FNE 00-311

Biological Control of Western Flower Thrips in Commercial Greenhouses
Involved with project:
Gary Magnum, Owner of Bell Nursery, Stanton Gill, Regional Specialist, Rondalyn Reeser, Agricultural Technician, John Speaker, Professional IPM scout.

Situation: Western Flower Thrips are one of the major pests of greenhouse bedding plant producers. Thrips feeds on foliage and flowers resulting in stunting, twisting and distortion. The insect can vector the deadly plant disease, impatiens necrotic spot virus (INSV). Thrips have a relatively short life cycle with rapid reproduction and ability to develop resistance to pesticide sprays. The purpose of our field trials was to investigate potential biological control for western flower thrips using the predacious mite, *Amblyseius cucumeris*, and the biological pesticide *Beauveria bassiana* (an entomopathogenic fungus). We concentrated on finding an efficient and cost effective method of using predators or predators combined with application of entomopathogenic fungi. We also investigated whether adding apple pollen to the *Beauveria bassiana* improved the health and thrips predation activity of *Amblyseius cucumeris.* The application of sugar at 1 lb/100 gallon was also tested to see if it improved the exposure of thrips to spores of *Beauveria bassiana* and improvement of the efficacy of the biopesticide.

Grant source:
Grant money of $3330 was requested from SARE to conduct this on-site demonstration project.

Field Research Project:
Gray Magnum from Bell Nursery wished to work with the University of Maryland Cooperative Extension to investigate biological control for western flower thrips in working greenhouses. Two greenhouses in central Maryland were in this field research project, Bell Nursery of Burtonsville, and Terra Nursery / Greenhouse of Olney, MD (managed by Bell Nursery). It was agreed that if the population of thrips reached an uncomfortable level (causing noticeable injury) or INSV was detected that we could end the trial and the grower could treat with chemicals. On the other hand, we asked the grower to work with us and if biological control was working they would not apply any additional chemicals.

For the 2001 trials we ordered shipment of 25,000 predacious mites every week. To effectively distribute the mite through the bedding plants growing area we built a blower dispersal device that shot the mites out 8 ft. This made applications of the mites quickly (under 10 minutes to apply to 3,000 sq.ft.) and efficiently distributed the mites among the crop.

2000 Trials

Bell Nursery

In the 2000 growing season, we ran two trials (2 rotations of bedding plants) at Bell Nursery in Burtonsville, Maryland. In the first trial, we used 5 greenhouses. Plants in each of the greenhouses consisted of a mix of bedding plants. Treatments were made to whole greenhouses. Treatments were as follows:

Treatment applied in the first trial	Greenhouse Designation	Rate of application	Application dates
Control	31	N/A	
Amblyseius cucumeris	32	4 mites/ sq ft	3/28,4/4, 4/11
Amblyseius cucumeris and *Beauveria bassiana*	23	4 mites per sq ft and *B. bassiana* at 29 gr/1000 sq ft	3/28,4/4, 4/11, 5/1 3/28,4/4, 4/11, 5/1
Beauveria bassiana (BotaniGard)	24	29 grams / 1000 sq ft	
Beauveria bassiana (BotaniGard) and sugar	28	29 grams /1000 sq ft and sugar at 137 grams in 7 liters of water	3/28,4/4, 4/11, 5/1

In the second turn of bedding plants, we used 4 greenhouses, dropping the treatment involving application the application of predacious mites by themselves. The fifth greenhouse was used by the grower for multiple crops making treatments and evaluations impossible. Whole greenhouse crops received an application of one of the treatments through 2 crop cycles. The *Beauveria bassiana* was applied using a Dramm cold fogger run at 3000 psi. Plastic cover slips were placed on the undersides of the foliage to establish spore counts. This was used to determine whether applications of the fungus were being made uniformly through the crop. In the greenhouses where a combination of mites and *Beauveria bassiana* was applied the mites were applied first followed by the application of the entomopathogenic fungus.

A portable, gas powered leaf blower was purchased. A hole was drilled in the blower tube and a plastic hose connector was held with epoxy glue. A ball cock trigger device was screwed into the hose connector and a standard soda bottle was screwed onto the ball cock trigger. When the blower was turned on the ball-cock valve was slowly opened to meter out the mites and grain carrier into the air blowing through the leaf blower tube. For the trial, we ordered a shipment of 50,000 mites every 2 weeks. One half of the mites were applied shortly after a shipment and the second half was released the following week. This method was used to keep the mite shipping cost down.

Thrips populations were evaluated by yellow sticky card counts and whole plant inspection of 20 random plants in each greenhouse.

2000 season

Terra nursery site (managed by Bell Nursery)

Five greenhouses (double poly houses) of 3000 sq ft were used in this trial. The plants in the greenhouses were a mix of bedding plants in 4" pots. Whole greenhouse received treatment with applications being made on 7-day intervals starting on 3/27/2000 and continuing until 5/1/2000 when all plants were shipped out. This trial was run through two crop cycles. Twenty plants were randomly selected for whole plant inspection for thrips.

Treatment applied	Greenhouse Designation	Rate of application	Application dates
Control	# 14	N/A	
Amblyseius cucumeris	# 21	4 mites per sq ft	3/27, 4/3, 4/10, 4/17.4/24,5/1
Amblyseius cucumeris and apple pollen	# 15	4 mites per sq ft and B. bassiana at 29 gr/1000 sq ft	3/27, 4/3, 4/10, 4/17, 4/24, 5/1
Beauveria bassiana	# 16	29 grams / 1000 sq ft	3/27, 4/3, 4/10, 4/17.4/24,5/1
Beauveria bassiana and sugar	# 17	29 grams /1000 sq ft and sugar at 137 grams in 7 liters of water	3/27, 4/3, 4/10, 4/17, 4/24, 5/1

Bell Nursery Site - 2001

A gutter connected greenhouse with rolling benches was used in this trial. Because the greenhouse had open bays the application of *Beauveria bassiana* was not feasible without having the spores drift into the areas of the greenhouse serving as the untreated control. We opted to compare treatments of the predacious mites applied to 1200 sq ft of rolling benches of marigolds and 1200 sq ft of wax begonias that were growing in separate bays in the gutter connected greenhouse. The untreated control plants were in a separated by an 8-ft walkway so it was unlikely that the predacious mites would migrate off the benches and across the concrete floor into the untreated blocks of plants. All the marigold and wax begonias were growing in 4" pots and there were 588 flats on plants on each bench receiving a treatment. Upon the suggestion of the biological supply house we increased the number of predacious mites released to 10 per sq ft of growing area every two weeks.

Pre-treatment counts were taken on March 30, 2001. Ten random plants received whole plant inspection. Precounts on the marigold treatment and control benches had zero population of thrips at the beginning of the project. This was also true for the wax begonia treatment block and control block.

Post treatment counts were taken on a weekly basis starting on April 4th and continuing until April 26th when the plants were moved out to sell. Only one crop rotation was sampled for thrips. A second crop rotation was not started. The bedding plant crops being grown in this location were going to be kept for too short of a time to conduct a trial.

The predacious mites, *Amblyseius cucumeris,* were applied on 10 mites per sq ft of growing area applied on April 4th and April 18th. The mites were applied using a gas powered power blower.

Results:
Bell Nursery - 2000
See attached Excel charts

Twenty plants were selected each week and received a whole plant inspection for thrips. During the first rotation of bedding plants the thrips counts was extremely low for all treatments including the untreated control plants. We could detect no significant difference between any of the treatments throughout the first plant rotation.

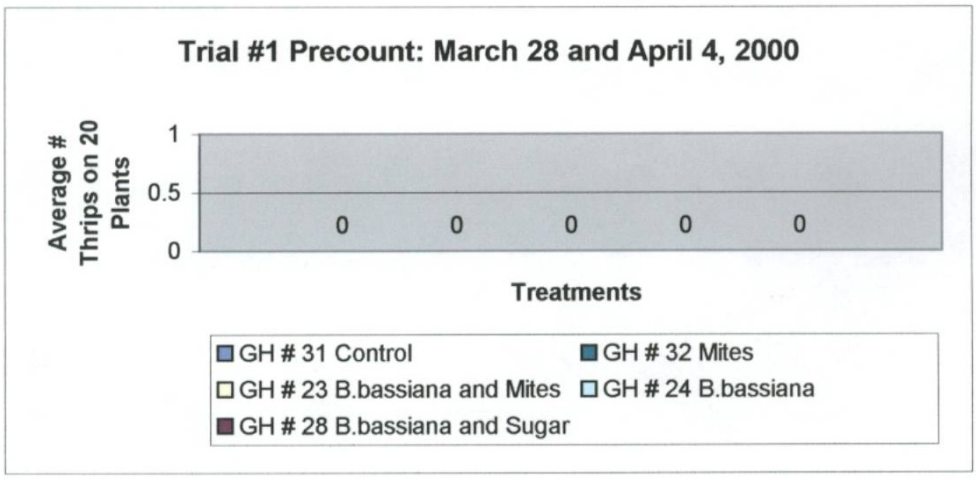
In the second rotation of bedding plants the thrips population increased but was still extremely low for all of the treatments. Final whole plant thrips counts of the control plants averaged 1.1 thrips while the treated plants ranged from 0.7 to 1 thrips per plant. No significant difference was detectable between any of the treatments.

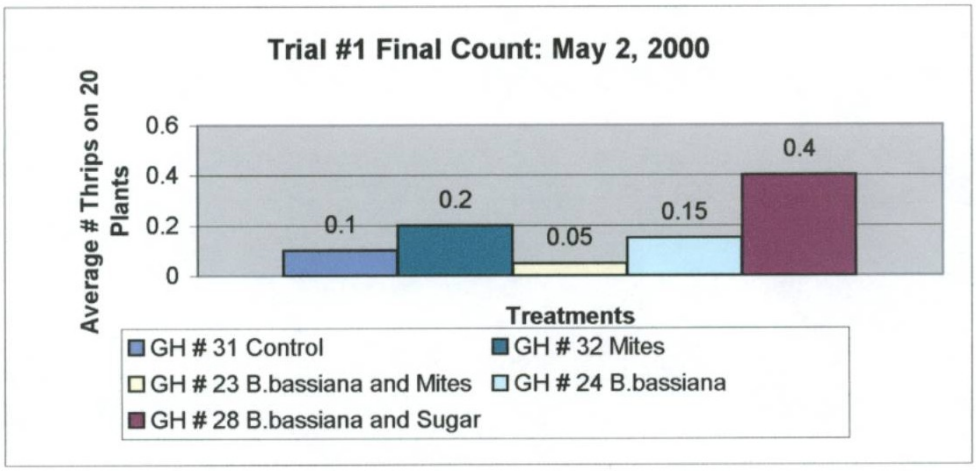
Terra Nursery - 2000
Twenty plants were selected each week and received a whole plant inspection for thrips. During the first rotation and the second rotation of bedding plants the thrips counts was extremely low (< .03 thrips/plant) for all treatments including the untreated control plants. We could detect no significant difference between any of the treatments for first and second rotations.

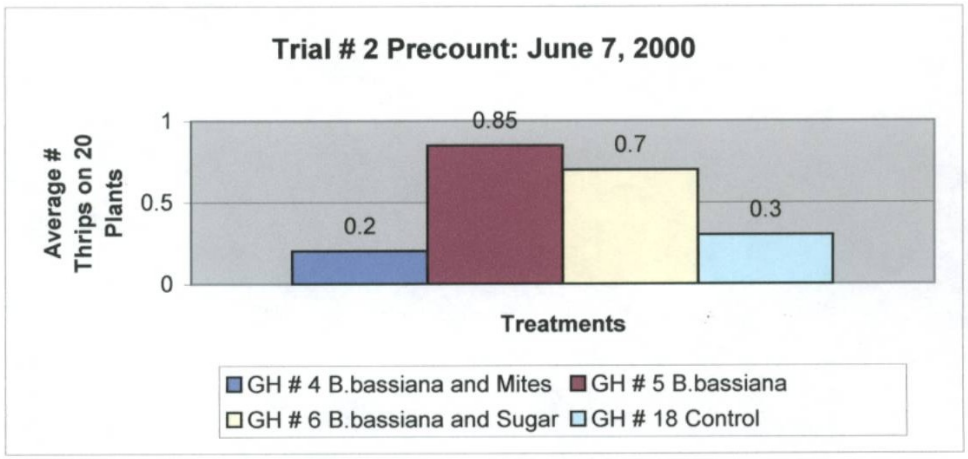
Bell Nursery - 2001

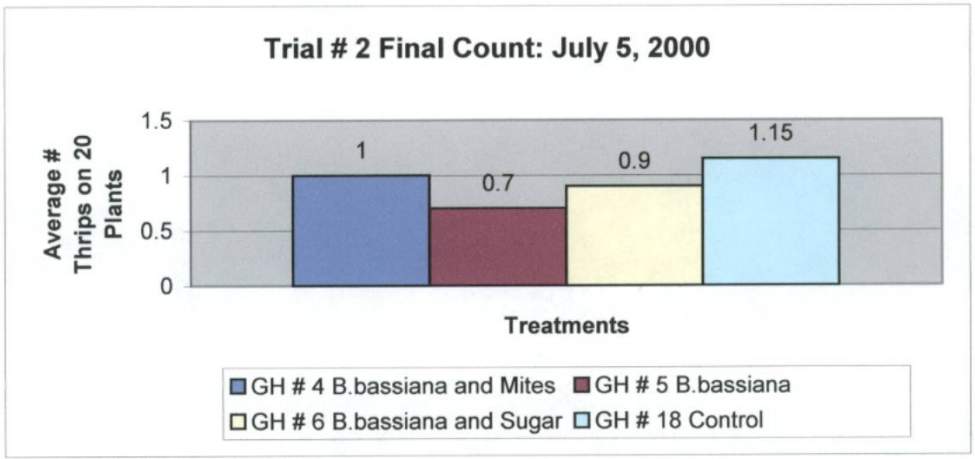
Results:
The thrips counts were zero on all of the treated plants at the start of the trial. At the final sampling date of April 26 the marigolds and begonia treated with mites had an average of 3 and 1 thrips per plant, respectively. The marigolds were in flower and tended to have as lightly higher count of thrips found mainly in the flowers. The untreated control plants had an average of 4 thrips and 2 thrips per plant, respectively. There was no damage noted on the treated and untreated plants. These numbers were so low that there was no statistical difference between the treatments.

Conclusion
Since these were operating commercial greenhouses thrips could not be artificially introduced into the greenhouse and we had to use existing populations. The monitoring for the two years revealed that thrips pressure was extremely low in March through May in these two Maryland greenhouses. The good news is that no spraying for thrips control was necessary in either of the greenhouse operations and supports the benefit of monitoring a crop instead of planning on preventative treatments of insecticides. We saw that 3 – 4 of western flower thrips per plant at market time for marigold and wax begonia is a tolerable level in the absence of impatiens necrotic spot virus (INSV). The critical season for bedding plant production is March through Mothers day. After this period greenhouse bedding plants sales generally are reduced until mid-summer when poinsettia, cabbage and kale and poinsettia sales production is started. Hanging baskets and mixed color bowls are produced from May through the end of June. Thrips populations generally rise in Mid-May to June in Maryland. Possibly these plants could be targeted as another trial using the predacious mites and *Beauveria bassiana.* We had good success with *Beauveria bassiana* and *Amblyseius cucumeris* in 1999 at Bell Nursery and we feel these are still good biological control options that need additional testing in working greenhouses.


Trial #1 Precount: March 28 and April 4, 2000
Average # Thrips on 20 Plants
1
0.5
0
0
0
0
0
0
Treatments
GH # 31 Control
GH # 32 Mites
GH # 23 B.bassiana and Mites
GH # 24 B.bassiana
GH # 28 B.bassiana and Sugar


Trial #1 Final Count: May 2, 2000
Average # Thrips on 20 Plants
0.6
0.4
0.2
0
0.1
0.2
0.05
0.15
0.4
Treatments
GH # 31 Control
GH # 32 Mites
GH # 23 B.bassiana and Mites
GH # 24 B.bassiana
GH # 28 B.bassiana and Sugar


Trial # 2 Precount: June 7, 2000
Average # Thrips on 20 Plants
1
0.5
0
0.2
0.85
0.7
0.3
Treatments
GH # 4 B.bassiana and Mites
GH # 5 B.bassiana
GH # 6 B.bassiana and Sugar
GH # 18 Control


Trial # 2 Final Count: July 5, 2000
Average # Thrips on 20 Plants
1.5
1
0.5
0
1
0.7
0.9
1.15
Treatments
GH # 4 B.bassiana and Mites
GH # 5 B.bassiana
GH # 6 B.bassiana and Sugar
GH # 18 Control