Greenhouse Integrated Pest Management (IPM)
University of Vermont Entomology Research Laboratory
Summary of Current & On-going Research 2012-2013

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Managing Thrips with Fungi, Predatory Mites, and a Pheromone in a Plant-Mediated System

We are evaluating use of marigolds, a thrips pheromone lure, insect-killing fungi and predatory mites combined together as a plant-mediated system to manage thrips. Marigolds and pheromone lures are highly attractive to thrips, drawing them from the crop to allow for their early detection. Predatory mites are released on the marigold plant leaves to feed on thrips larvae. When three are no thrips, predatory mites feed on marigold pollen sustaining them until prey becomes available. A granular fungal formulation is mixed into the soil to target pupating thrips. The granular formulation enables the fungus to colonize the soil, eliminating a need for repeat applications.

Marigold system in commercial greenhouse.

For several years, controlled greenhouse and laboratory trials have been conducted testing the effectiveness of different rates and strains of fungal formulations produced on grain combined with predatory mites (*Neoseiulus cucumeris*). Three fungi were tested, including the *Beauveria bassiana* isolate found in the commercial product Botanigard®. We found there were 80% less thrips on marigolds treated with an experimental isolate of *B. bassiana* in the potting soil compared to a marigold without the fungus. Combining this isolate with predatory mites in the marigold foliage further reduced the thrips population. Now we are currently testing this system in 12 commercial greenhouses at 6 sites, with the addition of a pheromone lure to increase its attractiveness. The following treatments were tested, 1) marigold with an experimental *B. bassiana* isolate, thrips lure and predatory mites, 2) marigold with the *B. bassiana* isolate in Botanigard®, thrips lure and predatory mites, 3) marigold with a thrips lure only, 4) marigold without a thrips lure, fungi, or mites, 5) yellow sticky card with thrips lure, and 6) yellow sticky card without a lure. At all sites, more thrips and damage were detected on the marigold system than surrounding plants. Though marigolds were highly attractive to thrips, because populations were generally low, differences in thrips numbers between the treatments were not significant. There was also little difference in the attractiveness of sticky cards and marigolds to thrips that had the lures than ones without lures. This suggests the lure may have limited value for detecting thrips. Mites were detected in marigold flowers throughout the experiment, suggesting that mites are sustained on thrips and/or pollen in the system for at least 12 wks, eliminating costs associated with their re-application. Over the next 2 years, we will continue to test and refine this system to determine the most effective and functional system for commercial greenhouses.

IPM One-On-One & Grower Training Session: Reducing Pesticides by Increasing IPM Proficiency

Over the past several years, the VT Greenhouse IPM One-on-One program has been increasing grower adoption of IPM in greenhouse ornamentals by providing individualized goal-oriented educational programs that provide hands-on learning experiences tailored to growers' unique interests, skill levels and needs. To date we have reached 9 locations in VT. Through meetings, surveys, site visits and evaluations, we assisted growers in their effort to increase implementation of IPM. All participants who took part in the program have adopted new practices, such as use of sticky cards and indicator plants for early pest detection, sanitation and rouging of infested plants, spot treatments rather than greenhouse-wide applications to reduce overall pesticide use, and refinement of biocontrol and pesticide use. All of the participating growers felt pest damage to their crop plants was reduced because they used more IPM. As a result of their improved scouting skills and implementation of systematic scouting programs, growers took action earlier to reduce or prevent outbreaks and damage. Growers in general said participating in the program gave them greater confidence in their ability to identify and manage their pests and they transferred this knowledge to co-workers. In addition, three of the locations have transitioned from conventional chemical control to a program that relies primarily on biological control to manage insect pests.

This past March, small training sessions were held in NH and VT that brought together over 45 growers or their workers. The goal of these sessions was to develop formal scouting programs by training on pest and disease diagnosis and soil and water testing in order to reduce their use of agrochemicals and increase their adoption of IPM and biological control. Through pre- and post-surveys we are tracking changes in management practices used by grower participating over the past growing season as a result of attending these intensive training sessions.

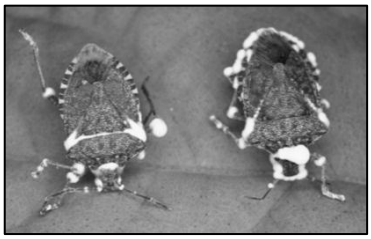
Bubble Greenhouse & Greenhouse Energy Efficiency

Greenhouses can demand large amounts of energy to produce crops during the winter. We are testing the suitability of two environmentally-friendly methods for reducing heat costs in hoop greenhouses—a standard thermal curtain and an experimental bubble insulation system. This is a unique device that generates soap bubbles to fill the space between the two layers of plastic covering the house. A standard 2-layer inflated plastic hoop house has an R-value of 1-2, while one filled with bubbles is reported to have an R-value of 30-40, which could reduce fuel use by 80%. To date results in our 3 test greenhouses (each 30 x 75 ft) show that the bubble system significantly outperforms the thermal curtain in reducing fuel use. Over the period of operation in 2011 and 2012, gas use was less in the houses with the curtain and bubble system than in the unimproved house. However, further improvements are needed for the bubble system to fully realize its energy conservation potential. Testing will continue through 2013 while we continue to refine the operation of the bubble system. We are also coordinating energy audits for growers in ME, NH and VT to demonstrate the value of this service for cutting energy costs. If you are interested in receiving an audit at your operation, contact Margaret Skinner (see below). Check out the **Small Farm Quarterly** article "***Soap Bubbles to Insulate Greenhouses: A New Approach to Energy Conservation***" for an article describing this system.

WBC larvae

Western Bean Cutworm (WBC)

This is an emerging pest in the eastern US. It attacks crops late in the growing season, feeding on field, sweet and popcorn and dry and snap beans. Larvae feed on developing kernels in husks or beans in pods. Prior to 2000, losses were limited to the western Corn Belt states, but now they are moving East. In 2011 and 2012, we collaborated with Penn State and Cornell Univ. on a survey, which resulted in the first detection of WBC in VT (Chittenden Co.). In 2012, the survey was expanded to three VT additional counties (Franklin, Rutland and Addison). This will allow farmers to be prepared to manage WBC in the future. In 2012, we collected 82 WBC adults. Although these numbers are low, it is expected that this could become a serious pest in the future. Please see the "***Regional Western Bean Cutworm Monitoring Program Progress Report and Results Summary"*** handout for more information.



Dead BMSB with fungal outgrowth after treatment.

Brown Marmorated Stink Bug (BMSB)

This exotic pest is expected to impact vegetable and fruit production in our region in the future. The BMSB has spread to 38 states including Maine, New Hampshire and Vermont. It feeds on over 300 plants, many of which are important food crops causing millions of dollars in damage. It is also a nuisance pest, entering homes in the fall in large numbers. To date, no chemical pesticide or biological control agent has been found to be particularly effective. UVM ERL scientists tested different concentrations of the commercial insect-killing fungus Botanigard® against the adult stage in lab trials. The high rate killed 67-100% of the adults in 12 days. We hope to continue this work in the future when funds are available. Several other native insects are often mistaken for the BMSB. If you see a suspect insect, collect it and take it to your Extension office to check its identity. Please refer to the ***"Brown Marmorated Stinkbug***" handout that describes this pest and common lookalikes.

Scientists, Technicians and Students Currently Involved with these Activities

Bruce L. Parker	Margaret Skinner	Cheryl E. Frank Sullivan	Ross Bell
Svetlana Gouli	Vladimir Gouli	Don Tobi	Joyce Bell

Funding Sources and Grower Collaborators (Alphabetical Order)

- Allen Brother's Farms
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- Claussen's Florist & Greenhouses
- Dutton Berry Farm
- Edgewater Farm
- Gardener's Supply
- ME Extension Service
- NH Extension Service
- NH Horticulture Foundation
- NE Sustainable Agric. Res. & Ed. Prog.
- Organic Farming Res. Foundation
- Sam Mazza's Farmstand
- Univ. of Vermont Extension System
- USDA Emerging & Critical Pest Prog.
- USDA Extension IPM Program
- USDA Agric. Research Service
- USDA HATCH Prog.
- USDA NE IPM Comp. Grants Prog.
- USDA NRCS CIG Prog.
- VT Greenhouse IPM Prog.
- Walker Farm

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