UTAH PESTS News

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

What's Inside

News Highlights

NEW SPIDER SPECIES DISCOVERED IN NORTHERN UTAH

During their time as PhD students, Dr. Lori Spears, USU CAPS coordinator, and Dr. Stephanie Cobbold, stumbled upon a tiny spider during their field research that they suspected was a new species. They sent specimens to a professional taxonomist (Dr. Herbert Levi) who confirmed their suspicions and later named the spider *Theridion logan*. So far, specimens have only been found in 3 locations of juniper-sage habitat in Cache County, Utah. The finding was published (by Dr. Levi) in the Nov 2013 issue of Journal of Arachnology.

NEW FACT SHEETS

Apple Maggot
Botrytis Neck Rot of Onion

www.utahpests.usu.edu

Systems-Based Onion Pest Management in Utah

In Utah, producers are leading the way with innovative insights into sustainable management of onion cropping systems. A group of producers recognized that crop rotation sequence and nutrient management influenced the susceptibility of the following onion crop to a key pest, the onion thrips. A team of Utah State University research and extension faculty and students were intrigued by the improved onion growth and yields on these farms despite high onion thrips pressure. Onion thrips is the primary vector for Iris yellow spot virus (IYSV) that causes a potentially devastating onion disease worldwide. In most years, at least some onion fields in Utah are severely affected by IYSV.

New research has shown that onion fields adjacent to alfalfa and certain weed species are more at risk of becoming infected by Iris yellow spot virus via feeding by onion thrips.

The USU team took up the challenge to investigate the on-farm observations. Studies have advanced to a landscape-scale perspective for growing onions. The team has been successful in garnering funding, including collaborations with other onion-producing states. Western Sustainable Agriculture Research and Education has been a strong supporter of onion systems research and outreach. Recent results have demonstrated the importance of nitrogen rate, previous crops, soil health, certain weeds and alternate crops, and other factors in influencing the susceptibility of onions to thrips and IYSV.

High rates of nitrogen applications, viewed by some as necessary to promote large bulb size in onions, has been shown to increase the attraction of onion thrips to the crop. Researchers hypothesize that high

Feeding by onion thrips, which congregate at the onion neck, can reduce yields.

nitrogen levels in onion tissues may reduce the plant's ability to produce natural plant

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Onion Pest Management, continued from page 1

defense compounds, such as phenolics, which can be less 'tasty' to thrips. In Utah studies, nitrogen application rates exceeding 150-200 lb per acre were correlated to higher thrips populations which increased the risk of IYSV transmission and leaching potential of excess nitrogen. Soil microbial populations, and thus soil health, was improved by more complex crop rotations. Studies have shown that planting corn before onions reduces excess carry-over of nitrogen in the soil profile.

Onions infected with Iris yellow spot virus develop elongate lesions along leaf blades, reducing the potential for bulbs to size.

Current Utah studies are clarifying the role of weeds and other crops as reservoirs of thrips and IYSV between and within onion growing seasons. So far, four weeds that are common in onion fields have been implicated as likely "green bridge" sources of thrips, and perhaps of the virus as well. Flixweed, common mallow, field bindweed, and shepherd's purse have been found in field and greenhouse trials to readily support all life stages of onion thrips. The insect was also found to readily reproduce on alfalfa, and to a much lesser extent, on corn and wheat.

Incidence of onion thrips on crops and weeds in the onion landscape of Utah. Data is from field samples and greenhouse experiments.

	No. of onion thrips*		
Plant	**Adult**	**Egg**	**Larva**
Alfalfa[P]	M	M	H
Corn	H	L	L
Wheat[P]	L	L	L
Common mallow[P]	H	H	M
Dandelion[P]	L	L	L
Field bindweed[P]	M	H	M
Flixweed[P]	H	H	H
Foxtail barley	M	H	L
Prickly lettuce[P]	L	L	L
Shepherd's purse	H	H	H

* L = low, M = moderate, and H = high numbers of onion thrips life stages.

[P] Plants tested positive for Iris yellow spot virus.

All of these hosts and others were tested for the presence of IYSV. Although it was found on alfalfa, wheat, and many weeds species, we have not confirmed whether the virus can replicate in these plants. The presence of the virus, however, indicates that a virus-infected thrips has fed on the plant. The four identified weeds and alfalfa may be serving as overwintering hosts of the thrips, and perhaps the virus as well, providing an inoculation source to infest nearby onion plants the following growing season.

A better understanding of a whole farm or systems approach to assessing the impacts of crop management decisions on pests can contribute to a better understanding of cumulative risk for crop production. A primary goal is the development of more resilient farming systems with fewer off-farm inputs and reduced potential for environmental contamination. This goal is a good deal for all – the land, the environment, the producer, and the consumer!

- Diane Alston, Entomologist
(*Article is based on research findings of the USU Onion Team and others*)

The Usual Suspects for Turf Insects and Research Results in 2013

TURF SAMPLES

The variety of turf arthropods diagnosed by the Utah Plant Pest Diagnostic Lab this year mirrored what was seen in 2012. In particular, chinch bug and Banks grass mite were among those unusual pests that were submitted to the lab for a second consecutive year. Light feeding damage from these pests resembles drought stress in a lawn, but with high chinch bug populations, the turf begins to die in irregular patchy areas. Heavy mite pressure can also kill turf, where the blades of grass turn brownish-yellow and become stiff.

The common factors of the past two seasons were warm springs and summers and drought conditions that favored both chinch bugs and mites. Drought-stressed plants often have amino acids and other nutrients that are more available to these arthropods compared to healthy plants. In addition, drought conditions can make for an unsuitable habitat for predators that feed on these pests. It is predicted that these climatic conditions will continue, leading to more occurrences of these pests in our region.

TURF RESEARCH

Billbugs (*Sphenophorus* spp.) are another problematic turfgrass pest in the Intermountain West. These weevils deposit eggs in turf stems, where the larvae hatch and begin to feed on plant tissue. Feeding damage causes severe discoloration of turf resembling drought stress, and in severe cases, can lead to plant death.

A degree-day (DD_{50}) model, which is a tool to predict timing of insect emergence and activity, has been developed for billbugs in the eastern U.S. The model calculates degree days from daily maximum and minimum temperatures using a baseline development threshold of 50 F. Insect activity and development is, in part, dependent on temperature, so degree day models provide optimal treatment timing recommendations. Because temperatures vary among years, applications based on calendar date may be too early or too late, resulting in poor control of billbug larvae.

This model, which includes information for first occurrence of adult activity, timing of egg deposition, and duration of larval stages, has yet to be validated in the West. In 2013, we began to survey billbugs to determine their seasonal activity and to test the DD_{50} model, as a component of a USDA-Western Region Integrated Pest Management grant (#2012-03313).

Golf course sites were selected from Boise, Idaho to Logan, Utah where major billbug issues had previously been reported. From May to October, with the help of University of Idaho Extension in Ada County, billbugs were surveyed in the rough at each course where billbug damage was suspected. Researchers used linear pitfall traps to collect ground-active adult stages and turf soil cores to detect the eggs and larvae in stems and soil.

Chinch bugs are active in the thatch layer and damage turf stems with their piecing-sucking mouthparts (***top***). Hot, dry conditions in 2013 also flared mite problems (***bottom***).

The bluegrass, hunting, and Rocky Mountain billbug species made up the complex of billbugs found at all sites. Bluegrass billbug was the dominant species and composed 60% of the total trap catches, followed by the hunting billbug (34%), with the Rocky Mountain billbug being the least abundant species. We compared billbug emergence with the existing DD_{50} model. It predicts that the first flight will occur between 280 and 352 DD_{50} after March 1. However, in 2013, we found the first occurrence of billbugs to be before 217 DD_{50} (May 15), about one week earlier than the current model predicted. We found that peak billbug adult activity occurred in mid-June (540-650 DD_{50}). Billbugs deposited eggs from late May into

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The Cooperative Agricultural Pest Survey is a federal program, administered jointly by USDA-APHIS-PPQ and each state, whose purpose is early detection of invasive species that could threaten U.S. agriculture. In Utah, the program is co-coordinated by Lori Spears (Utah State University) and Clint Burfitt (Utah Department of Agriculture and Food).

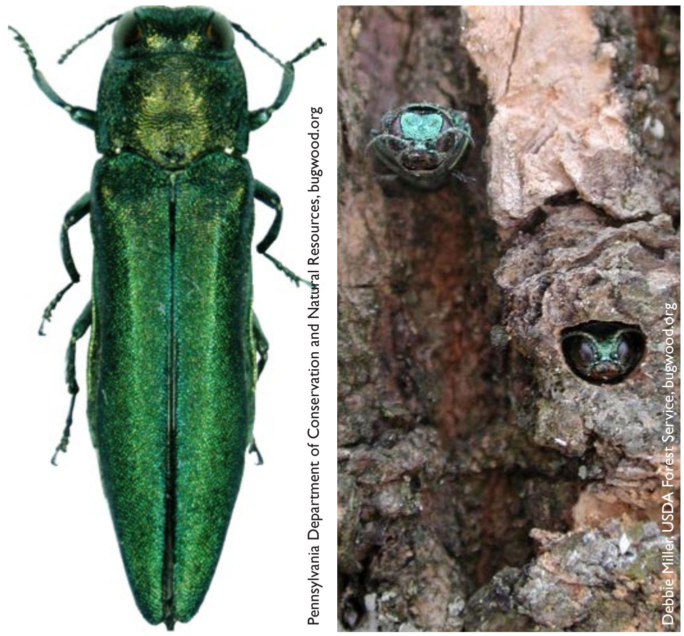
Emerald Ash Borer Hits Close to Home

Emerald Ash Borer (EAB) is an invasive pest that specializes on ash trees, and is considered to be the most destructive forest insect to ever invade the U.S. In 2002, EAB was first detected in the U.S. in Michigan, and is thought to have arrived in wood packing material from its native Asia. Since then, EAB has been found in more than 20 mid-western and eastern states, killing more than 50 million ash trees.

In September of 2013, EAB was found in Boulder, Colorado, and is now on Utah's front door. We have not yet encountered EAB in Utah, but this pest does pose a significant risk of introduction and establishment. Further, evidence suggests that EAB is generally established in an area for several years before it is detected (see USDA's EAB Pest Alert for more information).

EAB adults are bright, metallic, emerald-colored insects and are only about one-half inch long. In the spring, the adults will lay eggs on ash bark, and are particularly attracted to compounds given off by stressed ash trees. Once the eggs hatch, the larvae will bore into the tree, eating the bark and creating S-shaped galleries, where they will eventually pupate and overwinter. The next spring, the new adults will emerge from the tree, leaving behind distinctive D-shaped exit holes. The larvae are the damaging stage of this pest and kill trees by destroying the tree's water and nutrient conducting tissues. Obvious signs of EAB damage include thinning of the tree's canopy, new growth at the base of the tree, bark splits, and woodpecker feeding. Once damage is noticed, however, it is already too late; an EAB infestation is nearly always fatal to the tree. When EAB is found in an area, federal quarantines are enforced to prevent ash timber from being moved out of infested areas.

The Utah Cooperative Agricultural Pest Survey (CAPS) program team has been conducting pest detection surveys for EAB, and is hoping to conduct surveys for EAB again next year in addition to teaching workshops to help inform the public about this pest. If you are interested in participating in these workshops, watch for updates on the Utah CAPS program website. We will know the status of these workshops by mid-summer.



Adult emerald ash borers are colored a distinct, deep metallic green. Their D-shaped exit holes are typical of many flatheaded borers.

EAB is primarily spread by movement of infested wood by humans. Therefore, we encourage the public to help stop the spread of EAB by not moving firewood and burning wood where you buy it. Also, if you have ash trees in your yard, please check them periodically for signs of EAB. The sooner EAB is detected, the easier and cheaper it will be to control. If you suspect you have EAB in your area, please contact Lori Spears (USU CAPS coordinator; lori.spears@usu.edu) or Clint Burfitt (State Entomologist; cburfitt@utah.gov). Since EAB looks similar to other insects, it is important that trained entomologists examine suspect specimens.

For more information on EAB and related topics, please visit the following websites:

USDA APHIS: www.stopthebeetle.info
USDA Forest Service's EAB site
Multi-agency Emerald Ash Borer website

- Lori Spears, USU CAPS Coordinator

Don't Let Mice Run Rampant Indoors

Mice are a common household pest in Utah. The house mouse does not hibernate, and as temperatures drop in the fall and early winter, they migrate into homes seeking food, warmth, and shelter. People do an excellent job providing these basic needs to mice. Mice investigate house perimeters for warm air and food odors leaking out from any opening. Mice only need a hole about the size of a #2 pencil (1/2" high by 3/8" wide) to gain access to your home. They are unwanted visitors capable of spoiling food with fur, urine and feces, and transmitting disease. A few important steps can minimize mice in the home.

STEP 1: EXCLUSION

Search the perimeter of your house and look for possible entry points. All holes should be sealed using appropriate materials: caulk, sealant, and/or Xcluder. Before choosing a material to repair cracks and crevices, consult the Purdue fact sheet on selecting caulks and sealants. Expandable foam, steel wool, and copper mesh are not recommended. Steel wool will rust and disintegrate over time, and copper mesh can be easily pulled out of place by mice. One effective product that is robust and unpalatable to rodents is called Xcluder (found online).

Thresholds and door sweeps are the primary area of weakness in your house's security. Replace thresholds and/or door sweeps with high-quality options such as a thick, brush-style door sweep. During installation, check to see if the eraser side of a #2 pencil will fit through any gaps and fix if necessary. Installing door sweeps will also keep out other pests, in addition to reducing heating and cooling bills.

STEP 2: INSPECT

Mice need three things: food, shelter, and warmth. Focus inspections in places where food is stored, as well as under, behind, or in appliances that generate heat (anything with a motor and the stove/oven). Also look in areas that are secluded, dark, and shadowy, especially corners.

Look for fecal pellets, urine droplets (which will illuminate under a blacklight), build-up of brown grease (sebum) along frequently traveled routes, gnaw marks, and tiny hairs (seen with a hand lens) in feces or stuck to openings in walls where mice squeeze through. You can also look and listen for mice activity. Again, think food, shelter, heat, shadows, and corners.

STEP 3: SANITATION AND FOOD STORAGE

Sanitation is pest management. Eliminating food sources through proper food storage in mouse-proof containers will take its toll on mouse populations. Sanitation and food storage stress mice, causing them to have fewer offspring, and to travel farther to find food. Remember, mice want food. Don't let them have it!

STEP 4: TRAPPING

The most effective and humane traps are the standard snap-traps with an expanded trigger. Traps should be baited with 3 or 4 different types of bait. Peanut butter, bacon, grain, and even a piece of string or dental floss tied to the trigger are good choices. Pregnant females make many trips per night to collect nesting materials like string. If you can trap one pregnant female, you have effectively eliminated at least one, and maybe up to 7 or more mice at once.

Place traps in high-activity areas located during your inspection. These are places where mice travel and feed. Place 4 to 6 traps per mouse. Position traps against walls with the cocked trigger facing the wall. Corners are great places to place traps, but traps should also be placed every six feet along walls in high activity areas. Never place traps right in front of a mouse entrance hole. Traps can also be placed inside lockable, tamper-resistant boxes (into which mice can enter) to protect pets and children. After 3 days of trapping, remove the traps for a few days and then put them out again for 3 days, slightly shifting the locations of particular baits. If you had bacon in one spot, put peanut butter there next time, and shift the trap left or right of the previous placement.

Examples of trap placement strategies: 1) an overall trapping strategy for a corner and adjacent wall baseboards; 2) trap placement for a corner; 3) two traps placed 1 inch apart near the middle of walls to prevent mice from jumping over them; 4) alternative placement for sprinting mice.

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Turf Research Results, continued from page 3

early June just before peak adult activity and the damaging larval stages were most abundant in July.

This study will continue in 2014, where we will add additional sites around the Wasatch Front. Data from multiple seasons will be used to adjust and validate the DD_{50} billbug model to optimize timing of management in the West and to assess factors contributing to the variation in billbug populations (elevation, precipitation, temperature). It is clear that monitoring with traps is a useful tool, and once the billbug DD_{50} model is validated, both can be used to improve management practices, such as more efficient timing of prophylactic pesticide applications.

- Ricardo Ramirez, Extension Entomologist and Madeleine Dupuy, USU Biology graduate student

For More Information:

Kopp, K., R.S. Davis, and R.A. Ramirez. 2013. Chinch Bugs. Utah State University Extension. ENT-169-13PR.

Cranshaw, W.S. 2012. Clover and other mites of turfgrass. Colorado State University Extension. Fact Sheet No. 5.505.

Murray, M.S. 2008. Using degree days to time treatments for insect pests. Utah State University Extension. IPM-05-08.

Shetlar, D.J. and J.E. Andon. 2012. Billbugs in turfgrass. Ohio State University Extension. HYG-2502-12.

A linear pitfall trap (***top***) consists of a 1 meter long PVC pipe with an opening (1 cm) along its length, buried flush with the soil surface. Billbug adults are captured in a collection cup held in an irrigation box at one end of the pipe (***bottom***).

GENERAL PEST MANAGEMENT NEWS AND INFORMATION, continued

Preventing Mice, continued from previous page

Tamper-resistant, lockable bait box with block-formulated rodenticide can be applied on metal posts. The yellow blocks are non-toxic and bioluminescent. Bait boxes come in various sizes; choose an appropriate size for your situation and pest (mice vs. rats).

STEP 5: BAITING

Anticoagulant baits should always be used inside a protective box. Placement of the bait box indoors is similar to that of traps: high-activity areas and corners. They can also be used outdoors on either side of the garage door or other doors where mice may enter. Use tamper-resistant, lockable bait boxes adhered to the ground or any permanent object and preferably use a block formulation of rodenticide. (The small green pellets that homeowners may have used in the past have been removed from residential use to protect children and pets.) The down side to using a rodenticide to kill mice is that they often die in inaccessible areas, and the odor may last several days.

Using a variety of proactive exclusion and management measures can eliminate mice populations in the home.

- Ryan Davis, Arthropod Diagnostician

Brown Rot of Peach and Nectarine

This summer, two fruit samples from different locations in Utah County were submitted to the Utah Plant Pest Diagnostic lab. One sample, a nectarine, was diagnosed with brown rot caused by *Monilinia laxa*. The second sample, peach, was diagnosed with *Monilinia fructicola*.

Brown rot has, until this year, not been reported from Utah. The outbreak this year may have been associated with heavy rainfall and high temperatures in mid August, two to three weeks before harvest. Both species have probably been in Utah for some time and have gone unnoticed because they did not cause any problems during our usually dry summers.

Both *Monilinia* species mostly infect peaches, nectarines, sweet and tart cherries, plums and apricots. Rarely, the pathogen can infect apples and pears. During bloom, blossoms can be infected resulting in a blossom and twig blight. Blossom and twig blight is most common in tart cherries but can also occur on other fruit trees. Small cankers with gumming, very similar to cankers caused by shothole disease, develop on twigs.

Infections on fruit are not visible until two to three weeks before harvest. Green fruit is less susceptible unless it is wounded, due to the harder skin and lower sugar content. The initial symptom on fruit is a soft brown spot on which tan colored spores develop. One lesion on an infected fruit can produce thousands of spores, each capable of causing many new infections. With rain, wind, and warm temperatures, the disease can literally spread through an orchard overnight and destroy all fruit within a week.

The fungi survive the winter in fruit that is mummified and left hanging on trees or lying on the ground. The entire mummified fruit can be covered with spores providing inoculum for the following spring that will infect blossoms.

Management of the disease is through good sanitation. Mummified fruit needs to be removed and destroyed to reduce the amount of inoculum. There are fungicides registered for brown rot, including Adament 50 WG, Elevate 50 WGD, Pristine, and Captan 80 WDG for pre-harvest applications, and Scholar for post-harvest application.

It is very important to follow all manufacturer's labels to prevent resistance (already reported for some fungicides in other parts of the country). It is most important to control initial blossom blight to reduce infection of fruit later in the season.

Brown rot lesions usually show up on fruit near harvest. New infections create a soft brown spot on which tan to gray colored spores develop (***top***). The pathogen survives the winter on previously infected "fruit mummies" that often remain attached to the tree (***bottom***).

- Claudia Nischwitz, Extension Plant Pathologist

Biochar: An Ancient History Leads to Modern Uses

Biochar is a product made when organic solids are slow-burned in the absence of oxygen in a contained system. This man-made technology of burning is called pyrolysis. Biochar is made like charcoal, but contains no petroleum, is made sustainably from biowaste products (herbaceous or woody crop residues, non-salvageable timber and slash, animal manure, and more), and is applied to soil for two benefits: long-term carbon storage and as a soil amendment. It is predicted that at least 50% of the carbon in any piece of waste turned into biochar becomes stable, locking away that carbon into the soil for a period of several to hundreds of years, offsetting its contribution as a greenhouse gas in the form of carbon dioxide. As people who work with plants, our primary interest is the potential for biochar to improve soil quality, growth, and yield.

The similarity of biochar to the organic matter found in ancient "Terra Preta" soils led scientists to theorize that biochar application to other soils could be beneficial. Terra Preta (dark earth) is a dark and loamy soil found in scattered pockets of the Amazon. Those pockets of soil are widely believed to have been amended or mulched with charcoal waste from pre-Columbian Indian hearths thousands of years ago. Research in the 1900s and early 2000s showed that Terra Preta soils have higher nutrient availability, higher cation exchange capacity, greater water retention, and greater porosity/aeration than the neighboring native soil, resulting in improved crop growth.

These results have fueled hundreds of studies in the U.S. on the effects of freshly-made biochar on plant and soil health. Trials in both agricultural soils and potted plants have shown mostly positive results, many of which are similar to the research on Terra Preta soils. Studies have also examined whether biochar helps plants defend against soilborne diseases, and some have been promising, showing that growth of beneficial rhizobacteria and mycorrhizal fungi is greater in the biochar soils.

It should be noted that some crop studies have shown decreased plant growth. These results, however, may be attributed to temporarily high pH, toxins present on the char surface (such as tannins), nutrient imbalances, or simply inherent nature. Problems like these may be corrected as pH neutralizes, or are prevented through proper biochar preparation of washing the char and "charging" it with compost or fertilizer. More research is needed to properly quantify the effects of biochar application in different climates and cropping systems. You can track all the latest research at The International Biochar Initiative.

HOW BIOCHAR WORKS

Biochar does not contain any nutrients; it is the physical properties that provide the benefits. Biochar's negative charge attracts positively charged plant nutrient ions (calcium, potassium, magnesium, etc.), preventing them from leaching out of the soil, and making them readily available to the plant roots. In addition, the high surface area and porosity of biochar attract and hold water and provide a refuge for beneficial organisms.

HOW TO USE BIOCHAR

Studies have shown that applying raw biochar alone in poor soil has little benefit to plants and may retard growth for at least 6 months. Biochar should be rinsed in water and then "charged" by mixing it almost half and half with compost or with a fertilizer. As far as how much to use, research trials have tested a wide variety of rates, and the recommended results of 1 to 10 tons/acre show that, "it depends"; certainly the soil type and crop play a role. One option is to apply low rates over a period of 2-3 years to slowly build up the content in the soil. But because effects on crops and soil types are still being investigated, it may be wise to wait for solid recommendations.

It is important to note that not all biochars perform the same: it depends on the biomass source, the temperature of pyrolysis, and the size of the product. There are several online options to purchase small batches, and they are not cheap. Gardeners interested in trying packaged biochar products should ref-

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Where is biochar being used?

- Greenhouse growers are using it in potting media to improve water-holding capacity.
- Cacao growers in South America are applying it to young trees to shorten the number of years to production by half.
- Several non-profits are creating biochar gardens throughout Third World nations to benefit depleted soils.
- Large food companies such as Nestle and Kraft are investigating biochar in food production.
- Tree care companies are experimenting with biochar as a remediation tactic for stressed trees.
- Botanic gardens are making their own char and using it in compost mixes.
- Scientists are exploring it for soil reclamation and mining remediation due to its sorption characteristics and relatively high pH.
- Foresters in the West are exploring biochar production from dead trees (largely beetle killed) as a value-added product and an alternative to slash and burn.

In the National News

BANANA RESISTANCE TO NEMATODES

Bananas are among the world's most important food crops; however, yields can be reduced by 75% from infections by the parasitic root nematode, *Radopholus similis*. In looking for plant resistance, an international team of researchers in Europe discovered plant toxins found in the root tissue in some varieties of bananas. The toxins only occurred in localized plant tissue being attacked by the nematode, and were able to kill the feeding parasites. This discovery may significantly aid in furthering the development of pest-resistant banana varieties.

PLANT VIRUS CONTROLS APHIDS

University of Cambridge biologists have been studying the interaction between viruses and aphids and found that the cucumber-mosaic virus—which is vectored by aphids—"forces" aphids to migrate to other plants, thus spreading the disease. The virus alters its host plant biochemistry, causing the plant to smell and taste unpleasant to aphids. After an initial feeding and "contracting" the virus, the aphids are repelled and transport the virus to neighboring plants. These findings cite the need to develop "aphid-decoy plants" that could draw the insects away from crucial crops and halt the spread of viral infections.

TRAPS FOR SWEETPOTATO WEEVIL

Sweetpotato weevil (*Cylas formicarius*) is the most serious pest of sweet potatoes. It is not easily controlled with insecticides and in the past, mass trapping had not reduced damage. In a paper published in *Annals of the Entomological Society of America*, the Montana State University authors found that sweetpotato weevils are attracted to trap colors depending on the environment. The researchers found green pheromone traps were most effective in attracting the weevils in indoor conditions, and light red traps were most effective outdoors. They believe this finding will allow for improved mass trapping results and they plan to investigate the reason for the color differentiation.

EXAMPLE OF INVASIVE BUMBLEBEE

The buff-tailed bumblebee, *Bombus terrestris*, is a European species that was introduced into Chilean greenhouses to perform pollination services. Bees that escaped the greenhouses began to establish colonies in the wild at a rapid pace. Ecologists have studied this bee's spread for the last 10 years and have recently published their work in the *Journal of Animal Ecology*. They concluded that this bumblebee spread throughout South America at a rate of 200 km/year and is displacing native bumblebees. It is said to be one of the most spectacular examples of an introduced species invading an entire continent.

COCKROACH SPECIES SHIFT

The life history and biology of Turkestan cockroaches was recently described in a new article in the *Journal of Economic Entomology*. This pest was first reported in the U.S. in California in 1978, and has since spread throughout the southwest and into the southern U.S. It is out-competing the Oriental cockroach in the southwest due to its rapid nymphal growth and life cycle, and greater egg production.

ADAPTING TO CLIMATE CHANGE

A UNC-Chapel Hill biology professor has shown, for the first time, changes in physiological traits of an organism due to recent climate change, as reported in *Functional Ecology*. Caterpillars of two species of *Colias* (sulphur) butterflies in California and Colorado have been evolving over the past 40 years to change their feeding habits. They have broadened their range of ideal feeding temperatures have also shifted their optimal feeding temperature to a higher one, making them better suited to a hotter, more variable climate than their ancestors.

Useful Publications and Apps

- Videos for Teaching IPM is an eXtension web page that offers dozens of training videos for teaching IPM, particularly in schools, on topics such as pest proofing, monitoring, bed bugs, bees, and more.

- Airblast 101 is a website that offers a self-directed course on the best practices for safe, efficient and effective operation of airblast sprayers in agriculture. It also houses a library of current information in the form of articles, fact sheets, videos and slideshows from researchers and extension specialists across North America.

- **Integrated Pest Management: Current Concepts and Ecological Perspective**, edited by Dharam P. Abrol, is a new book that presents an overview of alternative measures to traditional pest management practices using biological control and biotechnology.

- Created by USDA-APHIS' Identification Technology Program, the ID Tools website houses a database of more than 30 tools to quickly identify pests, including insects, diseases, harmful weeds, and more, using taxonomic identification key software called "Lucid".

Featured Picture of the Quarter

Part of what we do in the Utah Pests group is monitor for insects and diseases on plants. Seeing pests "co-mingling" is common, but rarely in such a colorful arrangement. The cobalt milkweed beetle (*Chrysochus cobaltinus*) and red-femured milkweed beetle (*Tetraopes femoratus*) are both native insects that specialize on milkweed plants. Like monarchs, both species can afford to be colorful due to the protection that the ingested milkweed toxins provide from predators. They do provide a warning when disturbed: the cobalt milkweed beetle will emit a foul liquid and the red-femured milkweed beetle will "squeak".

Image by Erin Petrizzo, USU Research Assistant

PLANT PATHOLOGY NEWS, continued

Biochar, continued from page 8

erence label instructions. The International Biochar Initiative has developed standards for biochar production (and testing). Experimental trials are continuing throughout the world, the USDA is providing funds for research, and citizen science projects have been enacted (Sonoma Biochar Initiative (California), and The Big Biochar Experiment (England)). Improved recommendations for agriculture and landscape industries and residential sites are just a few years down the road.

- Marion Murray, IPM Project Leader, and
Britney Hunter, Assistant Professor, Hort., Davis County

For Additional Information:

Cox, Justine (ed.). 2012. Biochar in Horticulture. NSW Trade and Investment. 104 pp.

"Pest Press" Fact Sheets

Several new "Pest Press" fact sheets, are 2-page fact sheets on a wide variety of pests, located on the new School IPM website (utahpests.usu.edu/schoolIPM).

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