"Final Project Report to the NYS IPM Program, Agricultural IPM 2002–2003."

1. Title:
Developing A Cost-effective and Reliable Integrated Management Program For Western Flower Thrips

2. Project Leader(s):
John Sanderson, Dept. of Entomology, Cornell University, Ithaca, NY
Gary Couch, NYS IPM Program, Cornell Coop. Exten. of Orange County
Chris Logue, Cornell Coop. Exten. of Schenectedy Co.
Teresa Rusinek, Cornell Coop. Exten. of Ulster Co.

3. Cooperator(s):
Roy Van Driesche, Dept. of Entomology, UMASS, Amherst, MA

4. Type of grant:
Please select the category that best describes your project:

- Biological control and pest biology
- Pheromones; biorationals; microbials; conventional pesticides

5. Project location(s):
This applied research project was conducted in commercial greenhouses in Orange, Ulster, and Schenectedy counties, but findings could be applied throughout the Northeast.

6. Abstract:
We tested whether biweekly releases of the predaceous mite *Neoseiulus (Amblyseius) cucumeris* can be integrated with minimal application(s) of the reduced-risk insecticide spinosad (Conserve®) to provide cost-effective and reliable control of the western flower thrips, *Frankliniella occidentalis*, in commercial greenhouse flower crops, and thus increase the attractiveness of this program for widespread grower adoption. Results were unfortunately too variable, due to overall low thrips levels, to draw reliable conclusions about the effectiveness of each treatment.

7. Background and justification:
The western flower thrips, *Frankliniella occidentalis* Pergande (WFT), is presently the most serious pest problem of the greenhouse industry. WFT is the key pest of nearly all flower, bedding plant, and foliage and potted plant crops grown in the state. Based on surveys, growers have indicated that if there were effective methods of biological control for this pest, they would consider using them. Among the most commonly mentioned reasons for grower's reluctance to try biological control are lack of reliability (compared with pesticides) and higher costs.

Inundative biweekly releases of the commercially-sold predaceous mite *Neoseiulus (Amblyseius) cucumeris* appear to be able to control western flower thrips in greenhouse bedding plant crops, given some recent results from commercial greenhouse trials in NY and MA. We have previously learned that broadcast releases of this mite appear to be more effective than deployment of the "slow-release" sachets. But these trials have been limited in number and we didn't know whether the mites can provide control reliably under the wide mixture of spring crops grown in greenhouses. Also, we

have the most confidence in the use of repeated biweekly releases for the duration of the crop. But this practice is more expensive than typical pesticide programs. We wanted to increase our confidence in the use of the mites, while determining ways to make the cost of their use equal to or less than a typical spray program.

Spinosad (Conserve®) is currently widely used as the most effective thrips insecticide. It is an EPA-designated reduced-risk pesticide with a 4-hour Restricted Entry Interval. There is some evidence to suggest that spinosad may do only minor harm to populations of predatory mites and thus be compatible with biological control of western flower thrips. The LC_{50} for spinosad for the related predatory mite *Phytoseiulus persimilis* is over 200 ppm (Thompson *et al*., 2000). Informal reports suggest that labeled rates of spinosad appear to reduce the survival and egg laying of *Amblyseius montdorensis,* a species of phytoseiid mite from Australia that has recently been commercialized internationally for use against western flower thrips in greenhouses (but which is not yet approved for use in the United States). However, half rates do not appear to harm *A. montdorensis* (M. Steiner, pers. comm.). In New Zealand, *N. cucumeris* and *P. persimilis*, the two predatory mites most widely used for western flower thrips and spider mite control, respectively, are reported by Terril Marais not to be harmed by spinosad use in greenhouse sweet pepper and eggplant crops (pers. comm.). We suspect that the combination of Conserve and the predatory mite may be a viable means to economically suppress western flower thrips. Combinations of this sort take advantage of the strengths of both chemical and biological control. They avoid the risk of the pest becoming resistant to the pesticide (a serious risk in programs using only pesticides), but often maintain better and more reliable control of the pest. Because both of these products are already on the market, growers could immediately use the results of this research. If growers can be shown a WFT management program that is simple, reliable, and cost-effective, widespread adoption seems likely given the results of recent grower surveys.

8. Objectives:

1. Conduct trials in commercial greenhouses to evaluate whether releases of *N. cucumeris* can be integrated with application(s) of the insecticide spinosad (Conserve™) for reliable and cost-effective management of western flower thrips on spring bedding plant crops.
2. Project Evaluation will include an analysis of thrips levels as a result of each of the three treatments.

9. Procedures:

1. Trials were run at six commercial businesses, three in NY and three in MA. At each business site, tests were conducted in three separate greenhouses. In one greenhouse at each site, *N. cucumeris* (bulk formulation) were released at the rate recommended by the supplier (10 mites per sq. ft., with releases in weeks 1, 2, 3, 5, 7, and 9 of the 10 week crop). Releases were made by shaking the shipment bottles to mix the mites into the bran carrier and hand-sprinkling the mixture over the top of the foliage. In the second greenhouse, we intended that this rate and schedule of *N. cucumeris* releases would be combined with a single application of Conserve, at half the full labeled rate in the midpoint of the crop duration. The third greenhouse at each site was to be treated with one application of Conserve alone, at the full labeled rate. Each shipment of *N. cucumeris* was checked for quality by having one extra shipment from the same batch sent to Cornell where the number of living and dead mites in each of 10 subsamples (0.25 g each) were counted. Thrips numbers were assessed weekly in each greenhouse with 20-25 yellow sticky traps (standard size [3x5”] cards cut in half), counting adult thrips on both sides of the traps. Traps were replaced as needed.

10. Results and discussion:

Although there was wide variation in numbers of living adult and immature *N. cucumeris* per shipment (Fig. 1), only one shipment contained fewer mites than promised by the insectary. Most shipments exceeded the intended number of mites, including one that contained 2.5 times the intended number. Given that growers are not likely to take the time and effort to assess the number of mites in each shipment, predictable thrips control could depend on a minimum, and preferably consistent, number of healthy mites in each shipment. Our results suggest that nearly all releases made in this study contained at least the minimum number of living mites that were expected.

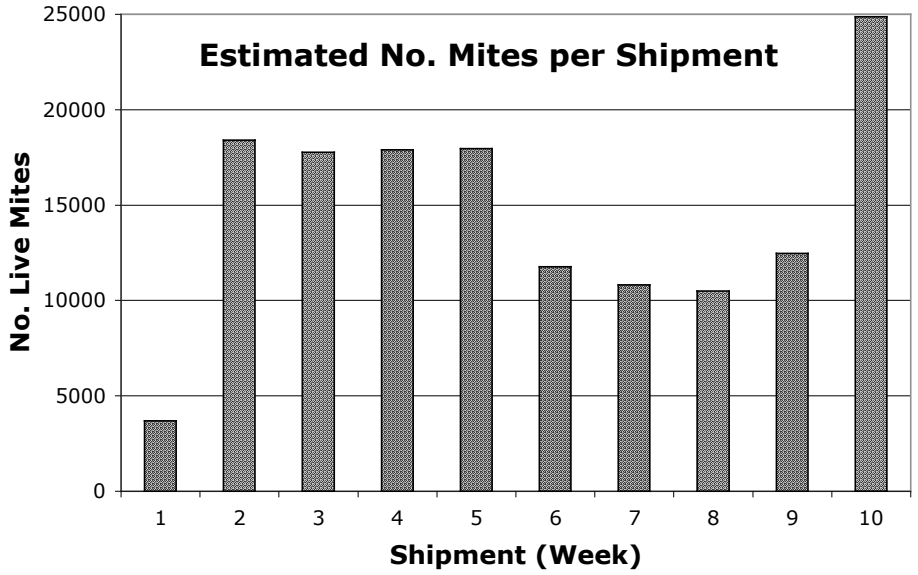

Figure 1. Estimated numbers of living adult and immature *Neoseiulus cucumeris* in 10 weekly shipments from a commercial producer of the mites. Each shipment is intended to contain 10,000 mites.

Trials were conducted in three commercial greenhouses, but only two are reported here. The third trial, in Ulster Co., was compromised by a thrips-transmitted infection of impatiens necrotic spot virus on much of the crop. To minimize losses from this severe disease, the grower applied insecticides against thrips across experimental treatments, compromising the ability to conduct the study and interpret the results.

At the Schenectedy Co. greenhouse business, mites were released as planned in the two treatments that included mite releases. But because of the low numbers of thrips (Fig. 2), the grower elected to not apply thrips insecticides in any of the experimental treatments. Thus, because Conserve was not applied, the "Mites plus Conserve" treatment was actually no different than the "Mites only" treatment, and neither mites nor insecticides were used in the "Grower House" treatment, which was to include a mid-crop application of Conserve. There was no statistical difference in thrips levels among any of the treatments, due largely to the very low numbers of thrips.

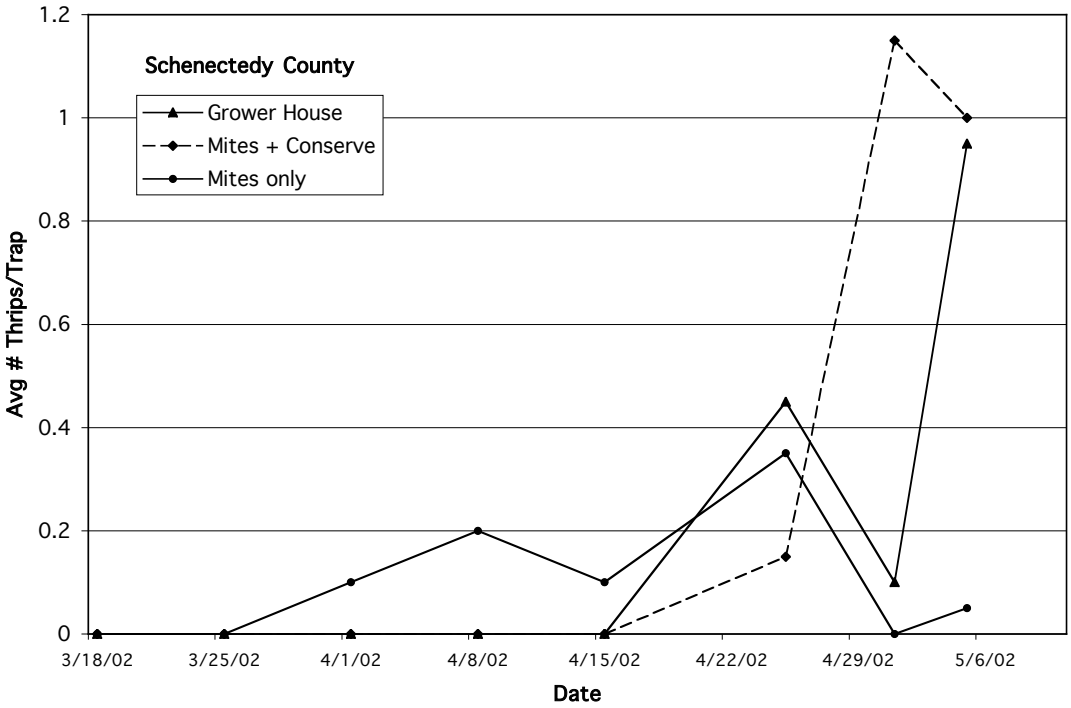

Figure 2. Trends in average number of western flower thrips per yellow sticky trap per week in each of three greenhouses at a bedding plant business in Schenectedy Co., NY. A different thrips control treatment was to be practiced in each greenhouse: "Grower House" = one mid-crop application of Conserve (spinosad); "Mites + Conserve" = weekly releases of *Neoseiulus cucumeris* plus a mid-crop Conserve application; "Mites only" = weekly releases of *N. cucumeris*. In actuality, no Conserve was applied in any treatment, so that there was no difference between the "Mites + Conserve" and "Mites only" treatments, and nothing was done for thrips control in the "Grower House".

At the Orange Co. greenhouse business, crop production in the "Grower House" began three weeks later (3/29) than when the trial was begun in the other two greenhouses (3/8). Also, no insecticides were sprayed (nor mites released) in the "Grower House" because of low thrips levels. Mites were released as scheduled in the two treatments that included mite releases. Conserve was applied between 4/5 and 4/9 in the "Mites + Conserve" treatment, as scheduled. Largely because of low numbers of thrips (Fig. 3), no statistical differences in thrips levels were detected, though it appeared that the mid-crop Conserve application in the "Mites + Conserve" greenhouse reduced a building population of thrips.

Because there were no differences in thrips levels among mite-release treatments and treatments in which ultimately nothing was done to control thrips, it could be interpreted that mite releases are not effective at controlling western flower thrips. Also, given that two growers had such low thrips populations that they never saw a need to spray for thrips, it might also seem that western flower thrips are not serious pests of Spring greenhouse crops in NY. But the latter interpretation is contradicted by the problems encountered at the Ulster Co. greenhouse as well as the long history of western flower thrips damage to greenhouse crops worldwide, including NY. And the former interpretation that *N. cucumeris* releases are not effective at western flower thrips

control is contradicted by at least one previous study of biological control of western flower thrips by mite releases (Van Driesche et al. 2002).

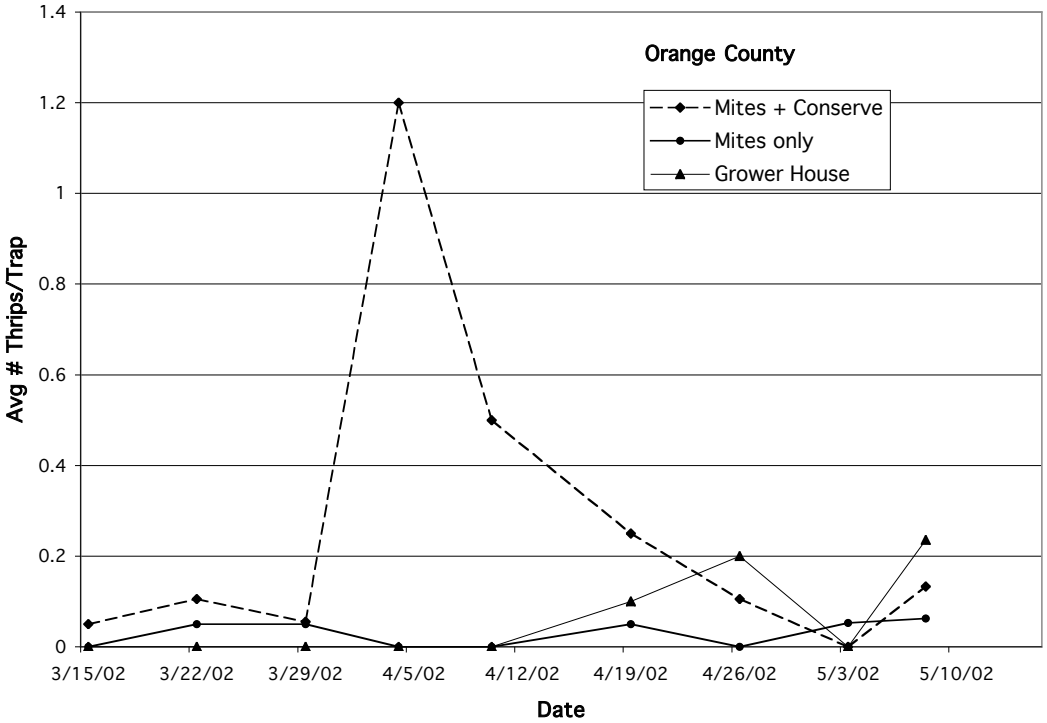

Figure 3. Trends in average number of western flower thrips per yellow sticky trap per week in each of three greenhouses at a bedding plant business in Schenectedy Co., NY. A different thrips control treatment was to be practiced in each greenhouse: "Grower House" = one mid-crop application of Conserve (spinosad); "Mites + Conserve" = weekly releases of *Neoseiulus cucumeris* plus a mid-crop Conserve application; "Mites only" = weekly releases of *N. cucumeris*. In actuality, no Conserve was applied in the "Grower House". Thus nothing was done for thrips control in the "Grower House".

The problem in our study was the unexpected and unexplained low number of thrips in the test greenhouses. We designed this study to contrast the effects of three different thrips control treatments under commercial greenhouse conditions. We were fully aware that conditions in each greenhouse at each location (e.g., mix of crop species, greenhouse size, production practices, etc.) would be dissimilar, including thrips population levels. That is why the study was replicated in several commercial greenhouses. We could not anticipate that unusually low thrips population levels would exist in the test greenhouses, particularly given past history in these same greenhouses. Unfortunately, meaningful contrasts among the three thrips control treatments could not be discerned due to the low levels of thrips among all treatments. Despite our best efforts, this study unfortunately provides an inconclusive evaluation of whether releases of *N. cucumeris* can be integrated with application(s) of the insecticide spinosad (Conserve™) for reliable and cost-effective management of western flower thrips on spring bedding plant crops.

11. References:

Thompson, G. D., R. Dutton, and T. C. Sparks. 2000. Spinosad – a case study: an example from a natural products discovery program. *Pest Management Science* **56**: 696-702.