

Biological Control of Spider Mites



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0.1 mm

Biological Control of Spider Mites

0.4 mm



Spider mite

- Herbivorous
- Pest

0.1 mm

0.6 mm



Predatory mite

- Carnivorous
- Beneficial

Natural enemies of pests

Presentation Outline

1. The Basics of Biological Control
2. Predatory mites for Spider Mite Control
 - *Phytoseiulus persimilis*
 - *Neoseiulus californicus*
 - *Neoseiulus fallacis*
 - *Neoseiulus longispinosus*
 - *Galendromus occidentalis*
3. Predatory Insects for Spider Mite Control
 - Ladybugs = *Stethorus* sp.
 - Predatory gall-midges = *Feltiella acarisuga*
 - Pirate bugs, mirid bugs and lacewings
4. Entomopathogenic Fungi for Spider Mite Control
5. Banker Plants for Conservation Biocontrol
6. Application and Optimization of Predatory Mite Establishment
7. Closing Remarks



The Basics of Biological Control

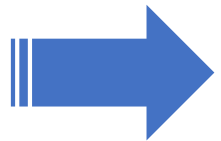
Biological control can be defined as the use of natural enemies - predators, parasites and pathogens to suppress populations of a target pest species (insects, mites, weeds, plant pathogens, and other pest organisms)

<https://www.nifa.usda.gov>

The Basics of Biological Control

➤ Three basic approaches to biological control of pests:

- **Classic:** importation of natural enemies to target exotic species entering in a new area
- **Conservative:** maintain natural enemies that are commonly found in the area (ex. banker plants to provide habitat to predatory mites and insects that can target spider mites)
- **Augmentative:** mass rearing and periodic release of natural enemies to control a specific pest (ex. releases of *Phytoseiulus persimilis*, *Neoseiulus californicus* to control spider mites)



***Phytoseiulus persimilis* for Spider Mite Control**



***P. persimilis* feeding
on spider mite egg**



***P. persimilis* feeding
on a spider mite**

Phytoseiulus persimilis for Spider Mite Control

- Used worldwide against two-spotted spider mite in several crops
- Optimum developmental rate: 25-27°C/ 77-80°F (60-80% RH)
- **Ideal for curative control** (<https://www.arbico-organics.com>)
 - Light Infestations: 1-3 mites/sq ft
 - Moderate Infestations: 5+ mites/sq ft
 - Heavy Infestations: 10+ mites/sq ft
- **Tips**: focus on hotspots and combine with other controls like knock-down spray, localized sprays if needed

Phytoseiulus persimilis: Easy to Find and Buy

Home / Beneficial Insects / / Phytoseiulus Persimilis / Phytoseiulus Persimilis PLUS Sachets



Phytoseiulus persimilis PLUS Sachets

Mite Predator

The most popular mite predator now available in easy-to-apply sachets.

Ships via Overnight methods Monday-Thursday only. See Shipping Info for details.

[WRITE A REVIEW](#)

5,000 in 50 Sachets w/Hooks

SKU: 1151235

~~\$50.00~~ **\$40.00**

BUY NOW

10,000 in 100 Sachets w/Hooks

SKU: 1151236

~~\$95.00~~ **\$76.00**

BUY NOW

25,000 in 250 Sachets w/Hooks

SKU: 1151230

~~\$225.00~~ **\$180.00**

BUY NOW

50,000 in 500 Sachets w/Hooks

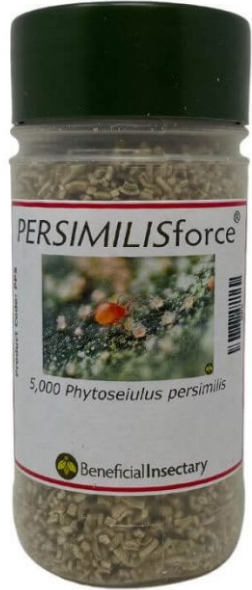
SKU: 1151231

~~\$387.00~~ **\$310.00**

BUY NOW

Application of Predatory Mites

- Sprinkle predator + substrate onto plants or place it near pest hotspots
- Use **sachets** or **blowers** for sustained release over time



bottles



sachets



blowers

Neoseiulus californicus for Spider Mite Control

- Greenhouse and field crops, including strawberries, cucumbers, peppers, tomatoes, ornamentals
- Moderate warm and dry to humid climates
- Can be used together with *P. persimilis*
- **Release Rates** (<https://www.arbico-organics.com>)
 - Preventative: 1-2 mites/sq ft
 - Curative: 3-5 mites/sq ft
 - Heavy infestations: 5-10 mites/ sq ft

SOME CROPS REQUIRE HIGHER RELEASE RATES!



Photo: Arbico-organics



Photo: Paola Villamarin

Neoseiulus fallacis for Spider Mite Control

- Control mites on greenhouse and field crops, including vegetable, ornamentals, hemp, etc.
- It feeds and reproduces over a wide range of temperatures (48-85°F), >50% RH
- They do best where there is a dense plant canopy
- **Release Rates** (<https://www.evergreengrowers.com>)
 - Preventative: 2-3 mites/10 sq ft
 - Low infestations: 1 mites/sq ft
 - Heavy infestations: 5 mites/sq ft



Galendromus occidentalis for Spider Mite Control

- Control spider mites and other mite species
- High temperature (80° to 110°F), low humidity (30-60%)
- It is more effective than *P. persimilis* in tree top foliage and on hairy leaves
- **Release Rates** (<https://www.arbico-organics.com>)
 - Indoors Releases: 1,000 per 500 sq ft bi-weekly for 2-3 applications
 - Outdoor Releases: 2,000-5,000 per acre bi-weekly for 2-3 applications



Neoseiulus longispinosus for Spider Mite Control

- Feeds primarily on spider mites
- It has recently established in FL, but it is **NOT** commercially produced in the U.S.
- It gets acclimatized faster in warmer conditions
- *N. longispinosus* was the most abundant predator sampled in 20 papaya orchards in southern Florida (*Carrillo et al. 2016*)

CONSERVATIVE CONTROL



Predatory Insects for Spider Mite Control

➤ **Ladybugs = *Stethorus sp.***

- Voracious predator of spider mites
- Females feed quickly to sustain egg-laying
- Great option for high temperature, low-high humidity
- For greenhouse, nurseries and field crops

➤ **Release Rates** (<https://www.appliedbio-nomics.com>)

- **Moderate infestation:** release 100 *Stethorus*/mite “hot spot,” or 1–2 beetles/10 sq ft, weekly, for 4 weeks
- **High infestation:** release 200 *Stethorus*/mite “hot spot,” or 3–4 beetles/10 sq ft, weekly, until established in all infested areas



spider mite eggs



spider mites

Generalist Predators for Spider Mite Control

- *Amblyseius swirskii* -> whiteflies, spider mites, thrips
- *Amblyseius andersoni* -> mites
- *Neoseiulus cucumeris* -> spider mites, thrips, aphids, psyllids
- **Mirid bugs** -> whiteflies, spider mites, aphids, thrips, leafminers
- **Minute pirate bugs** -> thrips, spider mites, aphids, whiteflies
- **Green lacewings** -> thrips, spider mites, aphids, whiteflies, mealybugs
- **Predatory gall midge** -> spider mites



Mirid bugs



Pirate bugs



Lacewings

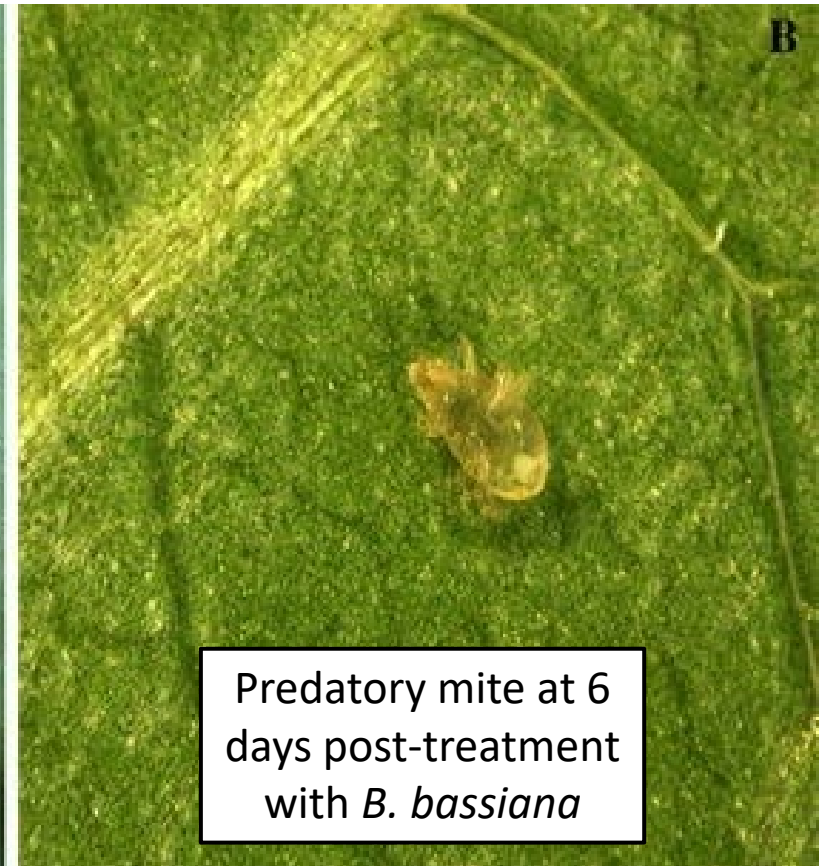
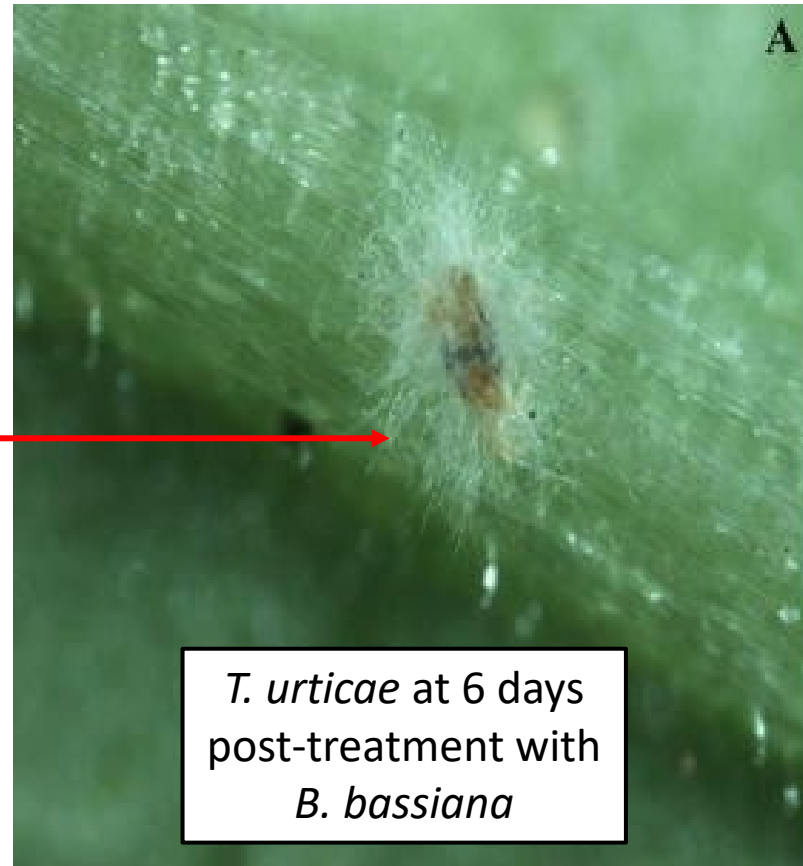


Gall-midge

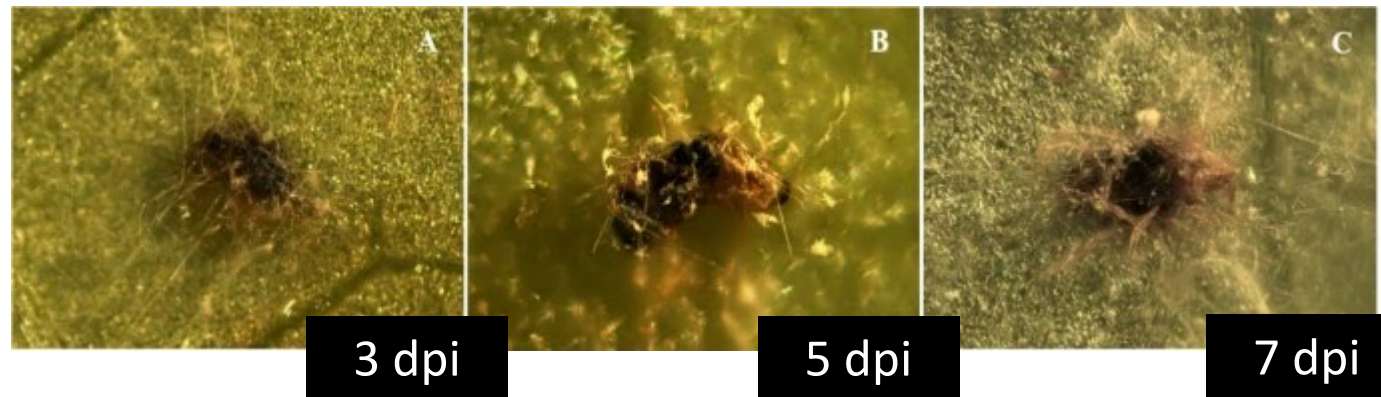
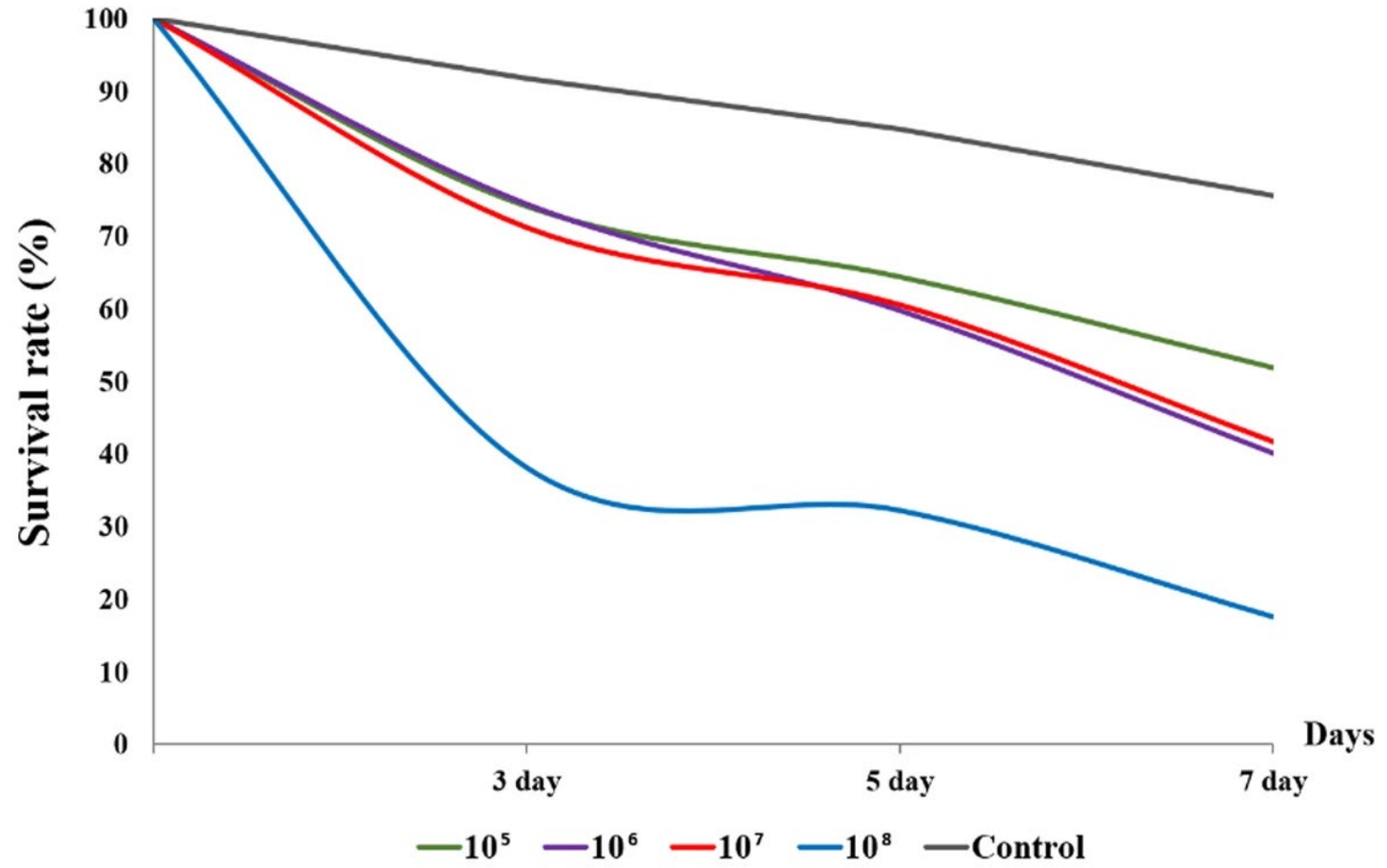
Entomopathogenic Fungi for Spider Mite Control

- They infect spider mites by penetrating their cuticle
- Products commonly used against insects are effective against spider mites

HYPHAE →

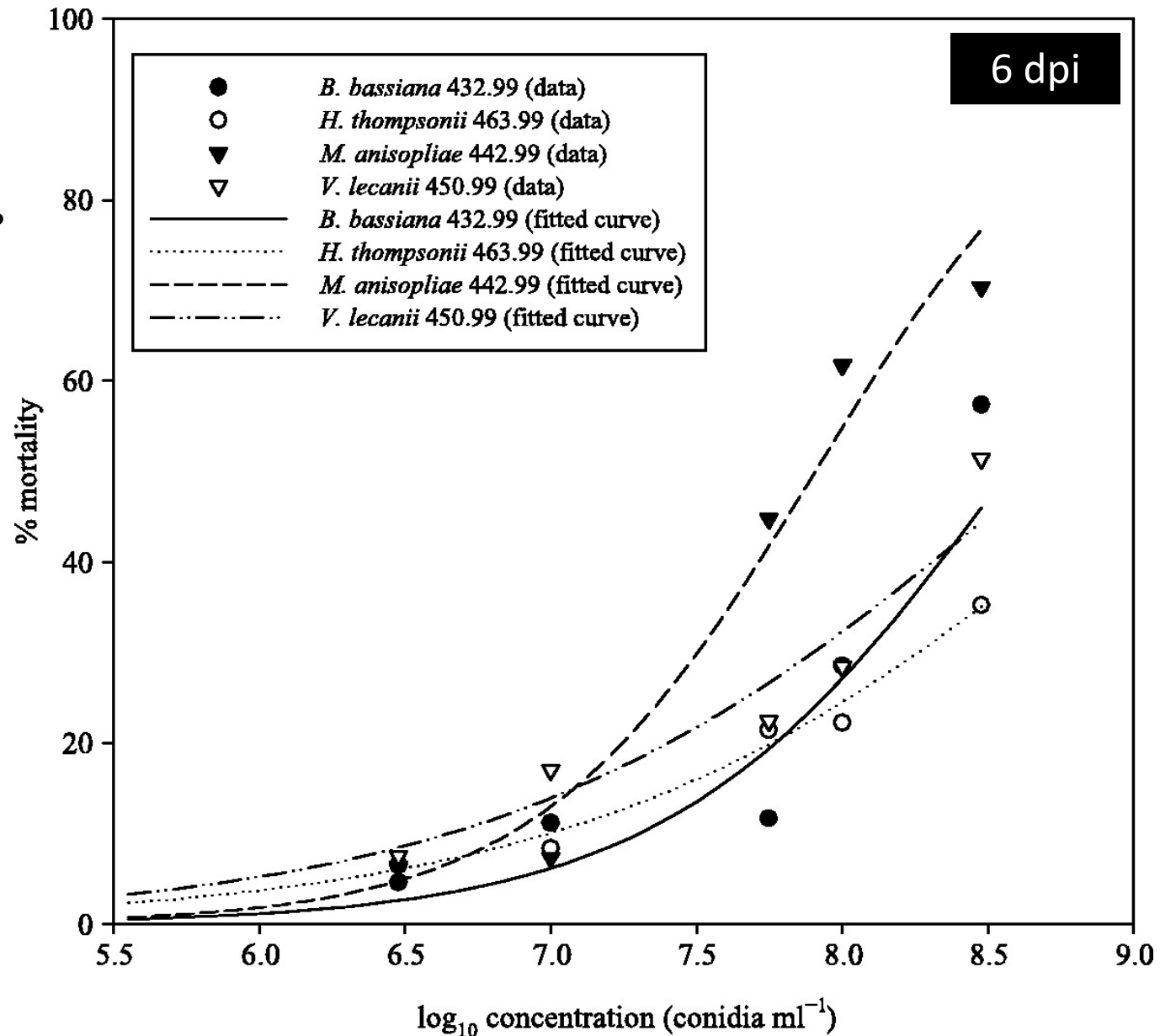


➤ *Beauveria bassiana*



Entomopathogenic Fungi for Spider Mite Control

- *Beauveria bassiana*
- *Hirsutella thompsonii*
- *Metarhizium anisopliae*



Commercially Available Entomopathogenic Fungi for Insect Pest Control that Include Efficacy Against Spider Mites



OBS.: research is still needed to evaluate its direct efficacy against spider mites under greenhouse and field conditions

Habitat Management for Conservation Biocontrol

- Designing agricultural landscapes to promote the survival of predatory mites and other natural enemies
- Use of banker plants and refuge habitats to sustain predatory mite populations
- Effective in controlled environments





 Bird cherry-oat aphids

Sprayable Food for Optimized Predatory Mite Establishment

- It provides an effective alternative to existing food sources
- It can be sprayed and even mixed with other products (chemicals or biologicals) to be sprayed
- Have a standing “army” before the pest arrives!



For Successful Application of Biological Agents

- Monitor spider mite population
- Using combinations of predatory mites like *P. persimilis*, *N. californicus*, and *Stethorus* to target different life stages or species of mites
- The release rate depends on the pest pressure and crop type
- Ensure that environmental conditions are favorable
- Avoid applying broad-spectrum insecticides that could harm the predators
- Complement with other IPM tools, including other biological control agents



Thank You!

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