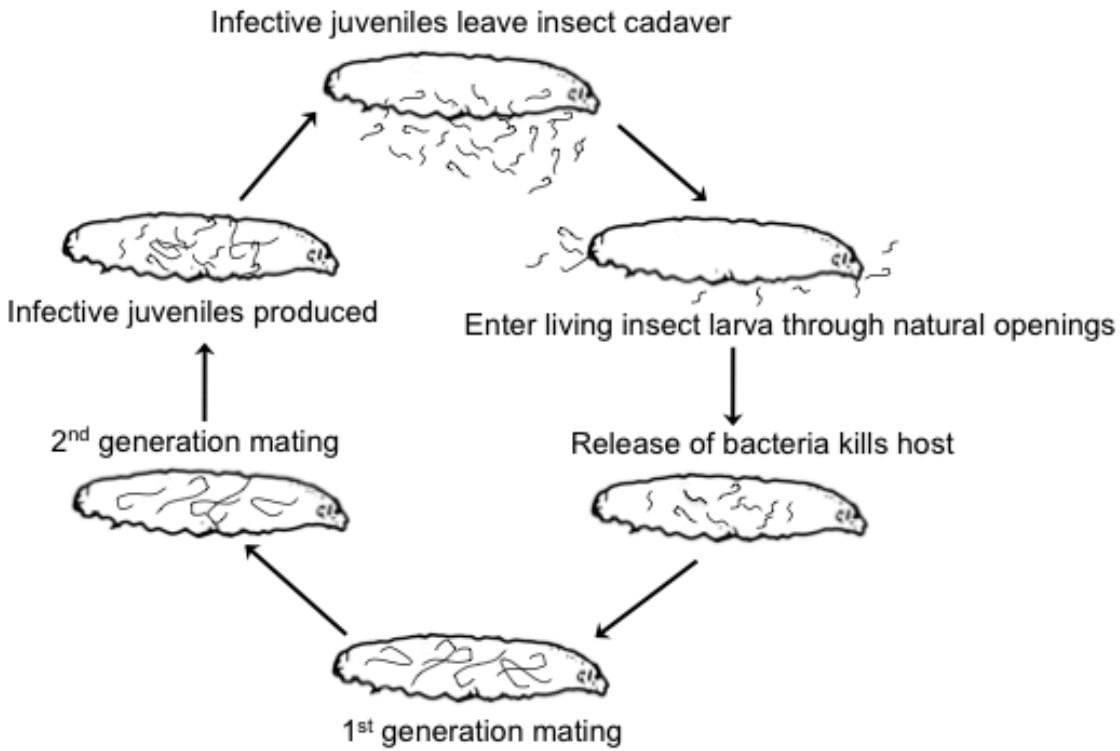
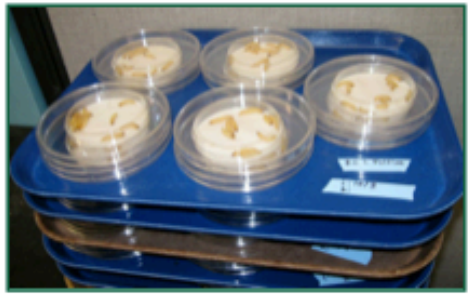


On site rearing of EPN

- OMRI approved nematodes are rare and expensive
- Nematodes are relatively easy to rear
- Why not rear them at greenhouses?

Model rearing system

- EPN reared on waxworms
- EPN maintained in 5 gallon jugs
- Aeration is key!
- 5 Greenhouses in Kzoo have adopted this!



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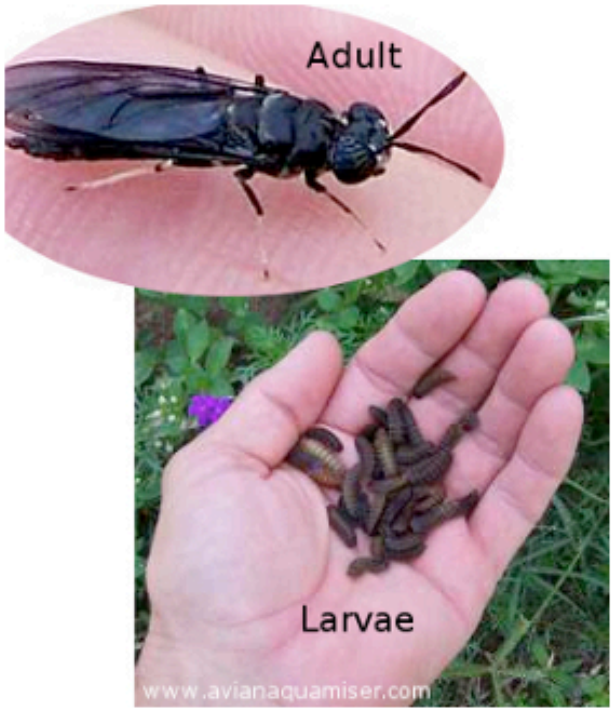
Future questions for EPN

- Refinement of EPN techniques for diversified farms
- Use of "sentinel" larva to maintain EPN populations
- Alternative hosts — arthrocomposting!

Arthro-composting

- **Black Soldier Fly**
  - Compost
  - Animal Feed
  - Nematode host?



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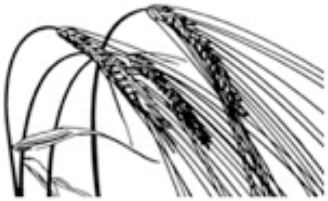

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