

**Research Reports and Handouts  
for the Tri-state Greenhouse IPM Workshops  
2006, 2007 and 2008**

**Compiled here for the Final Report of the  
USDA Northeast IPM Competitive Grants Program**

**“Promoting IPM Implementation in Greenhouses: Banker Plants, Grower  
Education and an Assessment of Consumer Attitudes”**

**Principal Investigator: Margaret Skinner**

**These feature research conducted at the University of Vermont  
Entomology Research Laboratory. The purpose of these handouts was to keep  
growers in this region informed of our research activities and recent results.  
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## Habitat & Banker Plant Systems for Greenhouse IPM

Entomology Research Laboratory, University of Vermont  
2005 Summary of Results & Future Plans

Habitat Plant Systems (HPS) are a complex of plants grown together to provide a suitable environment for sustaining beneficial insects and alternate hosts. Banker plant systems are similar to HPS, but usually involve only one plant species. We evaluated the effectiveness HPS and banker plants to sustain and attract beneficial insects for suppression of thrips and aphids.



Habitat Plant System in a hanging basket

Nine HPS were placed in each of two 30 x 50 ft. greenhouses, one termed the conventional management house in which pests were controlled primarily with pesticides (CON), and one that relied mostly on biological-based management approaches (BMP). Each HPS was prepared a hanging basket contained six plants: barley, alyssum, English daisy, and lemon gem, hero yellow, and antique yellow marigolds. These plants were selected for either their capacity to produce pollen or because they served as a host plant for alternate hosts for beneficial insects. In the BMP house only, two predator species were released onto each HPS--*Orius insidiosus*, a predatory bug and *Amblyseius cucumeris*, a mite species; and the barley was inoculated with bird-cherry aphids, which feed specifically on grain plants and serve as an alternate host for *Aphidius colemani*, an aphid parasite. No insects were added to the HPS in the CON house. This served as a control site and allowed us to evaluate the potential for naturally-occurring beneficials to be attracted to the HPS from outside. Each HPS was checked weekly from late April until late July for the presence or absence of natural enemies and pests.

In the BMP house, *Orius* was released on the HPS three times over the season for thrips control, but they did not appear to establish themselves there. *Orius* was detected only a few times on an HPS and in very low numbers. However, they were found on bedding plants in greater numbers, and appeared to have become established there. Thrips were also commonly found on the HPS, particularly on the marigolds. Because of concerns that the HPS was serving as a reservoir for thrips, they were removed in late July. After removal, several *Orius* were found during routine scouting until late October on mums and asters. Thrips populations were low during this period, but it is impossible to confirm that this was as a result of the predator.

The barley with the bird-cherry aphids provided a suitable habitat for the *Aphidius colemani* parasite population. The parasites were released into the BMP house in January onto the barley/aphid banker plants, and later were found parasitizing the aphids on the barley in the HPS. This demonstrated the parasite's ability to search out its host. The parasite population was sustained at high levels throughout the summer. Despite the removal of the HPS and banker plants in late July, resident *Aphidius* continued to be sustained in the BMP house, where it suppressed an outbreak of green peach aphid on mums. Hyperparasites, tiny wasps that parasitize the *Aphidius* after it lays an egg in the aphid, were observed in the greenhouse in late July, and may have entered from outside. These hyperparasites significantly reduced the effectiveness of *Aphidius*. To combat the hyperparasite



Barley plant banker system in greenhouse lettuce crop.

problem, an aphid predator, *Aphidoltetes*, was released and sustained by the barley/aphid banker system. To eliminate this problem, the barley/bird-cherry aphid systems were removed, and the hyperparasites slowly disappeared. Research is also underway to evaluate the suitability of marigolds and pepper plants as effective banker plants to sustain predatory mites for spider mite and thrips management.

The barley/aphid banker plant system is currently being used successfully in greenhouse-grown lettuce, and will be further evaluated in the coming year. Banker plants using papaya, and a whitefly specific to that plant may be assessed as a way to sustain whitefly parasites.

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**Greenhouse Integrated Pest Management (IPM)  
At the University of Vermont  
Entomology Research Laboratory**

**Summary of Current & On-going Research  
2005-2006**

**Indicator Plants for Early Pest Detection**

Early detection of pests is the cornerstone of IPM. It enables growers to address pest populations when they are low and localized, which is ideal for biological control. Indicator plants are varieties that are particularly attractive to pests. Growers know which plants are more likely to become infested, and we are using this information to develop them into an effective monitoring tool. We are assessing the effectiveness of two varieties of marigolds (Lemon Gem and Hero Yellow) and comparing them to yellow sticky traps. Preliminary data show that early in the season, thrips were detected on the marigolds at least 1 week before they were observed on sticky cards. This was particularly noticeable when thrips numbers were low early in the growing season. The effectiveness of marigolds as trap plants declined over the season as other plants began to bloom. This suggests that flowering marigolds may be an excellent tool for detecting emerging early-season thrips infestations. This would enable growers to address the problem with biological control or a “soft” pesticide before a serious outbreak occurs which would demand a stronger pesticide that is less compatible with IPM. We also found that other insect pests were attracted to marigolds which are not commonly detected on yellow sticky cards, such as spider mites and aphids. This enhances the value of indicator plants as a cost-effective pest monitoring tool. Trials will be repeated in 2006 to further refine how best to use marigolds as trap crops, and which cultivar is the best for this purpose. This includes developing a planting schedule to ensure that the indicator plants are in flower for use early in the season.



Lemon Gem marigold serving as indicator plant.

**Banker Plants for Biological Control**

Timing is everything for biological control, and early intervention is critical for success. Research is underway to assess the effectiveness of banker plants as a reservoir for alternate hosts of biological control agents. These systems can be a cost effective means of providing a continuous supply of the beneficial organism, which will then spread throughout the greenhouse in search of the target pest. The beauty of this system is that the beneficial organism will be sustained even if the pest population is very low. We are testing barley plants inoculated with bird-cherry aphids (which feeds on barley, not bedding plants, so they won't become a pest) to support *Aphidius*, a parasitic wasp of several pest aphid species. We also hope to try other banker plant systems such as using papaya plants inoculated with a whitefly specific to that plant to rear *Encarsia*, a parasite of whitefly pest species. In addition, research is ongoing to evaluate different marigold varieties as banker plants for predaceous mites for management of both thrips and spider mites.

**Activity Patterns of Western Flower Thrips**

Knowledge of the daily activity patterns of thrips enables growers to apply pesticides when the pest is most active, thereby maximizing on their effectiveness. We are studying the flight patterns of thrips to determine what time of day they are the most active, and thus most likely to be exposed to a pesticide. We are also examining their dispersal and population growth on greenhouse crops to gain a better understanding of their life cycle to maximize spray efficiency.

## **Public Education about IPM**

Based on a recent survey, the public has very limited knowledge of the meaning of IPM. However, after learning the benefits of IPM to the environment and human health, customers commonly indicate that they would be willing to pay 10-20% more for IPM-grown plants. Therefore growers who use IPM will benefit directly from greater public awareness of IPM. A colorful IPM poster was developed and distributed to growers last year to hang in their greenhouses. This poster was very popular, and was reproduced for distribution throughout the Northeast. In addition, an eye-catching brochure describing IPM was also developed for distribution to the public by growers. This is a partnership between growers and the University to spread the word about IPM and its many benefits. In 3 years we will conduct another customer survey to assess the impact of our public education efforts.

## **Insect-killing fungi for Thrips Biological Control**

IPM utilizes multiple tactics to control pest problems, and insect-killing fungi are one of several biological control agents that can contribute significantly. We are testing novel whey-based formulations to enhance the effectiveness of these beneficial microbes for use against thrips. In addition, additives such as sugar and bakers yeast will be evaluated.

## **Quality Assessment of Natural Enemy Shipments**

To be effective, a biological control agent must be in good health when released into the crop. Natural enemies are commonly shipped long distances under adverse climatic conditions which may reduce their effectiveness. The quality of predatory mite shipments from different distributors and shipping methods is being investigated to evaluate logistical and economical barriers faced by growers. Guidelines for assessing the quality of mite shipments will be developed that could be used by growers.

## **Scouting Efficiency & Costs /Benefits of Conventional vs. Biologically-Based Management**

Integrating biological control into an IPM program is complex. It requires vigilant scouting, rigorous record-keeping and considerable investigation and experimentation. The early detection of pests is critical, as is a thorough knowledge of what biological controls are available and when best to use them. We are testing different scouting methods, assessing them in terms of the time they take and how effective they are at detecting pests. For several years conventional pesticide-based pest control and biologically-based management have been compared here at the Entomology Research Laboratory with regard to the overall cost and effectiveness of both methods. Our hope is to develop systems for efficiently scouting crops and using biological control agents with and without pesticides that growers could adopt in their production program that are both cost-effective and practical.

## **Scientists and Technicians Involved with These Research and Outreach Activities**

Bruce L. Parker  
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Svetlana Gouli  
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## **Funding Sources (in Alphabetical Order)**

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VT Greenhouse IPM Program  
USDA Agriculture Research Service

USDA HATCH Project  
USDA Northeast IPM Competitive Grants Program

**Greenhouse Integrated Pest Management (IPM)  
At the University of Vermont Entomology Research Laboratory**

**Summary of Current & On-going Research  
2006-2007**

Prepared by Cheryl E. Frank, Margaret Skinner & Bruce L. Parker

**Indicator Plants for Early Pest Detection**

Early detection of pests is essential for effective IPM. It enables growers to address pest problems when populations are low and localized. This is ideal for using biological control successfully. Indicator plants are varieties that are particularly attractive to pests. We are assessing the effectiveness of two varieties of marigolds (Lemon Gem and Hero Yellow) compared with yellow sticky traps. Preliminary data show that thrips can be detected 3 weeks earlier on flowering indicator plants than on yellow sticky cards. This was particularly noticeable when thrips numbers were low early in the growing season and the indicator plants were the only plants flowering. This suggests that flowering marigolds may be an excellent tool for detecting emerging early-season thrips infestations enabling growers to address the problem with biological control or a “soft” pesticide before a serious outbreak occurs. See handout entitled “*Improving Thrips Control Through Better Monitoring and Timing of Pesticide Applications*” for more information.

**Banker Plants for Biological Control**

Timing is everything for biological control, and early intervention is critical for success. Research is underway to assess the effectiveness of banker plants as a reservoir for alternate hosts of biological control agents. These systems can be a cost effective way of providing a continuous supply of beneficials which spread throughout the greenhouse searching for the pest. The beauty of this system is that the beneficial organism will be sustained even if the pest population is very low. We are testing barley plants inoculated with bird-cherry aphids (which feeds on barley, not bedding plants, so they won't become a pest) to support *Aphidius*, a parasitic wasp of several pest aphid species. In addition, research is ongoing to evaluate marigolds as banker plants for predaceous mites to manage both thrips and spider mites. We also hope to try other banker plant systems such as eggplants inoculated with whitefly to support *Encarsia* and *Eretmocerus*, two whitefly parasites.



Eggplant banker plant for *Encarsia*  
in Canadian poinsettia crop.

**Activity Patterns of Western Flower Thrips**

Knowledge of thrips daily activity patterns enables growers to apply pesticides when the pest is most active, thus maximizing on effectiveness. We are studying thrips flight patterns to determine what time of day they are most active, and thus most likely to be exposed to a pesticide. We are examining their dispersal and population growth on greenhouse crops to better understand their life cycle and maximize spray efficiency. Preliminary data suggest that thrips larvae are more active in the evening, making it an ideal time to spray a pesticide. See handout entitled “*Improving Thrips Control Through Better Monitoring and Timing of Pesticide Applications*” for more information.

## **Insect-killing Fungi for Thrips Biological Control**

IPM utilizes multiple tactics to control pest problems, and insect-killing fungi are one of several biological control agents that can contribute significantly. We are testing novel whey-based formulations to enhance the effectiveness of these beneficial microbes for use against thrips. In addition, additives such as sugar and bakers yeast will be evaluated.

## **Quality Assessment of Natural Enemy Shipments**

To be effective, a biological control agent must be in good health when released into the crop. Natural enemies are commonly shipped long distances under adverse climatic conditions which may reduce their effectiveness. We are assessing the quality of predatory mites following shipments testing overnight versus two-day shipping. This will help growers decide if it is necessary to invest the additional cost of overnight shipping to ensure successful biological control. Guidelines for assessing the quality of mite shipments will be developed that could be used by growers.

## **Scouting Efficiency & Costs /Benefits of Conventional vs. Biologically-Based Management**

Integrating biological control into an IPM program can be complicated. It requires vigilant scouting, rigorous record-keeping and considerable investigation and experimentation. The early detection of pests is critical, as is a thorough knowledge of what biological controls are available and when best to use them. We are testing different scouting methods, assessing them in terms of the time they take and how effective they are at detecting pests. For several years conventional pesticide-based pest control and biologically-based management have been compared here with regard to the overall cost and effectiveness of both methods. Our hope is to develop systems for efficiently scouting crops and using biological control agents with and without pesticides that growers could adopt in their production program that are both cost-effective and practical. We have found that it is feasible to reduce chemical pesticide use considerably by using biological control. Furthermore, the crop of plants that are produced in the bio-based greenhouse are of as good or better quality as those produced using conventional pesticide-based control.

## **Environmentally-Friendly Greenhouse Design**

Traditionally greenhouses are significant consumers of non-renewable energy. The ERL recently received funds to design a cost-effective environmentally-friendly greenhouse. This will involve integrating many technologies to capture heat from renewable resources such as manure, solar and geo-thermal sources. Equally important is the conservation of any heat generated with specialized insulating materials and reflective surfaces. Specialists in greenhouse design, solar energy and bio-engineering have been enlisted to collaborate on the project. The design we develop will be in components which will allow growers and farmers to integrate one or more aspects of renewable energy to supplement their operation. The design will offer opportunities for dairy farmers to diversify their revenue sources. It will also provide greenhouse growers who have nearby access to manure ways to reduce their energy costs and produce compost which can provide an additional source of revenue.

## **Scientists and Technicians Involved with These Research and Outreach Activities**

Bruce L. Parker  
Margaret Skinner

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Teri Hata  
Robert Jones

Jan Manon  
Tom Doubleday

## **Funding Sources**

- American Floral Endowment
- VT Greenhouse IPM Program
- Univ. of Vermont Extension
- USDA Northeast IPM Competitive Grants Program
- USDA Agric. Research Service
- USDA HATCH Program
- USDA CSREES

**Greenhouse Integrated Pest Management (IPM)  
At the University of Vermont  
Entomology Research Laboratory**

**Summary of Current & On-going Research  
2007-2008**

Prepared by Cheryl E. Frank, Margaret Skinner & Bruce Parker

### Eggplants as Guardian Plants for Whitefly Control in Poinsettias

Insect pests are attracted to some plant cultivars more than others. Those plants act as a trap plant, drawing the pest away from the crop. Eggplants have been shown to serve that purpose for whiteflies. Why not use that trap plant as a site for controlling the pest by providing natural enemies to combat them? We tested eggplants as Guardian Plan Systems (GPS) in poinsettias at local commercial greenhouses. We supplied *Eretmocerus eremicus*, a whitefly parasitoid on the eggplants to control whiteflies. We found that the eggplants were highly attractive to whitefly adults and the parasitoids were always present. In some instances we found up to 12 times more whitefly on the eggplants than on the surrounding poinsettias and over time, more than 6 times more nymphs. Whiteflies were also found 1 week earlier on the eggplants than on standard sticky traps and it took significantly less time to find the whitefly using the eggplants as a quick scouting tool than by conducting random individual plant inspections. Pesticide usage was also reduced by 50 – 100%. For more information, please see “Guardian plant systems for greenhouse integrated pest management” handout.



Eggplant guardian plant in poinsettias in a commercial greenhouse.

### Indicator Plants for Early Pest Detection

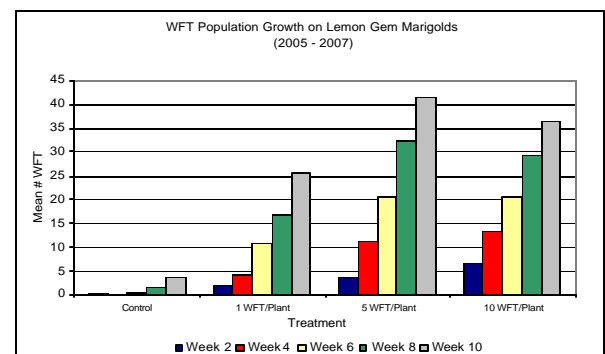
Early detection of pests is essential for effective IPM. It enables growers to address pest problems when they are low and localized with biological control or a “soft” pesticide before a serious outbreak occurs. Indicator plants are varieties that are particularly attractive to pests. We finished a 3-year study assessing the effectiveness of two varieties of marigolds (Lemon Gem and Hero Yellow) and compared to yellow sticky cards (YSC). These data show thrips can be detected as much as 3 weeks earlier on flowering indicator plants than on YSC. This was especially noticeable when the marigolds were the only plants in bloom in early in the growing season. There were no significant differences between the two marigold varieties tested suggesting that they are both equally as attractive. Other pests which are not readily detected by sticky traps were also attracted to the indicator plants. For example, in all 3 years in 3 of the 4 test greenhouses, aphids were found on the indicator plants before they appeared on YSC, alerting the growers that an infestation was present. Marigolds as indicator plants thus have a great potential as an early warning IPM tool of pest infestations that could save growers time and money.



Indicator plants and yellow sticky trap in a commercial greenhouse.

### Population Growth of Thrips on Indicator Plants

We recently completed a 3-year study assessing how long marigold indicator plants could be left in place before they would act as a source of thrips to greenhouse crops. We inoculated caged marigolds with different numbers of thrips (0, 1, 5 or 10/plant) and monitored their growth over a 10 week period. Over the 3 years, our data suggest that marigold indicator plants can be left untreated in a greenhouse for at least 4 weeks before they begin to act as a source of thrips.



## **Banker Plants for Biological Control of Thrips & Spider Mites**

Timing is everything for successful IPM, and early intervention is critical. Biological control agents must be present early to address pest outbreaks when they are low and isolated. Also, by providing a continuous source of biological control agents in a greenhouse would save growers money by having a natural enemy population reproducing on their own so multiple releases would not be needed. We completed a 3-year study to evaluate banker plants as a reservoir for biological control agents. We tested lemon gem and hero yellow marigolds, and bean and pepper plants as banker plants for predaceous mites for spider mite control. We found that the hero yellow marigolds provided the most suitable habitat for predaceous mites. Predatory mites survived longer and were being sustained by pollen in the absence of spider mite prey. When spider mite prey was available, more predaceous mites were present on the banker plants compared to those that did not have a source of prey. The largest drawback to this study was the buildup of thrips on the banker plants. Thrips became so severe that the banker plants themselves began acting as a source of thrips to the crop.

### **Insect-killing Fungi for Thrips Biological Control**

IPM utilizes multiple tactics to maintain pests at acceptable levels, and insect-killing fungi are one of several biological control agents that can contribute significantly. We are testing novel whey-based formulations to enhance the effectiveness of these beneficial microbes for use against thrips. In addition, additives such as sugar and bakers yeast are being evaluated. The effect of these beneficial microbes is being tested against two predatory mite species to determine the compatibility of these two biological control agents.

### **Insect-killing fungi and Banker Plants for Thrips Control**

This new project was conceived of based on results from our work on marigold indicator and banker plants and insect-killing fungi. Over the next 5 years, we will be assessing marigold banker plants for thrips control. Experience tells us marigolds: 1) are highly attractive to thrips, 2) can sustain predaceous mites on pollen in the absence of prey and 3) will act as a source of thrips if left in place for over 4 weeks. We will inoculate marigolds with different numbers of thrips, predatory mites and soil applications of granular insect-killing fungi. These treatments will be monitored over time to observe the effect of each component alone and in combination. We will then pick the best treatments and test them in local commercial greenhouses.

### **Environmentally-Friendly Greenhouse Design**

Traditionally greenhouses are significant consumers of non-renewable energy. In cooperation with an environmental engineer and greenhouse/compost specialist, we are currently designing a cost-effective environmentally-friendly greenhouse. This will involve integrating many technologies to capture heat from renewable resources such as manure, solar, geo-thermal sources. Equally important is the conservation of any heat generated with specialized insulating materials and reflective surfaces. Specialists in greenhouse design, solar energy and bio-engineering have been enlisted to collaborate on this project. The design we develop will be in components which will allow growers and farmers to integrate one or more aspects of renewable energy to supplement their operation. The design will offer opportunities for dairy farmers to diversify their revenue sources. It will also provide greenhouse growers who have nearby access to manure ways to reduce their energy costs and produce compost which can provide an additional source of revenue.

### **Scientists and Key Personnel Involved with These Research and Outreach Activities**

|                  |                |              |              |                    |
|------------------|----------------|--------------|--------------|--------------------|
| Bruce L. Parker  | Svetlana Gouli | Adana Kassa  | Teri Hata    | Don Tobi           |
| Margaret Skinner | Vladimir Gouli | Cheryl Frank | Robert Jones | Workstudy students |

### **Funding Sources (in Alphabetical Order)**

- American Floral Endowment
- Northeast IPM Center
- Univ. of Vermont Extension
- USDA Agric. Research Service
- USDA CSREES
- USDA HATCH Program
- USDA Northeast IPM Competitive Grants Program
- VT Greenhouse IPM Program

We extend our appreciation to the growers who cooperated with us on the research described above. They contributed significantly to the success of our work and ensure that the results are of value to other growers.

# Guardian Plant Systems for Greenhouse Integrated Pest Management

## Summary of Results at the University of Vermont Entomology Research Laboratory

- December 2007 -

Early pest detection is essential for successful greenhouse IPM. By detecting problems early, growers can manage pest populations when they are low and localized. Insect pests are attracted to some plant cultivars more than others and act as a trap plant, drawing the pest away from the crop. Eggplants have been shown to effectively serve as a trap plant for whiteflies. So why not use the trap plant as a site for controlling the pest by providing their natural enemies on the plant too? In 2007, the PIs of this project sought to assess the use of eggplants as Guardian Plant Systems (GPS) in poinsettias, bedding plants and tomatoes. The GPS would first attract whiteflies from a crop, and then serve as a site for releasing parasitoids to control the pest. This report summarizes the results to date of research done at the Univ. of Vermont in poinsettias.



*Eretmocerus eremicus* adult.

Techniques are being developed to utilize trap plants to attract the pest as well as sustain natural enemies in greenhouses. The trap plant could provide a continuous source of the pest, which could provide a cost-effective, on-going supply of their natural enemies. The GPS offer several IPM roles: 1) an indicator plant to attract the pest early, 2) a trap plant to draw the pest from the crop, and 3) a banker plant to provide a sustained source of beneficials.



Eggplant GPS in poinsettias.

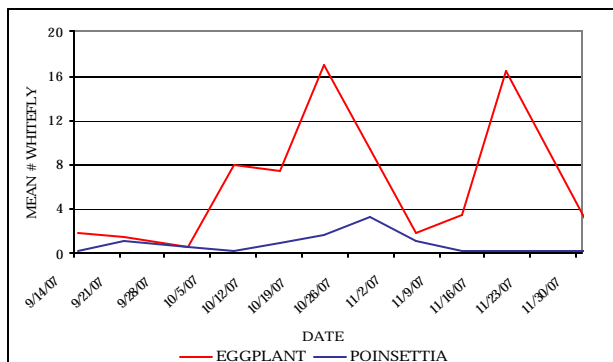


Silverleaf whitefly adult.

We tested eggplants (var. Fairy Tale Hybrid) as a GPS in poinsettias at two Vermont commercial greenhouses for whitefly control. *Eretmocerus eremicus*, a parasitoid that attacks nymphs of both greenhouse and silverleaf whiteflies, was released weekly on the GPS. We monitored whitefly and parasitoid numbers on the GPS, yellow sticky traps and the poinsettias throughout the fall growing season until mid-December to evaluate the effectiveness of the GPS as an IPM tool.

### Question #1: Do eggplant GPS attract whitefly and act as an early warning indicator?

Low to moderate levels of silverleaf whitefly (mean: 0-3 adults/poinsettia, 0-150 adults/sticky trap, 0-8 nymphs/plant) were present throughout the season. Whitefly adults were found 1 week earlier on the GPS than on sticky traps. When low levels of whitefly were observed, more were found on the GPS than on sticky traps. In one of the test greenhouses, >12 times more whitefly adults were found on the GPS than the poinsettias when whitefly populations were high. When considered over the season, >6 times more nymphs were found on the eggplants than on poinsettias. In both greenhouses it took significantly less time to find a whitefly on the GPS than on the poinsettias and whitefly were always found on the eggplants. This demonstrates that GPS have the potential to save growers time and money by providing a cost effective scouting tool and



Mean number of whitefly adults on poinsettias and eggplants in one test greenhouse.

clearly indicates that the GPS were more attractive to whiteflies than poinsettias (see graph).

### **Question #2: Are *Eretmocerus* parasitoids sustained by the eggplant GPS with their whitefly prey?**

There were significantly more *E. eremicus* on the GPS than on the poinsettias. This was expected given the higher number of whitefly on the GPS compared with the poinsettias. It appeared that limited dispersal of the parasitoids away from the GPS occurred. There were always more parasitoids on the poinsettias located closest to the GPS and less on those farther away. There was evidence of significant host feeding on the whitefly nymphs by the parasitoids on the GPS with high nymph populations. Parasitism of whitefly nymphs was >40% on both the GPS and the poinsettias. *E. eremicus* appears to serve a dual role, both as a predator and a parasitoid. It is unclear if significant parasitoid reproduction occurred and if the natural enemy population was sustained on the GPS. To ensure that adequate pest suppression was achieved, we made parasitoid releases weekly. In future studies it would be valuable to assess the effect of reducing the number of releases made, which would lower management costs.

### **Question #3: Does the use of the eggplant GPS help reduce pesticide use?**

In one test greenhouse where the GPS was used, no chemical pesticides were used in the finishing phase of poinsettia production, though in past years the grower had made one or more applications. At the beginning of the season a moderate number of whitefly were detected, but after the parasitoids became established, the population remained at low levels throughout the rest of the season. In the other test greenhouse, pesticide usage was reduced by 50% compared to equivalent greenhouses (2 vs 4 pesticides) where the GPS was not used. At the start of the season, this site had a moderate-high, level of whitefly infestation. The whitefly infestations became so high on the GPS that they were removed so they didn't serve as a pest source. Overall, the GPS system has a great potential to be an effective tool for the reduction of pesticide use in commercial greenhouses. If used throughout commercial greenhouses, a significant reduction in pesticide use would be realized. Better sanitation practices and reduction of residual whitefly populations before the season begins would enhance the effectiveness of the GPS.



Empty parasitized whitefly nymph.

#### ***Summary of Our Results***

- ✓ **There were more whitefly adults and nymphs on the eggplant GPS than on the poinsettias, demonstrating that eggplants are suitable as a trap plant.**
- ✓ **It took less time to find whiteflies on the eggplant GPS than by randomly scouting individual poinsettias.**
- ✓ **More parasitoids were present on the GPS than on the poinsettia crop.**
- ✓ **Pesticide use was reduced by 50-100% in commercial poinsettia crops by using the GPS.**

**Funding Sources :** USDA Northeast IPM Center Partnership Grant, Vermont IPM Program

#### **Collaborators (alphabetical order)**

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Chris Conant, Claussen's Florist & Greenhouse, Colchester, VT  
Ron & Ken Paquette, Paquette Full of Posies, Williston, VT

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