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FUTURE

Biologically-based IPM in greenhouse sweet pepper in Israel: Half-jubilee evolution of success. Past, present and lessons for the future.

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BioBee Sde Eliyahu Ltd.

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BIOBEE – MILESTONES & MORE

- 1983 – Established.
  Biocontrol with beneficial arthropods
- 1991 Bumblebees for natural pollination
- 2004 SIT Medfly
- 2013 BioTeam, Biopesticides
- 2014 Black Soldier Fly. Insects as feed
- 2019 Novel technologies
  Production and application

320 Employees
6 subsidiaries world-wide

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MAP OF ISRAEL

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THE NEGEV & THE ARAVA

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IPM-Biocontrol in Greenhouse Sweet Pepper in Israel
Milestones

- 1996 – Initial steps.
  Early adopters. Arava.
  Incentive: export!
- Early 2000's – BioOrius becomes a "true" product
- 2011- 2012 – Peak hectares using biocontrol
- 2015 onward – full commercial package.
  Competition.

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The IPM/Biocontrol package in vegetables (since 2006)

Persimilis **predatory mite**

Pepper
E.plant
Cuc.
Berry
W.Melon
Tomato

Controls spider mites

***swirskii*-mite**

Pepper
E.plant
Cuc.

Controls SPW & broad mites

Aphidius **parasitoid**

Pepper
Egg-plant
Cuc.
Berry

Controls aphids

Orius **predatory bug**

Pepper
E. plant
Berry

Controls WFT

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Persimilis predatory mite
Sweet pepper greenhouses – Arava region

Release rate: 20/m²

Chemical correction:
Bifenazate, Acequinocyl, Cyflumetofen

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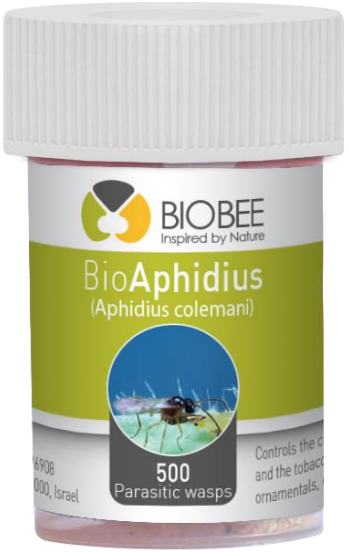
Aphidius parasitic wasp
Sweet pepper greenhouses – Arava region

Release rate: 1-2/m²

Chemical correction:
Pymetrozine, Flunicamid



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Orius minute pirate bug
Sweet pepper greenhouses – Arava region

Release rate: 6/m²

Chemical correction:
Spinosad, Spinetoram

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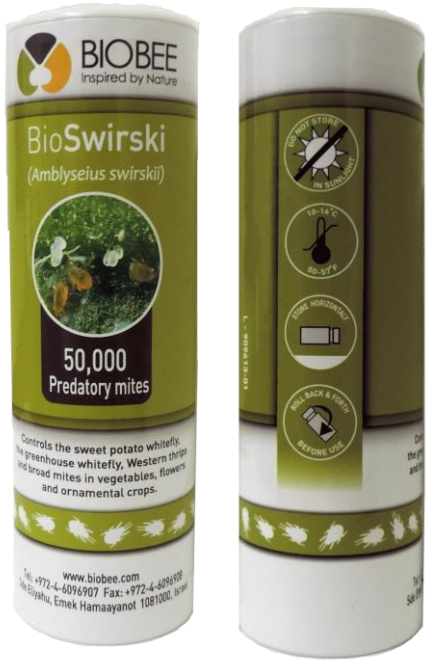
Swirskii mite
Sweet pepper greenhouses – Arava region

Release rate: 50-100/m²

Chemical correction:
Chenopodium extract



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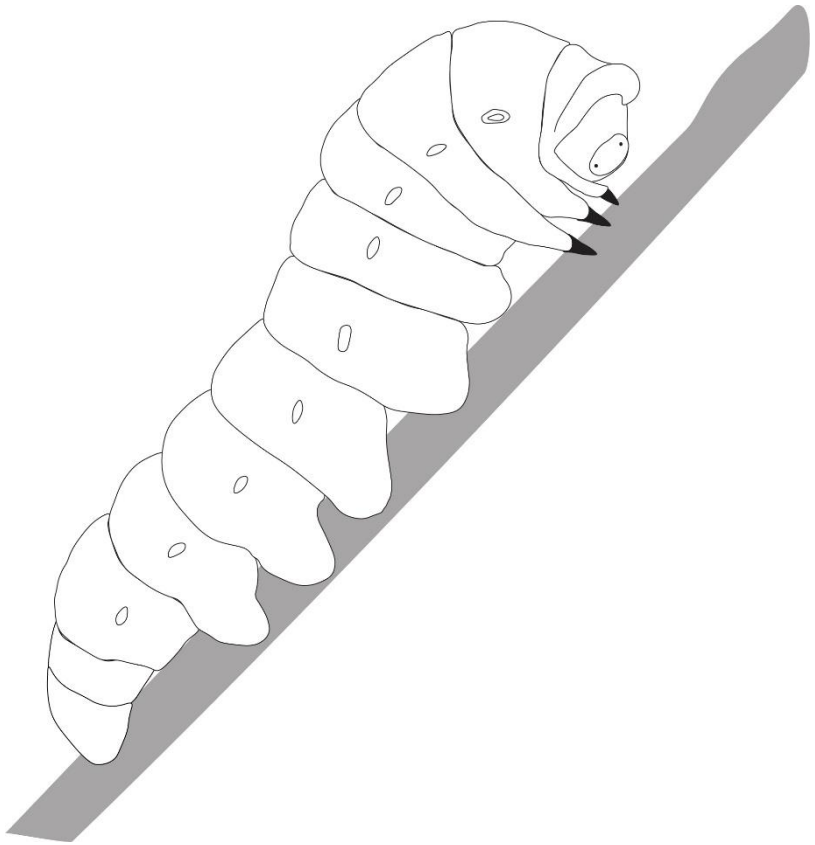
Lepidopteran pests, diseases



- ***Spodoptera***
- ***Helicoverpa***
- **Powdery mildew**
- **Grey mold**

Compatible chemical corrections

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Secondary pests

Chilly thrips

Chemical correction:
Spinosad, Spinetoram

Mirid bug

Chemical correction:
Pyrethrum, Bifenthrin

Cotton mealybug

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Establishing a “standing army” on the plant

CURATIVE: plant > pest > natural enemy

PREVENTIVE: plant > natural enemy > pest

PRECONDITIONS: “generalist” natural enemy, alternative feed

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Feed alternatives for natural enemies

Ephestia eggs

Artemia cysts

Prey mites

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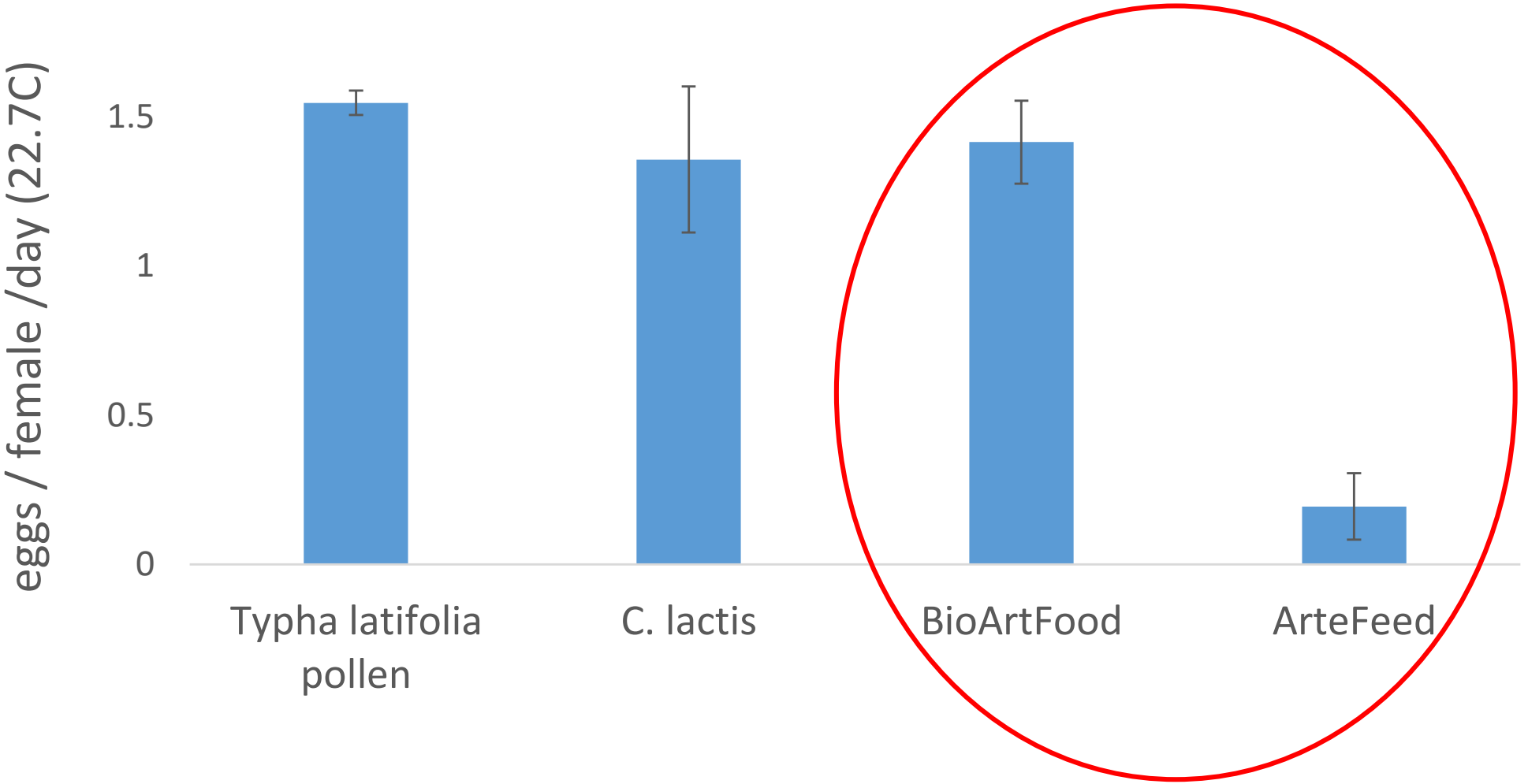
BioArtFeed vs alternatives. Response of *A. swirskii*



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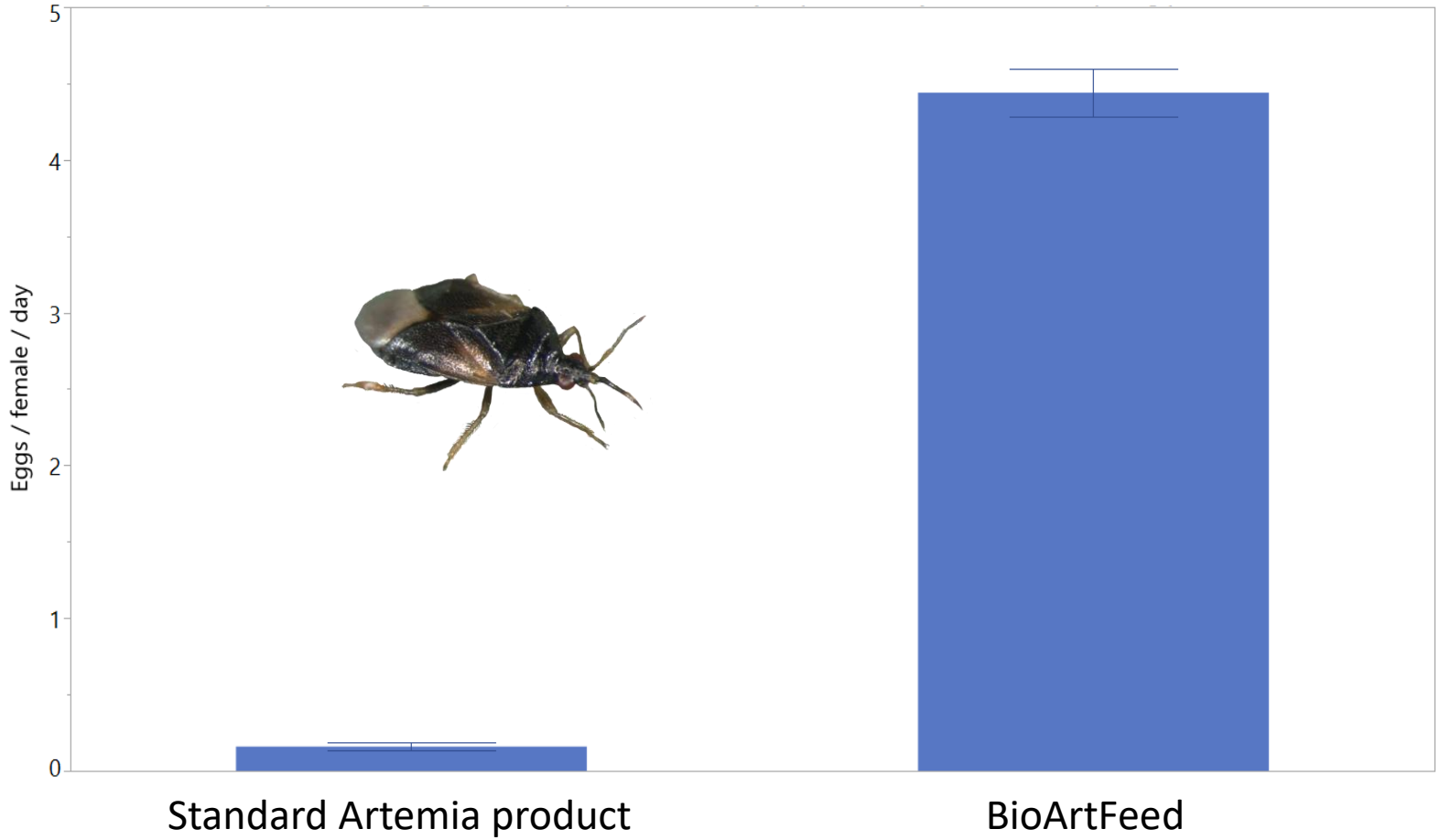
Response of *Orius laevigatus* to different types of Artemia products



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Loading the plants with beneficials at the nursery

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Establishment of *A. swirskii* Following Artemia-based release on seedlings

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Artemia-based establishment of *O. laevigatus* on sweet pepper

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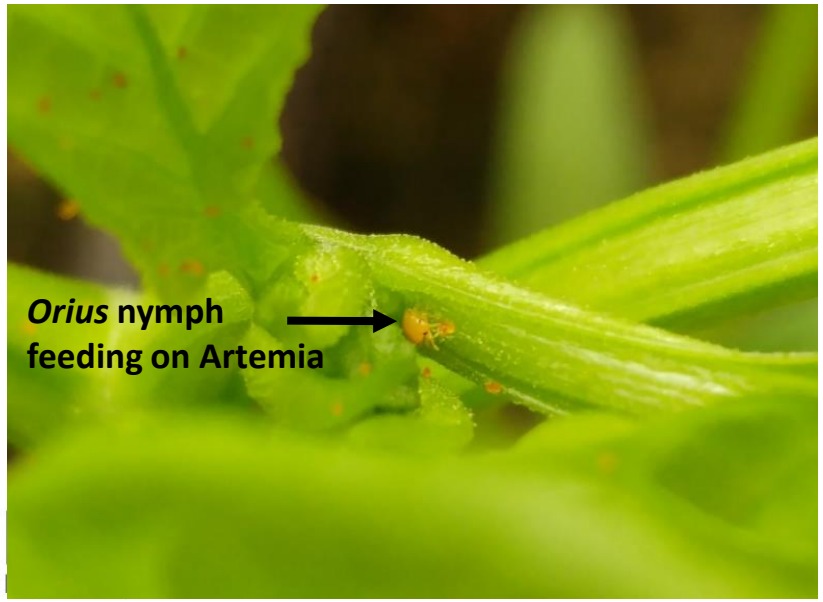
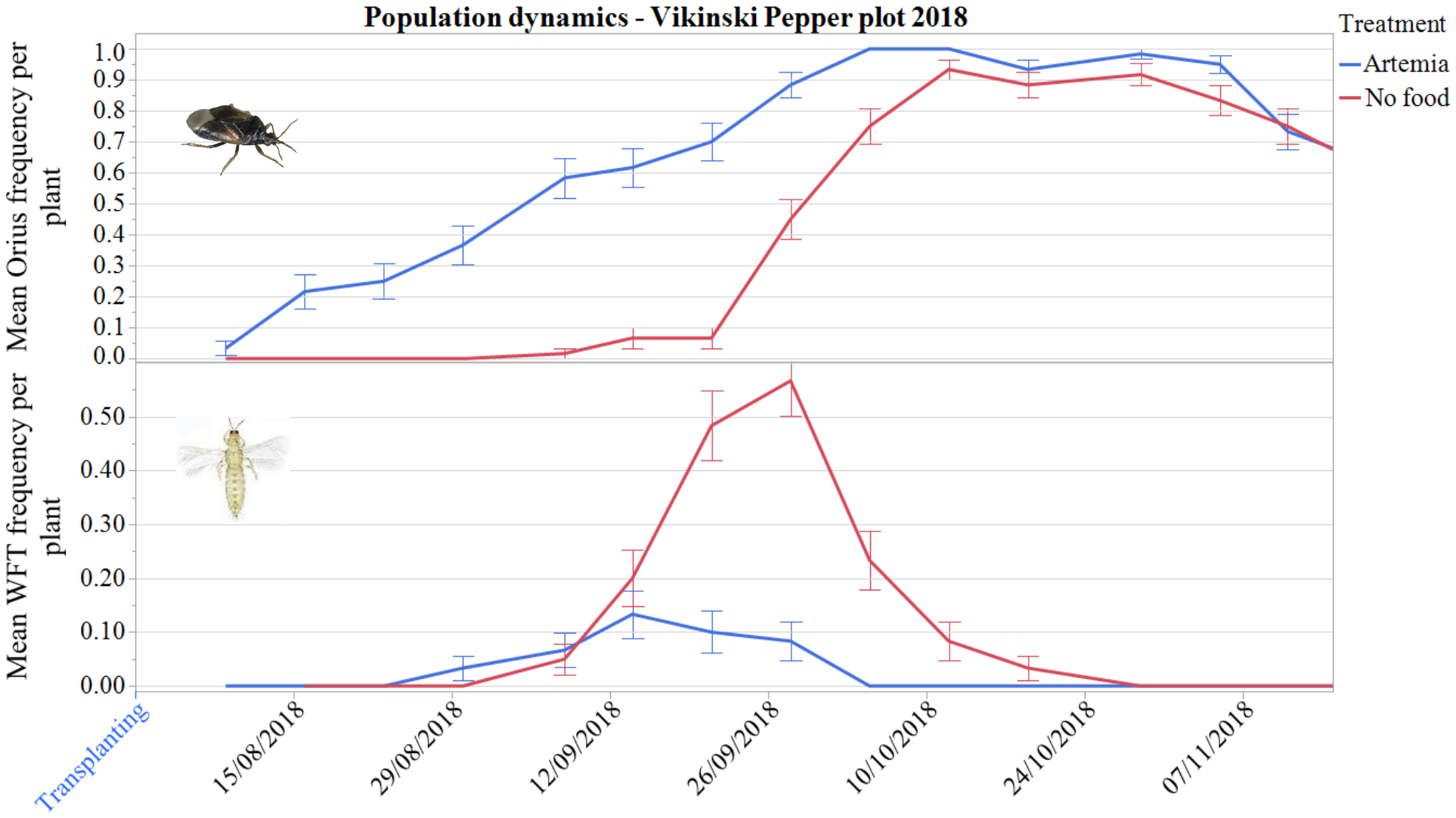
Artemia-based establishment of *O. laevigatus*



Artemia-based early establishment of *O. laevigatus* in sweet pepper greenhouse



BioArtLine. *Artemia* stripe deployed in cucumber

- Feeding station for natural enemies
- Interplant highway for natural enemies
- Mating and oviposition site

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The summer decline/crash of *Orius* population in sweet pepper in Western Negev, Israel

- At the beginning, good establishment
- From June onwards, gradual decline up to elimination
- Re-introduction of Orius, doesn't help
- Reason – chemical residues?
- Reason- age of the plants?
- Reason – decline in fitness?

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The summer decline/crash of *Orius* population In sweet pepper in Western Negev, Israel (cont.)

- *Orius* population is aging, more & more adults
- Less and less nymphs (= young stages)
- Eggs do not hatch

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Sampling *Orius* from the field

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Introducing: *Erythmelus funiculi* (Mymaridae)*
Orius' egg parasitoid

* ID and pics., Miriam Kishinevsky

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Erythmelus funiculi

- Belongs to Fairyflies. The smallest insects known
- Generalist parasitoid of Heteroptera (=bugs)
- A rare species (South Africa, Yemen, Hawaii, Israel)
- First (global) record of its host

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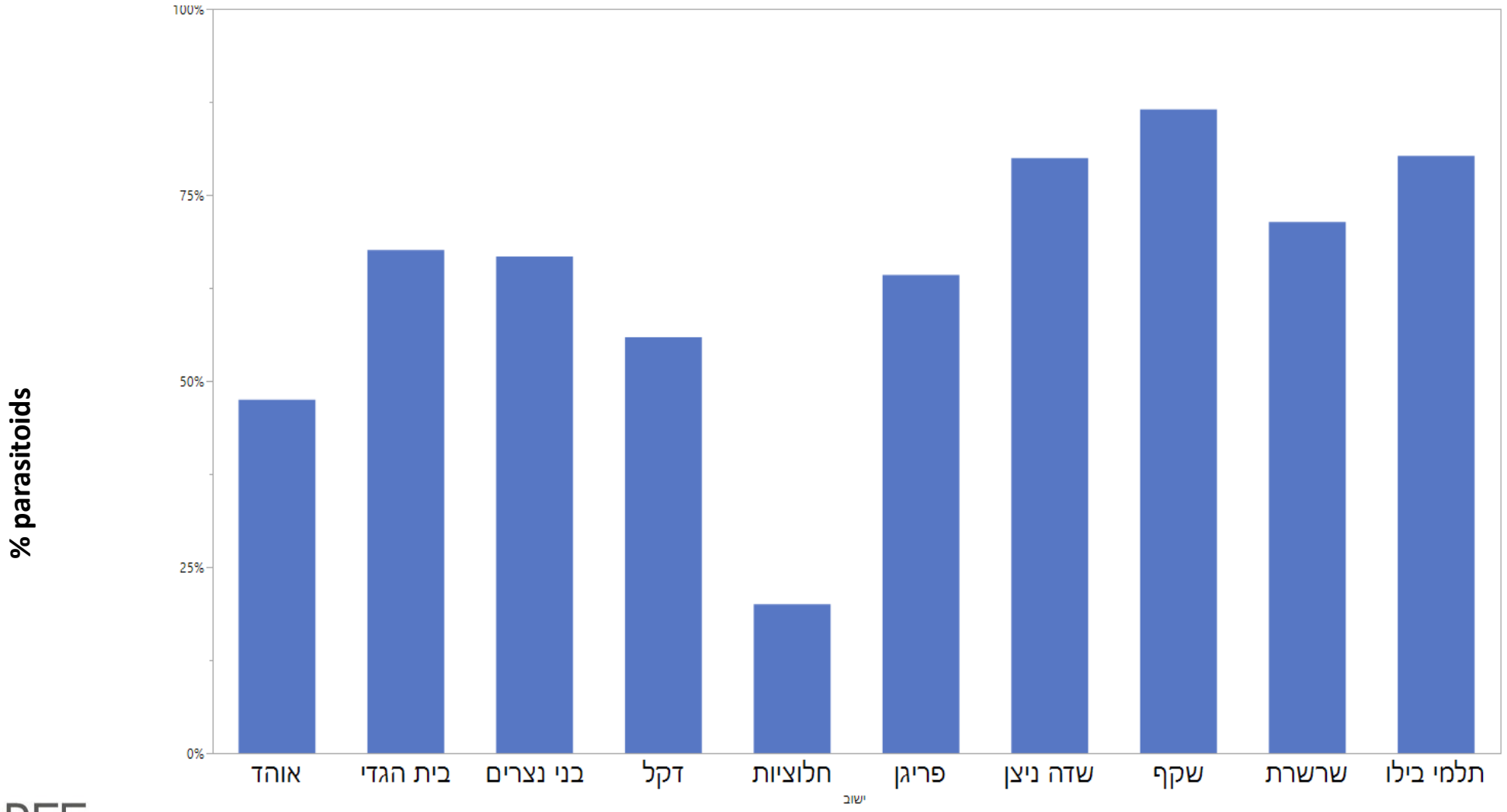
E. funiculi – summary of field survey



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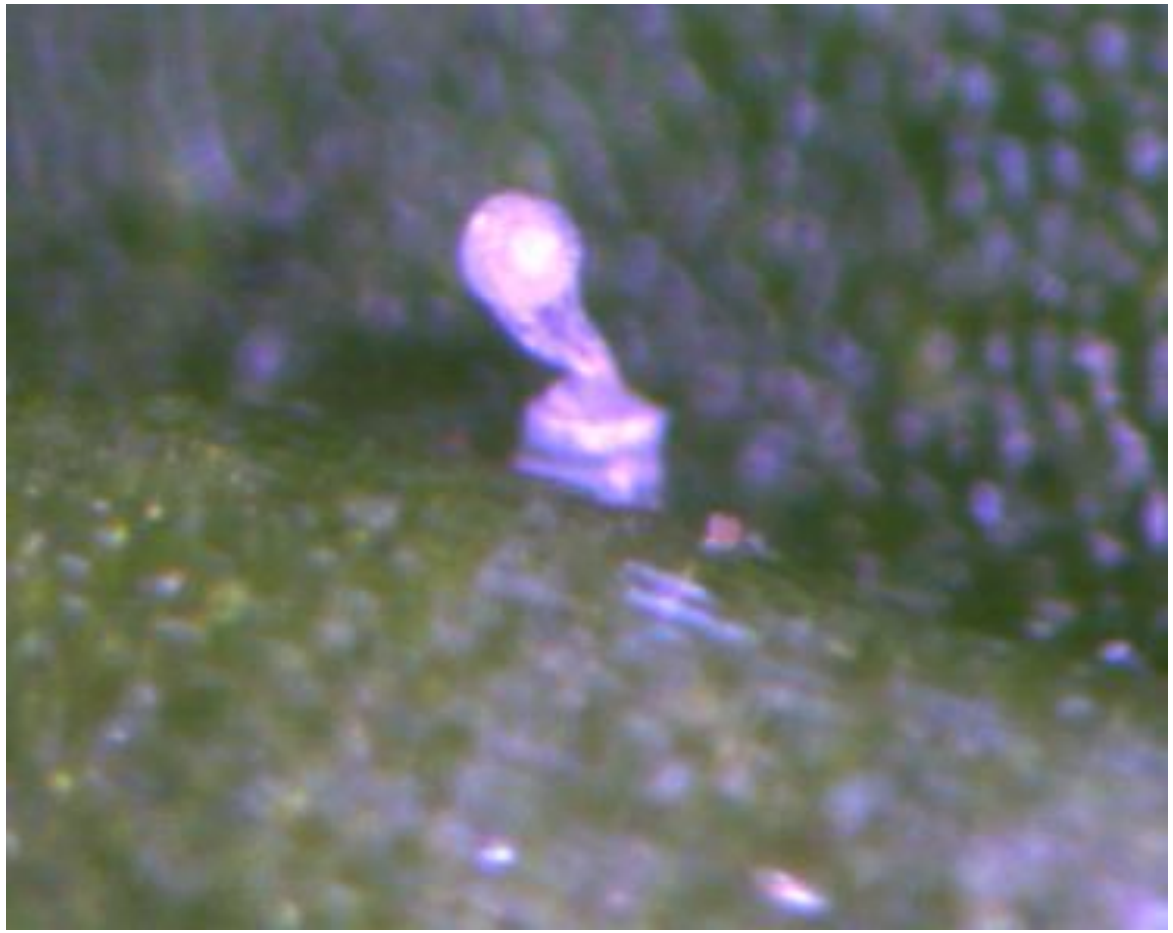
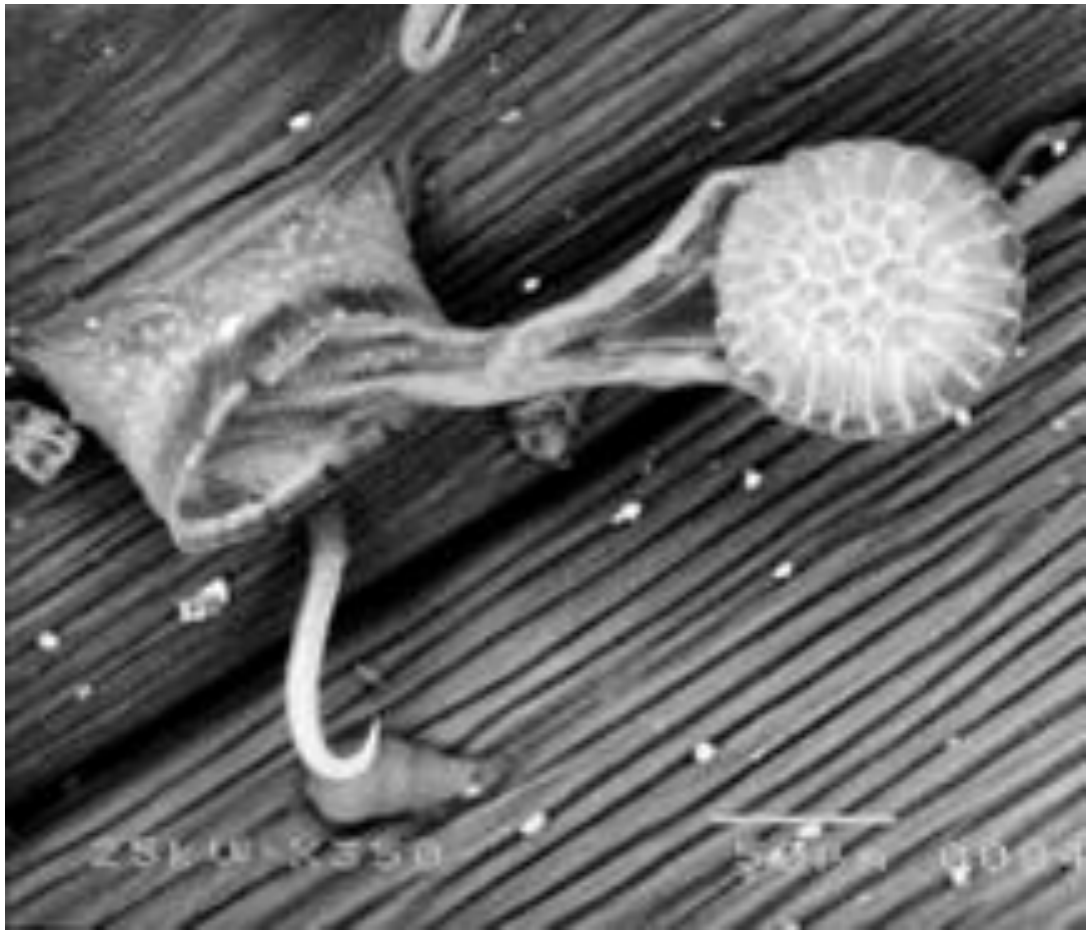
Ef scouting & monitoring - *Orius* egg hatch





Pictures: Leon-Beck & Coll, A .Grosman

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Ef scouting & monitoring - Parasitoid emergence

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E. funiculi. A natural enemy of a natural enemy = pest
Action to be taken

- Selective chemicals. Spinosad?
- Mass trapping by yellow sticky cards
- Population dynamics
- Treating potential reservoirs on alternative hosts

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TAKE HOME MESSAGE

- Establishing a standing army of natural enemies:
  The cutting edge of modern IPM-biocontrol
- IPM-biocontrol system is a living web. Therefore…
- Expect the unexpected. Therefore…
- Strict and professional scouting is a must!!
- It was a long journey! What comes next?
  (tomato, egg plant, water melon)

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A sweet pepper grower Faran, Arava:

Q: What does IPM-biocontrol mean to you?

A: Well, it is not just a plain a product.
It is my culture…

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IPM WORKS.

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Thanks!

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