UTAH PESTS News

Utah Plant Pest Diagnostic Laboratory and USU Extension Vol.VIII, Spring 2014

What's Inside

News Highlights

YELLOW SAC SPIDERS GET A BAD RAP

On two occasions, Mazda has had to recall thousands of 2008-2012 Mazda6 model cars due to the implication that common yellow sac spiders (one specimen identified by an entomologist) enter fuel vent hoses and build webs and/or sacs. The fear is that the blocked hose will cause pressure to build and the fuel tank to crack. Most national news sources have erroneously reported that the spiders are "attracted to gasoline," whereas it is more probable that they are attracted to the habitat: cool and dark. (Mazda is installing a blocking spring in the fuel line and software on recalled cars to combat the issue.)

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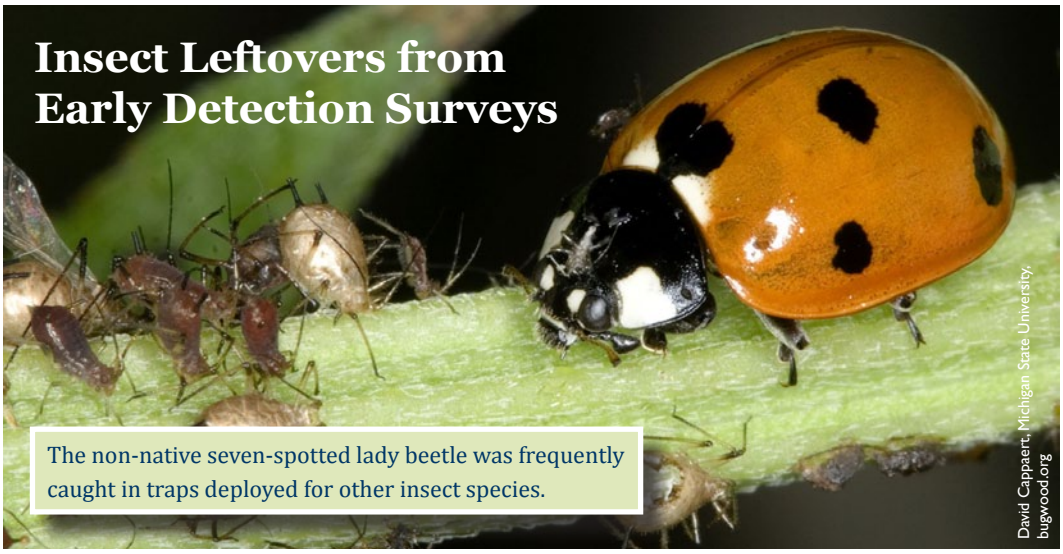
Insect Leftovers from Early Detection Surveys



The non-native seven-spotted lady beetle was frequently caught in traps deployed for other insect species.

Each year, the Utah Cooperative Agricultural Pest Survey (CAPS) program conducts statewide trapping surveys for exotic plant pests that have not yet been recorded in the state, but that threaten our agricultural and natural resources. In these traps, non-target insects (termed "by-catch") are frequently captured, including species of agricultural importance. In 2013, USU researchers Lori Spears and Ricardo Ramirez were awarded a USU Extension grant to learn more about these unintentionally trapped insects, such as how their diversity and abundances change over space and time.

During the summer of 2012, Spears and Ramirez conducted a statewide survey for old world bollworm, Egyptian cottonworm, and cotton cutworm. Approximately 90 bucket traps were hung in alfalfa and corn fields throughout Utah, and checked bi-weekly from July to September. The most frequently captured by-catch insects were identified to species.

Several species of lady beetles were among the most commonly caught species. The three most common were the native convergent lady beetle (*Hippodamia convergens*) and transverse lady beetle (*Coccinella transversoguttata*), and the non-native seven-spotted lady beetle (*Coccinella septempunctata*). The non-native, multicolored Asian lady beetle (*Harmonia*

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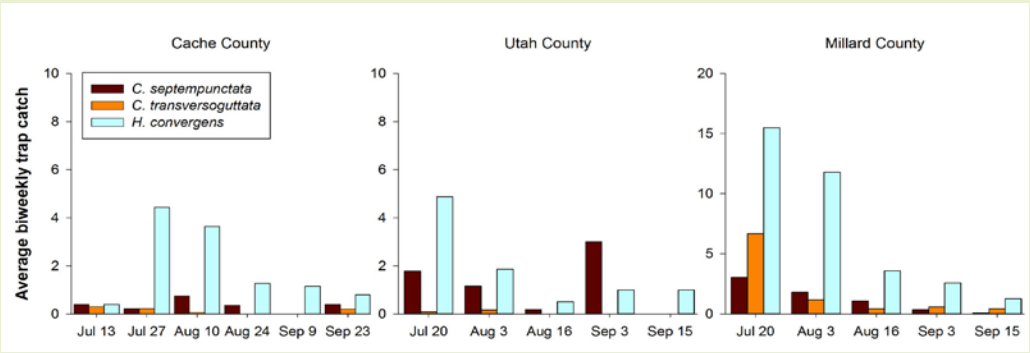

Average number of lady beetles collected per trap, bi-weekly, in Cache County, Utah County, and Millard County, Utah in 2012. Data were pooled across alfalfa and corn field traps.

UTAH PESTS Staff

Diane Alston
Entomologist
diane.alston@usu.edu
435-797-2516

Ryan Davis
Arthropod Diagnostician
ryan.davis@usu.edu
435-797-2435

Marion Murray
IPM Project Leader
Editor, Utah Pests News
marion.murray@usu.edu
435-797-0776

Claudia Nischwitz
Plant Pathologist
claudia.nischwitz@usu.edu
435-797-7569

Ricardo Ramirez
Entomologist
ricardo.ramirez@usu.edu
435-797-8088

Lori Spears
USU CAPS Coordinator
lori.spears@usu.edu
801-668-4056

Utah Plant Pest Diagnostic Lab
BNR Room 203
Utah State University
5305 Old Main Hill
Logan, UT 84322

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Lady Beetle By-Catch, continued from page 1

axyridis), and an additional four species of native lady beetles were also identified, although in fewer numbers. Other common by-catch included pollinators, such as honeybees and bumblebees, and non-target moths, including corn earworm.

Non-native lady beetles such as seven-spotted and multicolored Asian lady beetles were originally introduced to the U.S. to help control aphids and other harmful plant pests. While this is encouraging from the perspective of pest management, non-native lady beetles, like all introduced species, have the potential for causing ecological problems. For example, non-native lady beetles compete with native species for resources, and can prey on native lady beetles or other beneficial insects.

Research conducted by USU Entomologist, Dr. Ted Evans, found that when the non-native seven-spotted lady beetle was introduced into alfalfa fields in Utah, the population sizes of native lady beetles declined dramatically. He also found that native species still thrived in non-agricultural lands, and that the native convergent lady beetle quickly colonized alfalfa fields when aphid populations were high and disappeared when aphid populations were low. Conversely, seven-spotted lady beetle was common in alfalfa fields even when aphid populations were low. Our preliminary results show that the native convergent lady beetle was the dominant lady beetle species collected as by-catch. Measuring aphid abundances was not our priority during the 2012 trapping season, but from these results, we surmise that the return of native lady beetles to alfalfa fields may have been due to high aphid abundances.

Another possibility for the discrepancy between our results and Evans' research is that the seven-spotted lady beetle was more abundant earlier in the season, before our traps were placed in fields. If this was the case, then we missed our window of detecting high abundance of this species.

Bucket trap used for monitoring some invasive moth species.

Convergent lady beetle (*Hippodamia convergens*)

Analyses of additional years of survey data will contribute to our understanding of the current ratio of native to non-native lady beetles in Utah field crops. In addition, we hope to pair by-catch data with environmental data to understand insect activity patterns that may be useful for Extension and Utah growers.

- Lori Spears, USU CAPS Co-Director

References:

Evans, E.W. 2000. Habitat displacement of North American ladybirds by an introduced species. Ecology 85:637-647.

Evans, E.W. 2004. Morphology of invasion: body size patterns associated with establishment of Coccinella septempunctata (Coleoptera: Coccinellidae) in western North America. European Journal of Entomology 97:469-474.

Progress on School IPM Implementation in Colorado and Utah

Dr. Deborah Young is a Professor and Extension Specialist at Colorado State University. She is director of the Center for Sustainable Integrated Pest Management and conducts research and outreach on projects related to IPM practices affecting schools, housing, and parks and recreational areas. CSU and USU have a collaborative project on increasing school IPM in both states.

Using methods such as prevention, sanitation, and biological control agents on agricultural lands to manage pest populations isn't new. What is new is using integrated pest management (IPM) in schools. While only a small percentage of K – 12 schools are currently using IPM, there is a national effort to make safe, effective pest management standard practice in all schools. The Salt Lake City and Denver School Districts are shining examples of how to implement IPM.

For the last two years, with funding from the U. S. Environmental Protection Agency, the Rocky Mountain Consortium (comprised of members from Utah and Colorado) has been helping other school districts implement IPM. In 2012, the Consortium conducted an online survey to find out which policies, pests and pest management practices were being used. The survey was sent to of all school districts in the two states. You can see the results at utahpests.usu.edu/schoolIPM.

Consortium members are using the results to work directly with pilot schools, conduct pest assessments, and train staff on how to implement IPM. Here are a few critical areas we are addressing to help schools create a healthy learning environment:

- One of the key steps to implementing a school IPM program is having a designated IPM coordinator ("The Bug Stops Here" person). Only 17% of school districts reported having such a person. The IPM coordinator is an important part of the overall environmental quality team for the school or district and interacts with upper administration, principals, teachers, custodians, food service, and maintenance on a regular basis.

- Mice are, without a doubt, one of the biggest pest issues schools face. Sealing cracks, crevices and doors (pest proofing) and using properly placed and baited snap traps is critical to controlling mice. Eighty-five percent of school districts report mice, pigeons, raccoons, rats, bats or fox in or around schools.

- Ants are another frequent and persistent pest encountered around schools. Most schools (80%) reported that ants have been a problem. Seventy-three percent of those used a perimeter insecticide spray to control them. An effective and safer way to manage ants in schools is to use preventative methods and bait stations.

All schools, such as the Nebo School District's School IPM Inspection Team, should conduct careful inspections before initiating an IPM program. This allows allows for beginning pest management efforts in the most vulnerable areas.

- School districts found these goals equally important: reduced pesticide exposure; improved air quality; reduced number of pests; and pest control costs. Besides reducing pesticide costs and dealing with maintenance issues (fixing leaky faucets and replacing door sweeps), IPM can save money for the school district.

We have come a long way since 1962 when Rachel Carson wrote "Silent Spring". This book is credited with bringing the issue of how pesticides affect human and environmental health to the public's attention. In the 1970's EPA was created and given jurisdiction over pesticide regulation and Pesticide Education Programs were initiated at Land Grant Universities. There was an increase in IPM research in the 1980's.

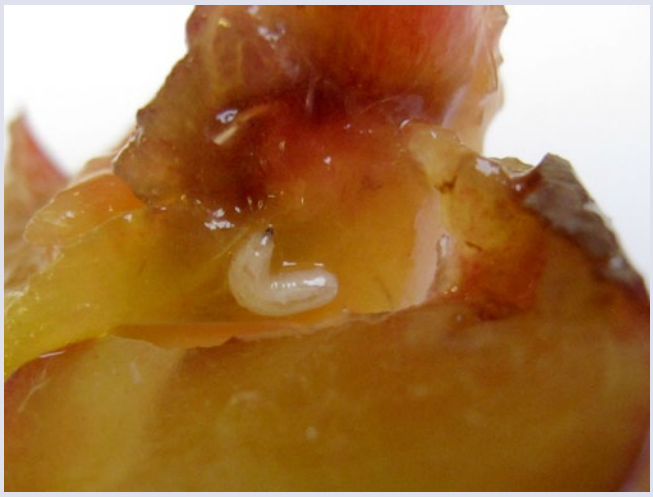
Today, use of IPM by growers and gardeners is widely adopted. Both EPA and USDA are strong proponents of IPM, and provide funding for its implementation in public structures. IPM in schools, housing and public buildings, indoors and on public grounds, reduces exposure to pests and pesticides, is cost effective, and reduces pesticide use and pest complaints.

If you would like to start an IPM program at your child's school, contact Ryan Davis (ryan.davis@usu.edu) or Deborah Young (deborah.young@colostate.edu).

Apple Maggot in Utah

Apple maggot is a true fruit fly in the Family Tephritidae. It has a prominent 'F' banding pattern on its wings, and the larvae tunnel into pome, stone, and some ornamental fruits. Female flies have a sharp ovipositor for laying eggs under the skin of ripening fruits.

Apple maggot primarily infests native hawthorn in Utah (*Crataegus rivularis*), but recently it has been found in home garden plums (*Prunus domestica*) in the Salt Lake Valley. It is a quarantine pest in Utah, regulated by the Utah Department of Agriculture and Food. Its presence in commercial fruit production areas can inflict substantial economic harm through loss of export markets. In addition, infestations cause fruit damage which could increase insecticide use in orchards, disrupting integrated pest management programs.



Apple maggots are typically known for infesting apples, but in Utah, recent infestations have been in plums.

Apple maggot is native to northeastern and north central North America, where it historically fed on fruit of wild hawthorn. In the eastern U.S., it is primarily a pest of apple, and requires a consistent insecticide program to keep fruit maggot-free. Apple maggot was first recognized in Utah in 1983, but an extensive survey of the state in 1985 showed that it was widely distributed in northern and west central regions of the state where it was most likely feeding on fruits of river hawthorn and unmanaged cherry. These facts implicate that apple maggot is likely native to parts of Utah.

In the mid-1980s, there was a small flush of findings of apple maggot flies on traps in non- and low-managed cherry orchards in northern Utah. Removal of abandoned orchards and elevated attention to management in nearby commercial orchards reduced its presence, and concern for its management diminished over time. To date, apple maggot has not been identified from apple fruits in Utah.

In 2013, the Utah Plant Pest Diagnostic Lab diagnosed apple maggot in plum fruits from several home gardens in Salt Lake County. In addition, several suspect apple fruit samples were submitted with possible insect tunnels, but no larvae were found. An effort is underway to educate home gardeners and producers about this fruit fly pest, and its potential to cause crop loss and economic harm to the state's fruit industry.

The risk for infestation by apple maggot is increased when fruit trees are left unsprayed and when they are growing near stands of native hawthorn. The key management strategies for apple maggot include mass-trapping (place multiple traps in fruit trees), sanitation (remove hawthorn trees and destroy infested fruit), ground barriers (place impenetrable mulches underneath infested trees to reduce access of larvae to soil), and insecticides (those used for cherry fruit fly will work on apple maggot).

Best management practices for commercial orchards at risk for apple maggot infestation include prompt and thorough removal of fruit at harvest, removal of nearby hawthorn stands and unmanaged fruit trees, and maintenance of an effective insecticide program when susceptible fruit is present.

USU Extension has produced an apple maggot fact sheet with more information, and will trap for this pest in hot spot locations. There are several types of effective traps for

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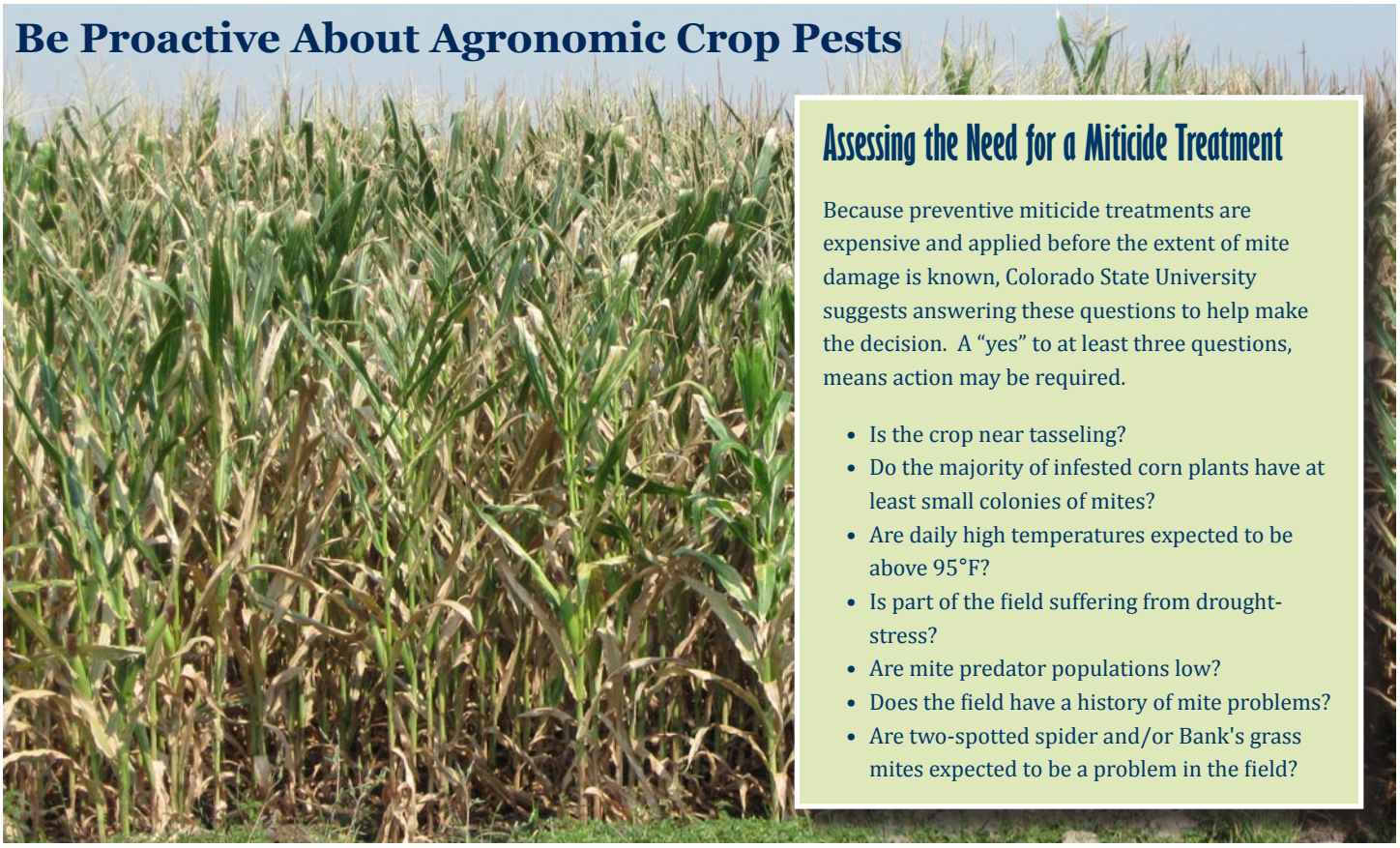
Be Proactive About Agronomic Crop Pests



Assessing the Need for a Miticide Treatment

Because preventive miticide treatments are expensive and applied before the extent of mite damage is known, Colorado State University suggests answering these questions to help make the decision. A "yes" to at least three questions, means action may be required.

- Is the crop near tasseling?
- Do the majority of infested corn plants have at least small colonies of mites?
- Are daily high temperatures expected to be above 95°F?
- Is part of the field suffering from drought-stress?
- Are mite predator populations low?
- Does the field have a history of mite problems?
- Are two-spotted spider and/or Bank's grass mites expected to be a problem in the field?

MITES IN CORN

The warmer weather and expected drought conditions in the West could make for a suitable environment for outbreaks of mites this season. In the last several years, a number of Utah counties have had to deal with Bank's grass mite and sometimes two-spotted spider mite in corn. Warm and dry conditions allow mites to build up rapidly because their generation times are shortened, they feed more, road dust builds up on corn leaves creating favorable mite habitat, and their natural predators are less effective under these conditions. In addition, drought-stressed plants are thought to have increased availability of amino acids allowing mites to thrive. With this in mind, proper irrigation is key for avoiding mite outbreaks and monitoring mite populations is a useful tool to decide whether treatment is warranted.

Start with monitoring drought-stressed sections of a field for mites. For established mite infestations, the general guideline for mite treatment is if damage on the lower third of the plant is visible and mite colonies are present on the middle third of the corn plants. Note that mite treatments when corn has reached the hard-dough stage are too late to provide an economic benefit.

ALFALFA WEEVIL

Early season monitoring of alfalfa weevil is key for successful suppression and improving the bottom line. Weevil damage occurs early in the season around the first cutting. Therefore the best success for management is monitoring weevil larvae with a sweep net (or stem sampling) regularly before the first cutting when stems are at least 10 inches tall. In 2008, USU county faculty conducted a study investigating commercial alfalfa fields where insecticides were used to treat weevil versus fields where weevil was not treated. They found that yield was not affected by treatment of weevil because weevils did not reach economic thresholds that year (<10 weevil larvae per sweep) - treatment would not have been recommended. Sampling in this case would have helped growers' bottom line. Unnecessary treatment of weevil, particularly with pyrethroid insecticides, can also lead to outbreaks of other pests like aphids that would require additional treatment costs.

Unfortunately, weevils are most problematic following a warm spring because weevils are active early in the season as alfalfa starts to grow. In cool springs (consistent daytime temperatures of 40-48°F) alfalfa is able to get a head-start and sometimes "outgrow" weevils which remain inactive at these cool temperatures. In a warm spring it is likely that

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Apple Maggot, continued from page 3

monitoring apple maggot in fruit trees: rectangular yellow sticky traps and plastic red balls. It is critical to add an external bait of ammonium carbonate or acetate to either style of trap to enhance its attractiveness to fruit flies.

Fruit becomes susceptible to egg-laying by fruit flies once the skin begins to soften and color. A degree-day model (based on temperature) is available to predict its development. Apple maggot management and timing information will be provided in the Tree Fruit Integrated Pest Management Advisory. You can sign up for a free subscription to the tree fruit and other IPM advisories here. Advisories are delivered by e-mail throughout the growing season to inform gardeners and growers about current insect and disease activity, and provide practical management recommendations.

- Diane Alston, Entomologist

Apple maggot can be monitored with either yellow sticky traps or red sticky spheres. Adding ammonium carbonate or acetate as an external bait is critical to improve effectiveness of the trap.

Preventing Crop Pests, continued from previous page

monitoring will reveal that weevil numbers have exceeded an economic threshold (more than 15-20 weevil larvae per sweep) and require treatment.

If the threshold is exceeded, what are the options? If the threshold is reached within 1 to 2 weeks of anticipated harvest, consider harvesting hay early and quickly removing bales from the field as an as an alternative to insecticides. Although some growers find it useful to run a spring-tooth harrow through the field following a cutting to mechanically crush weevil stages, it is generally not recommended because of the damage it can cause to alfalfa crowns and allow entrance for disease pathogens. The limited research on harrow use for weevil suppression does not support a measurable benefit. Finally, monitoring early can allow for better timing of any necessary insecticide treatments.

-Ricardo Ramirez, Extension Entomologist

Using a 15-in diameter sweep net, alfalfa weevil larvae can be calculated on a per sweep basis to determine whether management is recommended.

References:

Evans, E.W. 1989. The alfalfa weevil in Utah. Utah State University Extension Publication No. 58.

Higgins, R.A., S.L. Blodgett, and A.W. Lenssen. 1989. Alfalfa weevil management in Kansas: Non-chemical controls. Kansas State University Extension Publication No. 115.

Peairs, F.B. 2010. Spider mites in corn. Colorado State University Extension Publication No. 5.555.

Using Biocontrol in High Tunnels or Greenhouses

Biological control of pests can be very effective in greenhouses or high tunnels, but it requires a great deal of commitment. It is an option for a variety of reasons, whether your operation is organic, there is consumer demand, pesticides cannot be applied, or due to pesticide resistance issues. Often, there is interest because someone else raves about its success. Anyone can use biocontrol. A primary hurdle is using biocontrol without taking a hit on profits. Using biocontrol requires preparation, practice, and patience.

PREPARATION

Switching to biocontrol requires full commitment with complete understanding and ability to adapt.

- Know the biology, life cycle, and behavior of your common pests and the biological control agents that target them and are compatible with the crop and greenhouse conditions.
  - o *Beneficial nematodes* are microscopic roundworms that enter the host insect through natural openings, and produce protein-destroying enzymes on pests such as thrips and fungus gnats.
  - o *Predators*, such as lady beetles, lacewings, minute pirate bugs, and predatory mites, seek out insect and mite prey, and are usually generalists, feeding on a variety of pests.
  - o *Parasitoids* are wasps or flies that lay eggs and complete their life cycle, from larvae to adult, inside or on their host. A range of species are commercially available that target aphids, whiteflies, and scale insects.
- Get to know the biocontrol suppliers and their shipping process. Select reliable suppliers with whom to work.
- Spend at least one season transitioning to softer pesticides.
  - o Biologicals and pesticides don't mix. Direct contact or residues from prior applications can kill some species. Some biorationals (insecticidal soap, hort. oil, Bt, etc.) may be used when absolutely necessary.
- Before introducing biocontrol, take measures to lower the existing pest populations to increase the chances for success.

PRACTICE

Begin by focusing on a single pest and a single natural enemy. Longer term crops such as perennials or poinsettia that are not moved around extensively are easier to manage with biocontrol. Once you are comfortable with biocontrol of the first pest, gradually ramp up to a full program.

Using "banker plants" to help beneficials reproduce is a great option to reduce costs of using biocontrol.

Keep in mind that a quality biocontrol agent and reliable supplier are key to establishing a successful program. In the beginning, work with the supplier to determine the optimal release schedule for the organisms you are using. Request that orders are shipped overnight, if possible. Once they arrive, inspect the contents carefully before release. If the numbers are low or the insects are dead, a good quality supplier will provide reimbursement or a replacement shipment.

Using biocontrol successfully is impossible without a reliable scouting program. Train yourself and your employees to "always be scouting" rather than having a single person monitoring just once per week. Biological control works best when pest populations are kept at low numbers, and should not be relied upon after a flare up occurs.

When it comes time to sell or distribute your plants, you may find that they are harboring a population of beneficials. As much as we don't like to hear it, some customers will not tolerate any insects, whether they are a pest or not. In this case, the crop can be sprayed outside the greenhouse, before it goes out, to prevent any complaints.

PATIENCE

A successful biocontrol program will rely on regularly scheduled releases of beneficials throughout the growing season of the crop, and only when pest populations are moderate to low. After releasing beneficials, it may take several weeks to see noticeable reductions in pest levels. If pest densities get too high, the supplier you work with can help identify compatible pesticide options.

Initially, the cost of managing pests with biocontrol is greater than using conventional pesticides. For some growers, the financial commitment is worth it to get a premium on their product, and for avoiding sprays and dealing with re-entry

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Clover Mites May be Showing up in Homes Now

Clover mites (*Byrobia praetiosa*) are active in the spring and fall months. They can be pests of many types of plants, including turf, and can occasionally invade homes. Typically they are active from February through May until hot temperatures force them to lay eggs that will over-summer in protected exterior places. Once temperatures decline in fall, the eggs hatch and a new generation of mites will emerge. The fall generation can remain active until winter.

Clover mites are roughly the size of a pinhead and are described as moving dark spots. They can range in color from dark green to dark brown, sometimes with a dark red appearance. Their front legs are elongated, about twice the length of the other legs. Eggs are tiny, round, and red in color. Other mites and arthropods that could be misidentified as clover mites include other spider mites, Banks grass mite, predatory mites, bird/fowl mites, and springtails.

Clover mites can injure many plants, but symptoms are most commonly seen on turfgrass, particularly in the spring months. Symptoms resemble drought-stress and show up on areas of the lawn that are particularly dry and sunny. Close inspection of grass blades shows silvery streaks. During severe infestations, patches of turf can be killed.

In Utah, clover mites are more common as an indoor nuisance pest, particularly in the fall when mites seek refuge from the cold. In the late winter or early spring, warming temperatures stimulate mite activity, particularly inside, or on south or west-facing sides of buildings. Mites may seem to appear out of nowhere if they are prompted to migrate by cutting their host plant; an increase in heat or heavy rain; or a change in seasons. Clover mites are not a pest of health concern and do not bite.

Controlling clover mites is best accomplished by habitat modification. Outside, clover mites can be reduced by the following:

- Focus control efforts on the south and west sides of buildings where clover mites are most likely to live and enter the home.
- Create a 1.5 to 3 foot wide vegetation-free zone around the foundation exterior.
- Use supplemental water to water-stressed areas of the lawn.
- Plant plants that are unattractive to clover mites, such as geranium, chrysanthemum, zinnia, marigold, salvia, rose, petunia or shrubs such as barberry, juniper and yew.

Clover mites feed in a meandering pattern, which is evident by the damage on the leaf of a plant. Feeding on grass blades results in a silvery appearance, especially just prior to turf death.

- Apply insecticides to turf within 10 feet of the foundation (e.g., bifenthrin or lambda-cyhalothrin).

Indoors, mites only survive a few weeks, so they may be tolerated in low numbers. If present, vacuum the area and dispose of the bag. Never crush clover mites because they can stain fabrics. To prevent them from entering the home, seal exterior cracks and crevices, especially around windows. and doors

- Ryan Davis, Arthropod Diagnostician

References:

Cranshaw, W.S. Clover and Other Mites of Turfgrass. Colorado State University Fact Sheet No. 5.505.

Gomez, C., and Mizell, R.F. 2008. Featured Creatures: Clover Mite (Bryobia praetiosa Koch). University of Florida, No. EENY-437.

Correct Sample Submission for Plant Disease Diagnosis

As the new growing season starts, plant diseases will begin to show up. In order to provide a correct diagnosis, samples submitted to the diagnostic lab must be of good quality. Here are a few guidelines for sample submission:

For turf samples: Cut a 3 by 3-inch square of turf that includes both healthy and diseased looking plants. Put the sample in a plastic ziploc bag *without* a moist paper towel and send overnight to the Utah Plant Pest Diagnostic Lab.

For soft-tissue samples (annual plants, vegetables and fruit): Put symptomatic plants in a plastic ziploc bag *without* a moist paper towel and send it either the same day or the next day. Do not refrigerate or store the collected samples for more than one day. Do not send the samples in a paper bag as they will dry out and may make a diagnosis impossible.

For all samples: Fill out the sample submission form on the Utah Plant Pest Diagnostic lab website with as much information as possible. This can help us narrow down possible causes of the problem. Include all pesticides, including herbicides, that were sprayed, irrigation type and frequency, age of the plants, symptom description, etc. If possible, e-mail images of at least 3 views: a wide view showing the affected plant/area plus the surroundings; a closer view of just the affected plant/area; close-ups of the symptoms.

Make sure to correctly address the package to the diagnostic lab. The address is:

Utah Plant Pest Diagnostic Lab, Utah State University,
5305 Old Main Hill, Logan, UT 84322

If the package is addressed to the USU Soils Analytical lab, the sample will be delayed by several days and its quality for diagnostics may be reduced.

To avoid tissue deterioration to the point that we may not be able to identify the cause, it is best to send the sample overnight. We have received samples in the past that were kept in a refrigerator (or left in the car) for several days before shipping and we could not tell what kind of plant it was, let alone identify the problem.

In those cases, we have to request another sample, which will delay identification of the problem and recommendation for treatment. If moist paper towels are included in the Ziploc bags, the additional moisture can result in quick development of mold that may make it impossible for us to identify the original problem.

How not to send a sample: Bag an entire plant in a tight ziploc bag with moistened paper towels so that there is 100% chance that the plant will turn to mush.

Louisiana State University AgCenter

To prevent the above from happening, the ziploc bag or plastic should be wrapped around the roots only, leaving the top part of the plant (with the symptoms) exposed and dry.

Time frame for diagnosis: Many samples cannot be diagnosed by looking at the sample under a microscope alone. We may have to culture bacteria or fungi or run tests for virus diagnosis. Fungi do not grow very fast and it may take five days to a week before we can identify a fungal pathogen. Bacteria grow faster but often need additional processing for identification. In that case, we will be able to give you a preliminary identification that will be followed by a confirmation one to two weeks later.

- Claudia Nischwitz, Plant Pathologist

In the National News

HONEY BEE DISEASES THREATEN BUMBLEBEES

Entomologists in Austria and England have mapped the distribution of honey bees and bumble bees affected by the disease, deformed wing virus (DWV), and found that the occurrence of this disease overlaps between the two species. The results, published in *Nature*, suggest that the disease is being spread by honey bees, perhaps during foraging on flowers. Bumble bees infected with DWV are impacted more significantly than honey bees, and have a 6-day shorter life span. The study, underlines the importance of threatened wild pollinators, including bumblebees, which are estimated to provide $3 billion in pollination services to crops such as tomato, blueberry, melon, soybean, cucumber, squash, apple, peach, and bell pepper in the U.S.

AGRICULTURE PEST CONTROL OPTION USED ON STORED-FOOD PESTS

Mating disruption, used for decades against certain crop pests, is now available for stored-food moths. Mating disruption works by mimicking the female pheromone used to attract males for mating. Dispensers are attached to small hooks on walls and inside cabinets. Males are attracted to the dispensers and are unable to find females, delaying or preventing mating. The product, called Moth Disruption System, is manufactured and sold by Rentokil. It is currently available in the UK and unknown when it will be available in the U.S.

PESTICIDE RESISTANCE ON THE INCREASE

The recorded cases of resistance in insects, mites and other arthropods, which include resistance to multiple pesticides per species, more than doubled between 1990 and 2013, from 5,141 to 11,254. To date, resistance to pesticides has been recorded in more than 500 insects, 218 weeds, and 190 fungi that attack plants. In the past, there has been confusion about the occurrence and severity of resistance due to lack of standardization in terms defining resistance. Authors of a recent *Journal of Economic Entomology* paper say that a new glossary of updated definitions is needed to clear confusion between scientists, industry, and government on the multitude of resistance levels.

FINDING VALUE IN STINK BUG SPIT

As stink bugs feed, a toxin in their saliva damages plant tissue. Researchers from the Department of Entomology at Penn State reported in *PLoS One* that, for the first time, they have characterized the saliva of stink bugs, in particular the brown marmorated stink bug. They identified proteins from two types of saliva: watery saliva and sheath saliva. Water saliva helps stink bugs to digest their food while sheath saliva surrounds stink bugs' mouthparts and hardens to prevent spillage of sap during feeding. The interaction between the sheath saliva and the plant is what causes injury to crops. By understanding the specific details of feeding and the damage it causes, researchers can begin to develop targeted control methods for these pests.

PLANT-SPEAK MAY CONTROL INSECTS

Christer Lãfstedt, a chemical ecologist at Lund University in Sweden, and his team, have devised a method that enables them to produce pheromones from plants themselves, a safer and potentially more economical approach than producing pheromones from insects. This breakthrough technology involves extracting components from genetically modified plants. The researchers used GM tobacco plants to produce pheromones for two ermine moth species, and then tested them against synthetically-produced pheromones in traps. The plant-derived pheromone traps attracted about half as many moths as the synthetic pheromone traps, which was better than expected. This technology would engineer plants for both synthesis and sustainable release of insect pheromones, bypassing the need to produce the compounds in the laboratory using harmful compounds.

THE KEY TO REDUCING PEST RESISTANCE TO BT CROPS

Increased use of Bt (*Bacillus thuringiensis*) crops has prompted concern that pests will develop resistance to the proteins in the plants that kill them, making Bt plants ineffective. Research by Cornell University entomologists has demonstrated the first example of a predator being able to delay the evolution of resistance in an insect pest to a Bt crop. In particular, they looked at lady beetles and showed that they can reduce the number of potentially resistant diamondback moth pests in the population. The ability to slow pest resistance would significantly increase plant production, as well as relieve pressure off of the GM plant industry.

FARM WORKER PROTECTION STANDARDS TO BE UPDATED

The EPA, in February 2014, released the first proposed update to the Farm Worker Protection Standards in 20 years. The WPS protects farm workers from pesticide exposure through training and application requirements. The update proposes a revised training program that is required every year rather than every 5 years. Other updates include requiring posting of no-entry after spraying, setting a minimum age of pesticide applicators to 16, and expanding no-entry buffer areas around pesticide-free zones to farms and forests. The EPA did not announce when the new standards would be implemented.

Featured Picture of the Quarter

In nature, nothing goes to waste. The dirt dauber is a wasp that builds a nest of mud, and the color of the nest varies from light to dark, depending on what type of soil was used. The nest is only used for one year, for wasps to rear their young inside. When the next generation of adult mud daubers emerge from the nest, they leave behind round holes. Other species may take advantage of that space, like leafcutter bees (*Megachile* sp.). Last summer, female leafcutter bees found this mud nest and laid eggs, each separated by a leaf disc, inside the round holes. Leafcutter bees are important native pollinators of a wide variety of plants, including alfalfa.

-Image by Diane Alston, USU Entomologist

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intervals. Some growers report that finding labor is easier when they know they don't have to spray.

Biocontrol is a growing trend in the greenhouse industry and beyond, and it can be successful with the right preparation, expectations, and under the right conditions. As your operation learns more about implementing biological control, efficiency will be increased and costs reduced.

- Marion Murray, IPM Project Leader

For Additional Information:

bioworksbiocontrol.com/nov2010.pdf: An article describing the larger producers of biocontrol agents.

Greenhouse Biocontrol Workbook, Cornell University: nysipm.cornell.edu/nursery_ghouse.pdf

Greenhouse Biocontrol Handbook, Penn State University: pubs.cas.psu.edu/FreePubs/pdfs/agrs96.pdf

Orchard Bee ASSOCIATION

Become a member of the Orchard Bee Association (orchardbee.org) and reap the benefits:

- *Orchard Buzz* quarterly newsletter
- Networking/support from professionals and peers
- Support and fellowship of other bee enthusiasts
- Access to research reports
- Free admission and lunch at the annual meeting

The Annual Conference is scheduled for September 25-27, 2014, at the Kaysville, UT Educational Center.

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