UTAH PESTS News

Utah Plant Pest Diagnostic Laboratory and USU Extension Vol.VI, Spring 2012

Manage Chlorotic Pine Trees in the Spring

Many pine tree species in northern Utah are showing chlorotic (yellowing) needles this spring. Chlorosis of needles often indicates nutrient deficiency, in this case, iron and possibly nitrogen. Pine trees grow best in soils with a pH between 5 and 6, while most Utah soils have a pH of 7 or higher, preventing iron from being available for absorption. Iron chlorosis has been exacerbated by the wet soils of the past two to three springs. Saturated soils make it more difficult for pine trees to take up enough nutrients, including nitrogen. Soil application of chelated iron (in the form of EDDHMA or EDDHA), when the tree actively starts growing again in spring, can improve the symptoms. Foliar-applied iron may also be necessary. When planting new trees, the pH requirement of the tree should be considered and species should be used that are adapted to high pH.

-Claudia Nischwitz, Plant Pathologist

Tomato Diseases to Watch for in 2012

TOMATO SPOTTED WILT VIRUS

Tomato spotted wilt virus (TSWV) is a major pathogen for tomatoes, peppers, peanuts and tobacco in the U.S. It has over 2,000 known hosts, many of which are asymptomatic weeds. In Utah, the virus is transmitted by western flower thrips and onion thrips. Thrips have to acquire the virus when they are young (larvae) to be able to transmit the virus as adults. Therefore, adult thrips have to lay eggs on infected plants because thrips nymphs cannot fly.

Infection of plants occurs early in the season. Symptoms on tomato leaves are necrotic, brown lesions. Plants are often stunted. Necrotic, brown ringspots occur on immature fruit and chlorotic spots occur

TSWV causes ringspots on young fruits and chlorotic spotting on ripe fruit.

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News Highlights

COMMERCIAL FRUIT WEBSITE

Check out the new Utah-Colorado Commercial Tree Fruit website at intermountainfruit.org.

NEW *UTAH PESTS* FACT SHEETS

The following can be found on our website:

Blue Orchard Bee

www.utahpests.usu.edu

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

Cory Stanley
USU CAPS Coordinator
cory.stanley@usu.edu
801-388-5433

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

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on ripe fruit. Similar symptoms can also be observed on peppers.

TSWV is managed by using resistant tomato varieties when available. Names of resistant varieties can be found on the Internet. Reflective mulch (silver colored) can reduce the number of thrips flying to the plants. Thrips control with insecticides is the most common way to prevent infection. Insecticide applications can be challenging due to thrips' ability to quickly develop resistance to some insecticides, as well as their ability to hide in buds, folded leaves, and other plant parts.

Late blight causes brown-black lesions on leaves and stems, and brown, firm lesions on fruit.

LATE BLIGHT

Late blight is caused by *Phytophthora infestans*. Infection occurs during wet or humid conditions at temperatures of 60-70°F. Necrotic lesions develop on leaves and can rapidly encompass the entire leaf. Infected leaves can fall off within a few days, leading to rapid defoliation of plants. Necrotic lesions can also develop on stems, and spread to fruit, forming firm brown spots.

Under humid conditions, mycelium develops that is visible with a hand lens. It is sometimes necessary to incubate symptomatic tissue for a few days with a moist paper towel in a Ziploc bag at room temperature to induce growth of mycelium.

Use of resistant cultivars such as 'Mountain Magic', 'Plum Regal', 'Legend', or 'Red Pearl' can significantly reduce disease incidence. The use of resistant varieties is especially important if potatoes, which are also susceptible, are grown nearby. Potato cull piles should be eliminated because the pathogen can overwinter on the culls.

To reduce the amount of inoculum present throughout the growing season, remove dead leaves, vines, and infected fruit and burn them or throw them in the garbage. Infected plant material should not be composted as temperatures in the compost pile often do not get hot enough to kill the pathogen. Avoid overhead irrigation to reduce leaf wetness and space plants widely to improve air flow. Preventive or protectant fungicides include chlorothalonil, azoxystrobin, or copper. Copper is acceptable for organic production.

EARLY BLIGHT

Early blight is caused by the fungus *Alternaria solani*. This pathogen causes necrotic lesions on tomato leaves that often have concentric rings and a yellow halo. Lesions on stems may also have concentric rings. Infections on fruit occur on the calyx end.

Other susceptible vegetables besides tomatoes include pepper, eggplant, potato, and weeds in the nightshade family. Infections occur during warm (75-84°F)

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Tomato Diseases, continued from previous page

Left: Early blight causes necrotic lesions on tomato leaves that often have concentric rings and a yellow halo.
Right: Infections on fruit occur on the calyx end.

and humid conditions. Under ideal conditions, *Alternaria* spores can germinate and infect plant tissue within one hour of landing on the host surface. Most infections occur on older leaves.

Alternaria can be seedborne and it is important to use clean seed. Growers who want to use seed from their own tomato plants should only collect seed from healthy plants. Removal of weeds in the nightshade family as well plant debris reduces the amount of inoculum and disease incidence. As with late blight, avoid overhead irrigation to reduce leaf wetness and space plants widely to reduce early blight incidence. When necessary, fungicides containing chlorothalonil, azoxystrobin, or boscalid can be used.

-Claudia Nischwitz, Plant Pathologist

Pest Management in High Tunnels

Tomatoes, field greens, berries, and more can be grown under high tunnels in Utah to get produce early in the season. Pests on high tunnel-grown plants are similar to those on plants in field production, but conditions inside tunnels are often warmer and more humid, resulting in greater pest pressure. Following preventive practices throughout the growing season can avert future problems.

Every high tunnel grower should implement a regular scouting program. Early warnings of pest problems will enable the grower to avoid an outbreak. Typically, at least 10% of the plants should be inspected weekly. Over time and with practice, diseases and pest insects will become easier to locate and identify. Don't rely on visual inspection alone; yellow and blue sticky traps are an inexpensive way to determine the presence of whiteflies, aphids, fungus gnats, and thrips.

DISEASE MANAGEMENT

Diseases typically are not a problem in well managed high tunnels. Problems arise when air does not flow inside the tunnel, plants are crowded together, or the plants are over-watered. These types of scenarios increase humidity, promote spread of pathogens from plant to plant, and create an environment conducive to plant diseases such as gray mold, phytophthora root rot, and powdery mildew.

To prevent diseases:

- Space plants properly to avoid excessive shading and to enhance air circulation.
- For larger tunnels, add ventilation (gable-end vents, etc.) and fans.
- Select disease-resistant varieties. The seed packet or plant label will specify the resistance such as V for verticillium wilt, F or FW for fusarium wilt, N for nematodes, A for alternaria or EB for early blight. There are several disease-resistant tomato varieties with good yields and taste qualities.
- Practice good sanitation by removing all diseased plants from the tunnel quickly and carefully (to prevent further spread), removing crop residues each year, maintaining a weed-free tunnel, and using only clean mulch.

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Pests in High Tunnels, continued from previous page

Botrytis (***left***) is a disease that can be prevented by proper plant spacing and reducing humidity in high tunnels, and verticillium wilt (***right***) is a soil borne pathogen that can be eliminated with proper crop rotation.

- Test the soil for nutrients at least every other year and provide the necessary amendments and water necessary for optimal crop growth.
- Utilize a good crop rotation scheme, such as rotating plants in the cabbage family (kale, radish), beet family (chard, spinach), or carrot family, with lettuce.
- In winter, open the high tunnel to kill tender overwintering pest insects or fungal spores.

INSECT MANAGEMENT

Like diseases, insects are typically not a problem, especially early in the season when the tunnel prevents immigration of aphids and other early season insects. But as temperatures rise and the tunnel remains open, pests with a broad host range like spider mites, thrips, aphids, and sometimes whiteflies, or even ants, can be a problem. In addition, insect pests that successfully overwinter inside the tunnel will emerge earlier than outside the tunnel.

Insect management without pesticides is ideal because application of chemicals in tunnels is more hazardous than in the open field due to the closed environment. Other options for insect pest management are:

- **Trap crops**. Some plants are highly attractive to certain pests, like thrips on 'New Guinea' impatiens, and can be used to draw the pest away from the desired crop. Trap crops are then destroyed.
- **Beneficial insects**. Purchasing and releasing beneficial insects is not practical when crops are grown outdoors, but in high tunnels, which are partially enclosed, beneficials may remain in the area to reduce insect pests. Parasitic wasps such as *Aphidius colemani* can be bought to control aphids and *Encarsia formosa* can be released to control whitefly. Suppliers of beneficials provide instructions on their release and management.
- **Floating row covers** can be effective at preventing certain pests like flea beetles, leaf hoppers, and leaf miners from reaching the crop. They must be put in place and sealed immediately before opening up the high tunnel.
- **Insect repellents** such as hot pepper, garlic, or kaolin clay may provide some control of certain insects.
- **Entomopathogenic nematodes** applied to the soil can help combat certain root-feeding or soil-overwintering pests like root weevils, flea beetles, cucumber beetles, and others. Beneficial nematodes require moist soil to be effective, and for this reason, are typically not used in field-grown crops in Utah. But in a high tunnel with a shade cloth and irrigation, the soil may remain moist enough for the nematodes to work.

There are a few low toxicity insecticides to choose from when a treatment is necessary:

- Horticultural oil (0.5-1% in water) and insecticidal soap target soft-bodied insects like aphids, whiteflies, thrips, and spider mites.
- Pyrethrin is mildly effective on most other pests.

If a stronger insecticide such as a pyrethroid or carbamate is necessary, determine if the material is registered for greenhouse use, and if so, follow the directions on the label and always wear appropriate protective equipment.

USU Extension specialists Dan Drost (vegetables), Brent Black (fruit), and their graduate students have created a series of fact sheets on building high tunnels and how to grow crops inside them. They can be accessed from their Production Horticulture website (vegetables.usu.edu).

-Marion Murray, IPM Project Leader

Getting Chemicals Into Trees Without Spraying
Part 1: Implantation and Injection

By Dr. Michael Kuhns, Extension Forestry Specialist, Wildland Resources Department, Utah State University Cooperative Extension, Logan. Kuhns maintains a very informative website at forestry.usu.edu.

Chemicals can be applied to trees to repel or kill damaging insects, to treat or prevent fungal diseases, to provide nutrients, and to kill sprouts, stumps, or even entire trees with herbicides. Spraying is the most typical way to apply these chemicals, but in some situations, sprays are inappropriate. Some chemicals can be placed or injected inside trees easily, which is what we'll cover here. We'll cover trunk implantation and trunk injection in this article and soil injection/drenching and trunk basal sprays in the next *Utah Pests News* issue.

TRUNK IMPLANTATION/INJECTION

These techniques work by placing water soluble chemicals just under the bark. The chemicals then move into and through the tree in the sap, and end up mainly in the leaves. Therefore they are good for treating leaf-feeding insects like aphids and adelgids. Borers and bark beetles can be killed if the chemical location and timing are just right, but this is often difficult to achieve.

Implantation – The main available implant is a capsule containing the chemical that is held in a gelatin shell. It is inserted into the tree in a hole drilled into the sapwood. Water in the sapwood dissolves the capsule and the chemical is taken up. Several are used per tree and they are placed low on the trunk in the root flare. Acecaps and Medicaps are the only implant brands currently available (treecareproducts.com and treerx.com). Implants are inexpensive, usable by non-experts, available through many retail nurseries, and easily installed. The main disadvantage is that the holes are fairly large (1/4-3/8 inches diameter).

Capsules containing the pesticide are implanted in the sapwood into a pre-drilled hole, and the chemical is absorbed by the tree.

Injection system without pre-drilled holes.

Injection – In trunk injection, liquid chemicals are injected into the stem through various types of holes and devices. Some systems use holes drilled in the trunk and a system of tubing and barbed plastic fittings to drain liquid chemicals into the trunk by gravity from a container hung above. Medi-ject for treating iron chlorosis is one example, but it uses large drilled holes. Also lack of pressure can make uptake slow. Low pressure systems that can speed uptake include the Mauget system which uses plastic capsules that you pressurize by depressing a plunger and then insert into a drilled hole. Similar systems are Tree Tech Microinjection Systems, and Rainbow Treecare's M3 Infuser. These systems require small, drilled holes (1/8" to 3/16 inches diameter), are fairly simple to use, and are slower than high pressure systems.

Higher pressure systems inject chemicals using either a syringe or tubing, tees, and a chemical reservoir designed to be under pressure. These include Arborjet's Tree I.V. system that uses tees, tubing, and a pressurized reservoir, and their Quik-Jet system that applies small chemical volumes with

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Implantation and Injection into Trees, continued from previous page

a syringe. Equipment costs for these systems can be high and they are fairly complex. Rainbow Treecare also has pressurized tubing and reservoir systems.

ArborSystems' Wedgle injection system is unique in that it doesn't use drilled holes but relies on injection with a syringe and a special needle. It is fairly fast because of the pressure created by the syringe. Equipment and methods for this system are fairly complex and equipment cost is high. No holes are drilled, but bubbles sometimes form under the bark which become wounds.

Pines and other resinous conifers produce resin when their living tissues are pierced and this resin can block chemical uptake. Special pressurizable tubes called STITs (Systemic Tree Injection Tubes) are used to overcome this. They have been used for treating Scotch pines for pine wood nematode. Commercial STITs are available from Rainbow Treecare and Mediject. ArborSystems has a different tip they use for injecting resinous conifers called the Portle that is said to reduce leakage and get more chemical into the tree.

Advantages of trunk injection methods include use of a low chemical volume, relatively simple equipment in some cases, it can be done in windy or rainy weather, and there is little non-target organism exposure. Disadvantages include the creation of wounds by drilling holes or by bubbles/embolisms, coverage can be spotty throughout the crown, and treating every year would be risky.

CAUTION

Use of trade names and specific product examples is not meant to imply endorsement of certain products. Always read pesticide labels and follow directions.

For a complete fact sheet on this topic go to Kuhn's Forestry Website at forestry.usu.edu and click on fact sheet #20, or click here.

CAPS UPDATE

Khapra Beetle Results in Tighter Restrictions on Rice Imports

New USDA-APHIS restrictions block the importation of rice from all countries known to have the Khapra beetle, *Trogoderma granarium*, including countries such as Afghanistan, India, Israel, Turkey, and many others. This small brown beetle is a pest of stored grains and other food products. It is known as one of the world's most destructive pests because it can survive without food for long periods of time, requires little moisture, and is resistant to many insecticides. When U. S. Customs and Border Protection detects other pests in incoming shipments, the shipments are treated and the cargo is allowed to enter the U.S.; however, when Khapra beetle is detected, the shipment is rejected.

-Cory Stanley, USU CAPS Coordinator

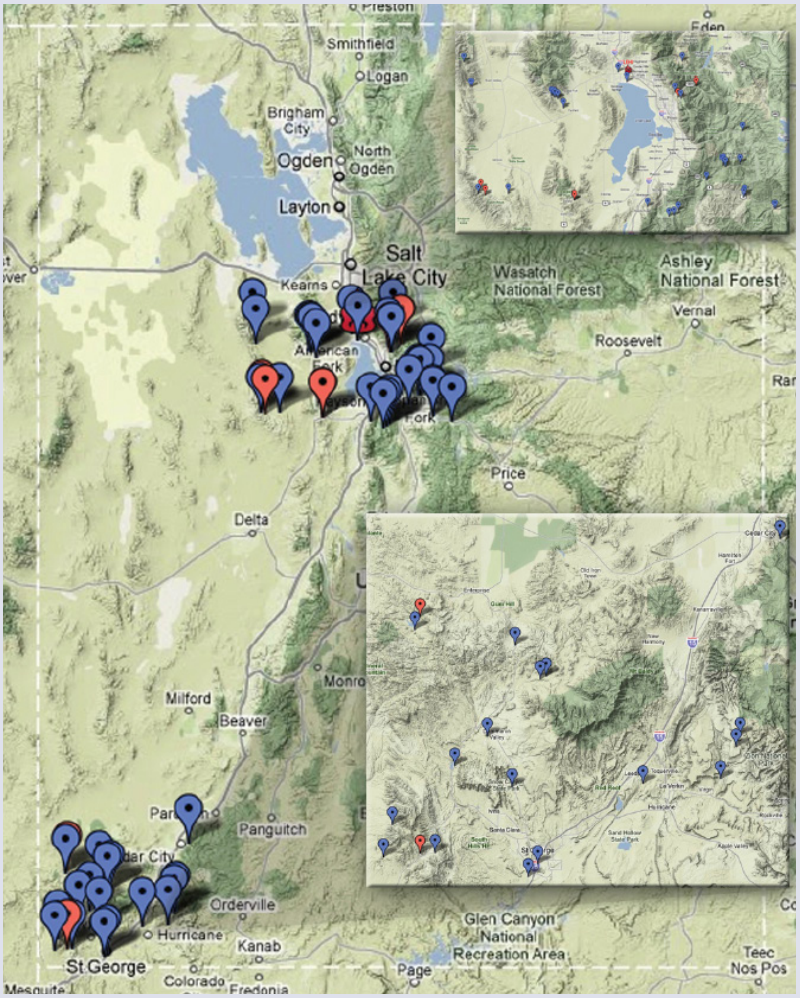
The Cooperative Agricultural Pest Survey is a federal program, administered jointly by USDA-APHIS-PPQ and each state, whose purpose is early detection of invasive species that could threaten U.S. agriculture. In Utah, the program is co-coordinated by Cory Stanley (USU) and Clint Burfitt (UDAF).

Top right: Adult Khapra beetle, larva, larval skins and damage to wheat grains.
Bottom right: Khapra beetles are small, oval-shaped, and very hairy.

Survey of Western Black-Legged Ticks and Lyme Disease in Utah

Lyme disease is the number one tick-vectored disease in the United States, especially in the Northeast, upper Midwest states, and Pacific Coast states. Its known prevalence in the Rocky Mountain region is limited to Colorado and Arizona; however the probability of human contraction in these states is considered low. There are no confirmed cases of Lyme disease originating in Utah; however, further investigation is needed to resolve the question: *Does Lyme occur in Utah*? Detecting Lyme in Utah would help inform the medical community of the presence of the disease, allowing clinicians to make informed, timely diagnoses and treatments.

In 2010, 36 residents from Lehi were associated with a potential Lyme disease cluster (UT Department of Epidemiology, 2010), prompting the Utah County Health Department and the Utah Department of Health to form a task force to examine the cases. To date, none of the people associated with this cluster have been shown to have contracted Lyme in Utah. As part of the task force, Utah State University researchers Ryan Davis, Scott Bernhardt, and Ricardo Ramirez sought to determine the prevalence of the Lyme disease-causing bacteria, *Borrelia burgdorferi* (Lyme), and its tick vector, the western black-legged tick (WBLT) (*Ixodes pacificus*), by collecting and testing ticks for the presence or absence of Lyme.



51 locations were surveyed in 2011 for western black-legged tick to determine if the Lyme disease-causing bacteria, *Borrelia burgdorferi,* occurs in Utah. The red markers above indicate sites where ticks were found and blue markers indicate sites without tick collections.

Lyme was not detected within any of the 41 western black-legged ticks that were collected. The survey will continue in 2012.

In 2011, 51 sites in Utah, Tooele, Juab, Iron, and Washington counties were surveyed between May and July, and October and November. Sites were selected using historical tick collection data, public input, information from the Centers for Disease Control, tick-host distribution maps, and vegetation typing. At each collection site, we recorded weather conditions, temperature, elevation, aspect, GPS coordinates, photographs, and vegetation description.

We sampled for ticks using a square felt cloth dragged over vegetation. Ticks were found at 7 of the 51 sites. In total, we 78 adult ticks–41 *Ixodes* (WBLT) and 37 *Dermacentor* (Rocky Mountain wood tick, winter tick, and "Rocky Mountain sheep tick")–and 57 *Dermacentor* larvae were collected. WBLT were found at 3 sites and *Dermacentor* ticks were found on 5 sites, some sites yielding both tick genera.

All ticks were DNA-tested (using PCR) for the presence of Lyme, and all tested negative.

As documented from prior tick surveys in Utah, WBLT is one of the more commonly encountered tick species behind Rocky Mountain wood tick and other ticks in the genus *Dermacentor*. WBLT prefer arid habitats associated with basin-and-range mountains. Ticks collected during our survey were

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Tick Survey, continued from previous page

found on south- to southeast-facing slopes at elevations between 5,600 and 7,000 feet, and when temperatures ranged from 43°F to 60°F. Preferred tick habitat included Gambel oak, juniper, sage, and small grass communities. Gambel oak was a major indicator of WBLT habitat and black sage appeared to be a favorite of WBLT adults and Rocky Mountain wood tick larvae in the fall.

While we did not detect Lyme in this survey, we believe that Utah's long winters and hot, dry summers affect the WBLT life cycle, limiting the spread of Lyme between tick and host. This means that if Lyme does occur in the state, it would occur infrequently and pose minimal threat to humans. In California, where the transmission of Lyme disease from infected ticks to humans is well documented, only about 5% or less of the WBLT population has been shown to carry Lyme. In Utah, there are no confirmed cases of Lyme originating in the state, indicating that the number of WBLTs carrying Lyme is likely to be even lower than in CA. Because of this, we will need to test a large number of WBLT to determine whether Lyme occurs in Utah.

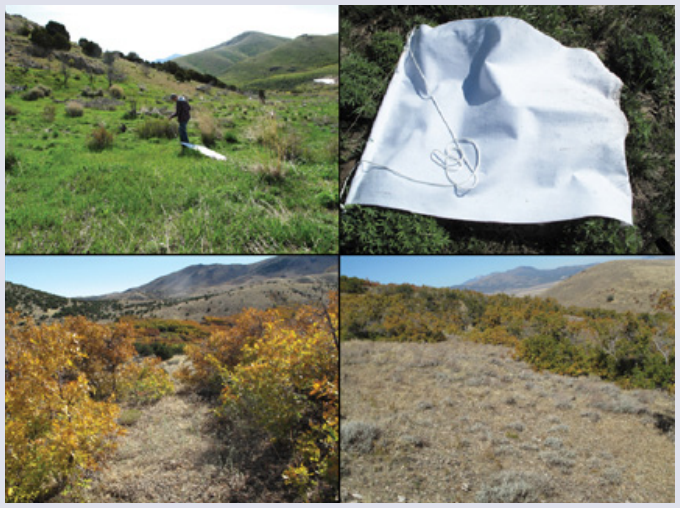
Until we can issue conclusive results, care should be taken to avoid tick habitat in early spring and late fall. The most commonly encountered tick in Utah is the Rocky Mountain wood tick and it is capable of transmitting other diseases besides Lyme, such as: Rocky Mountain spotted fever, Colorado tick fever, and tularemia (rare).

After spending time outdoors, always conduct a thorough tick inspection. Disease transmission usually takes over 24 hours of tick attachment. Removing ticks within a day will greatly reduce the odds of contracting any tick-borne illness. For more information on tick-borne diseases and proper tick removal, please see a previous article: Ticks and Associated Diseases Occurring in Utah.

If you find a tick in Utah, please send it to the Utah Plant Pest Diagnostic Lab to help us to increase our sample size for Lyme detection. Ticks should be placed in ethyl alcohol or rubbing alcohol with a notation of the date, time, and location of the collection. Please include a UPPDL sample submission form with your contact information (no fee).

A summary of our survey and the complete results, including site pictures, can be found here. This project is funded by grants from USU Extension, the Centers for Disease Control, and the Utah Bureau of Epidemiology.

-Ryan Davis, Arthropod Diagnostician



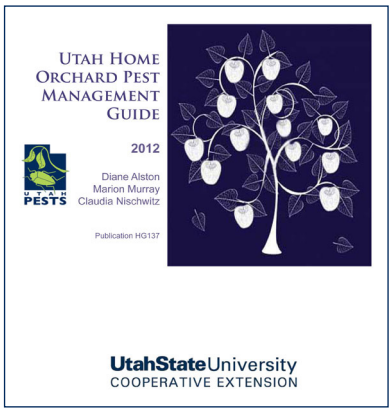
Top: Adult ticks that are frequently encountered in Utah are the western black-legged tick (*Ixodes pacificus*) (female, top left and male, top right) and Rocky Mt. wood tick (*Dermacentor andersoni*) (female, bottom left and male, bottom right).

Bottom: Ticks are collected using a standard flannel tick drag. Western black-legged ticks were most commonly collected on dry sites with gamble oak, juniper, sage, and small grasses.

Basic Pest Management for Home Orchards

Growing your own fruit can be a rewarding experience that contributes to a healthy lifestyle. However, if you are new to fruit gardening, it is important to have an understanding of common fruit pests. The big three insect pests in the home orchard are codling moth ("worm" in apple and pear fruits), peach twig borer (borer in new shoot tips and fruit of peach, nectarine, and apricot), and cherry fruit fly (maggots in cherry fruits). Powdery mildew (different species attack apple and cherry), fire blight (can kill apple and pear shoots, limbs, and trees), and coryneum blight or shothole (fungus that attacks stone fruits) are the three primary disease pathogens in home orchards in Utah.

Of all the fruit pests, USU Extension receives the most inquiries about codling moth. The most effective tools for this pest are insecticides because few natural enemies attack it due to its protected life stages. The least toxic insecticides, to humans and non-target insects, include spinosad (a natural toxin produced by a bacterium), codling moth granulosis virus, and acetamiprid. Accurate timing of sprays will reap the best insect control, minimize harmful effects to beneficial insects, and save time and money. The Utah IPM Advisories (fruit, vegetable, ornamental, and turf) provide information on current pest activity and management advice throughout the growing season. You can sign up for a free subscription that alerts you when a new advisory is posted. How-to video fact sheets on the Utah Pests website provide information on homemade traps and exclusion techniques for codling moth, earwig, spotted wing drosophila, European paper wasp, and other pests.



The peach twig borer can be a major pest of peach, nectarine, and apricot along the Wasatch Front and in the St. George area of Utah. The larvae (caterpillars) of this moth overwinter in protected cells on the twigs of trees, and so the delayed dormant oil spray that covers and suffocates the larvae is a very important first step to management of this pest. The dormant oil should be applied at bud break when pink blossom tissue just begins to show, but before flowers open. An insecticide, such as permethrin, gamma-cyhalothrin, or malathion can be added to the oil to provide greater suppression of the larvae. Alternatively, sprays of *Bacillus thuringiensis* (Bt), a bacterial insecticide, can be applied during bloom to kill the overwintered larvae as they begin to feed on the new shoot growth. Bt is harmless to bees and other pollinators. Bt, spinosad, or acetamiprid can be applied during fruit development when summer generations of peach twig borer larvae begin to hatch.

Cherry fruits become susceptible to infestation by cherry fruit fly when their color changes from yellow to pink blush. A yellow sticky trap hung in a cherry tree can inform if and when adult fruit flies are active. The female fly inserts her sharp ovipositor just under the skin of the fruit to lay her eggs. Prevention of egg-laying is the primary strategy to prevent wormy cherries. Spinosad, carbaryl, and malathion are all effective in killing adult flies. Begin sprays when fruit is susceptible based on color, reapply insecticides based on the protection interval listed on the product label, and don't spray too close to harvest. Use landscape fabric under the canopy of cherry trees to reduce pupation and emergence of adults from the soil. Clean up dropped fruit that may contain maggots. Chickens, ducks, and other fowl will eat maggots that drop from the fruit, and help reduce cherry fruit fly populations.

USU Extension offers numerous online publications to help diagnose and manage pests in the home orchard. The Utah Home Orchard Pest Management Guide is a comprehensive bulletin that includes an overview of integrated pest management (IPM) practices, spray tables for fruit crops, photos and descriptions of pests and natural enemies, suppliers of IPM products, and names of common home pesticides. A series of backyard orchardist fruit pest fact sheets are also available for apricot, apple, cherry, peach, pear, and plum. The USU Extension fruit website provides links to resources on home garden and commercial fruit production, including determining the hardiness zone of your location and fruit tree pruning and nutrition guidelines. Check out these home fruit production resources and contact your local Extension office for further assistance.

-Diane Alston, Entomologist

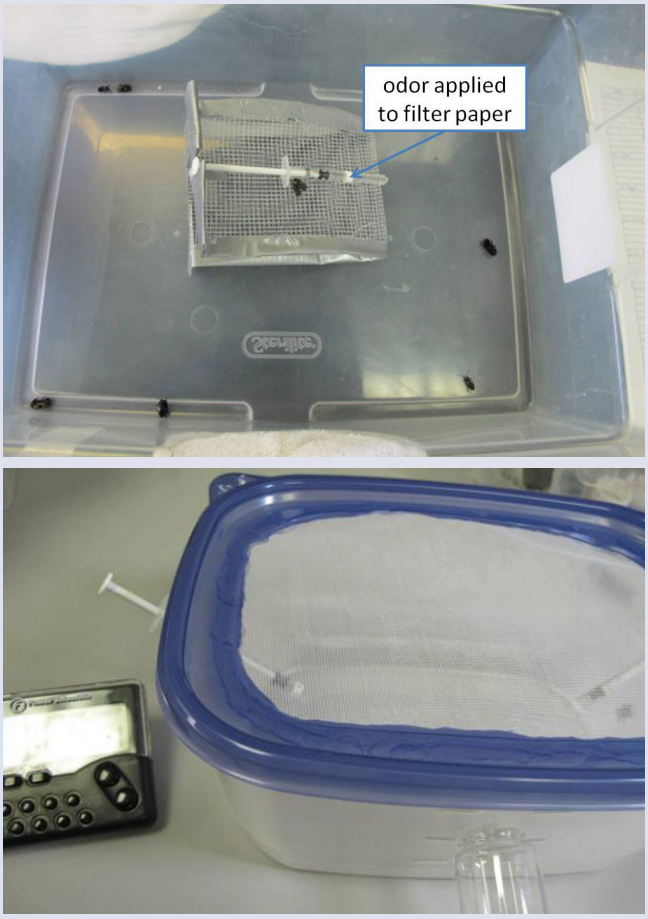
The Ongoing Search for Fungicide Effects on Blue Orchard Bees

Blue orchard bees (*Osmia lignaria*), like other mason bees, nest in pre-existing cavities (e.g., hollow berry canes or holes left behind by wood boring beetles). Unlike honey bees and bumble bees, blue orchard bees are solitary, meaning that they do not live in a hive, and each female creates her own nests and lays eggs. They are one of about 900 species of bees that are native to Utah, most of which are solitary (Cane and Kervin, 2011).

Male and female blue orchard bees.

Concern over declining populations of honey bees and other pollinators has led to increased use of blue orchard bees as a managed pollinator of tree fruits. As use of blue orchard bees has increased, so have reports that blue orchard bee nesting slows down, pauses, or ceases altogether following fungicide treatments. Derek Artz, a researcher at the USDA-ARS Bee Biology and Systematics Laboratory in Logan, Utah, recently observed the disruption of nesting behavior after fungicide sprays in field cages in California and soon will publish his findings. Previous research found only one of the five fungicides tested, captan, was lethal to blue orchard bees (Ladurner et al., 2005). However, despite lack of evidence for fungicides resulting in bee fatalities, the possibility remains that fungicides may cause other physiological and behavioral effects in blue orchard bees.

As part of an ongoing collaboration with Dr. Theresa Pitts-Singer (USDA-ARS), my lab has been determining if fungicides affect the ability of blue orchard bees (*Osmia lignaria*) to learn olfactory cues encountered during foraging. Olfactory cues are important for bee navigation, nest selection, foraging, and a variety of other bee activities. If fungicides disrupt blue orchard bees' ability to learn or remember olfactory



Top: Blue orchard bees were trained in a plastic cage with a feeder modified from a syringe. Odors were applied to a filter paper collar which was attached with hot glue. The cage had a mesh lid that facilitated air flow (not shown).

Bottom: An individual bee entered the testing arena from a glass vial attached to the side. The bee had 10 min to choose between two water-filled feeders that were inserted through opposite sides of the arena, equally distant from the entrance. One feeder was scented with geraniol, and the other was scented with PAA.

cues that they encounter during normal activities, bees may become confused and disoriented, possibly hindering their ability to create and find a nest, or find food. If the bees are not successful in these activities, they are also not going to be successfully pollinating the crops that we depend on for food.

The simple experiment is testing the fungicides Rally, Rubigan, Procure, and Pristine by training bees to associate a particular odor with a sugar reward. We assume that they will have

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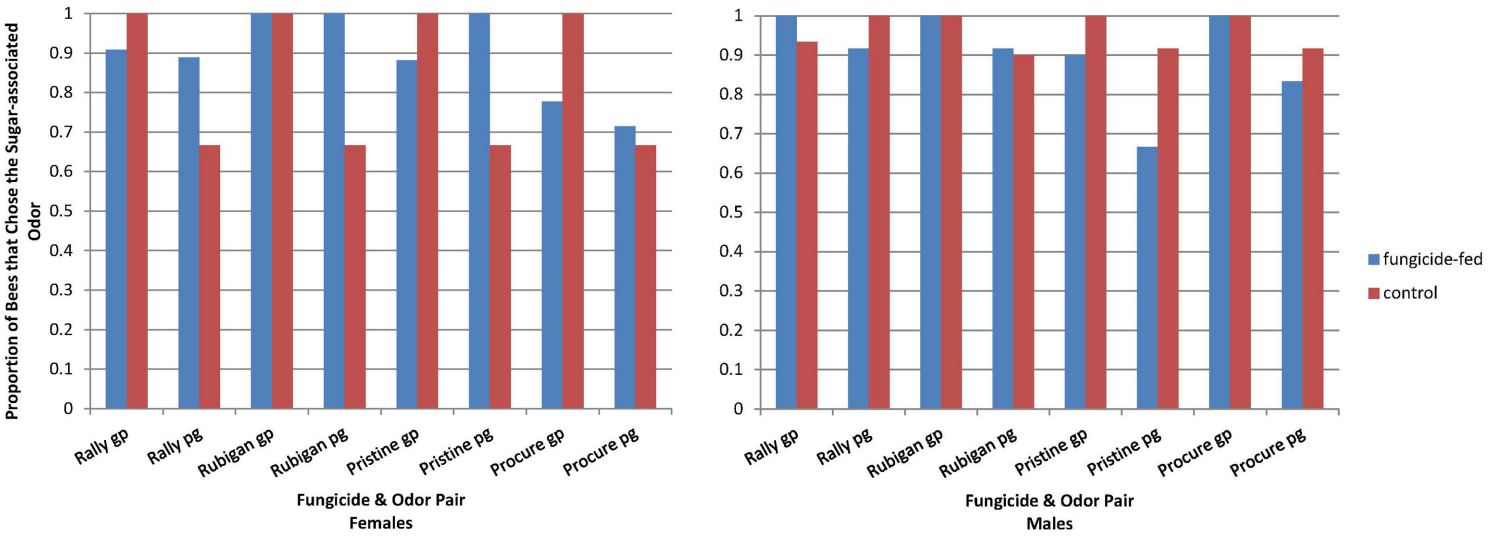
Fungicide effects on blue orchard bees, continued from previous page



Proportion of trained female and male fungicide-fed and control blue orchard bees that, when given a choice between two water-filled scented feeders , chose the odor that was previously associated with sugar. An odor pair designation of 'gp' indicates that geraniol was associated with the sugar-filled feeder and PAA was associated with the water-filled feeder. An odor pair designation of 'pg' indicates that PAA was associated with the sugar-filled feeder and geraniol was associated with the water-filled feeder. No fungicide-fed group was significantly different from its corresponding control group.

learned to choose the odor that was always associated with sugar. If a fungicide affects blue orchard bee learning, it is expected that fungicide-fed bees will not choose the sugar-associated odor as often as bees that were never given that fungicide.

Upon emerging from their cocoons, bees are fed sugar water laced with a known amount of one of the fungicides for a full day. The feeder containing the sugar water is scented with either geraniol or phenylacetaldehyde (PAA), both of which are components of common floral aromas. On day two, they are fed water that contains fungicide, but not sugar, from a feeder scented with the odor that they didn't experience on day one. The swapping of the scented sugar-fungicide feeder and scented water-fungicide feeder occurs over two more days, for a total of four days of exposure to the odors and the fungicide. On the fifth day, each bee is placed in a testing arena and allowed to choose between the sugar-associated odor and the water-associated odor. Their choices are then compared to the choices of a set of bees that went through the exact same procedure, but were never fed a fungicide. In spring of 2011, a total of 380 fungicide-fed blue orchard bees and 449 bees not fed fungicides, both males and females, were tested in this manner. Although a small proportion of fungicide-fed bees did seem less likely to choose between the two scents than bees that were not fed fungicides, thus far there has not been significant evidence that fungicide ingestion affects bees' ability to learn the odors. This is important to growers and others who wish to combat powdery mildew and other fungal diseases without decreasing pollinator efficiency and vitality.

This research is ongoing. Additional bees will be tested for learning effects in spring of 2012, and the effects of fungicides on bee memory will also be tested. Because fungicides are usually used with adjuvants such as stickers or spreaders, and because the effects of adjuvants on bees have not been rigorously tested, an experiment testing the synergistic effect of fungicide/adjuvant mixtures on blue orchard bee learning and memory is also being initiated in spring 2012.

-Cory Stanley, USU CAPS Coordinator

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Look Out for Blister Beetles and Clover Root Curculio in Alfalfa

Add two more pests to the list of beetles that alfalfa producers should watch for. The blister beetle does not reduce yield, but can be harmful to livestock in cut hay, and the clover root curculio—an often overlooked pest—could be reducing alfalfa yield and stand life in Utah.

BLISTER BEETLE

Alfalfa growers and livestock owners should always be concerned with blister beetles. These beetles belong to the family Meloidae and produce cantharidin, a chemical toxic to people and animals. Smashing one of these beetles against the skin can lead to painful blisters and swelling. A recent incident with alfalfa hay infested with blister beetles resulted in the death of a horse, which are particularly sensitive to this beetle's toxin. When livestock eat hay containing cantharidin the gastrointestinal and urinary tracts become irritated and complications can lead to death. If blister beetle poisoning is suspected (symptoms include blisters and colic among others) contact a veterinarian immediately.

Blister beetles lay eggs in the soil and first instar larvae actively search for grasshopper egg cases to complete their juvenile life stages. The spotted blister beetle is one of the most common ones found in Utah, but many species are present and vary in color. These beetles are frequently associated with grasshopper outbreaks. There are other species that actively search for bee eggs. Adults are soft bodied and emerge from the soil throughout the growing season. Typically, the first-cut hay escapes being contaminated by blister beetles because peak activity occurs in the middle of the season.

Minimize alfalfa hay contamination.

- Check alfalfa for blister beetles before cutting. These beetles tend to cluster in masses near field edges.
- Manage weed problems and harvest alfalfa prior to bloom. Blister beetles prefer blooming plants.
- Harvest practices such as hay conditioning, crimping, and other practices that kill or crush blister beetles exposing the cantharidin toxin to plants can increase contamination.
- Although insecticides are available for blister beetle management, some entomologists have recommended against using insecticides because beetles often leave the field after a short time and treatment would keep the beetles and their toxin in the field. The toxin lasts even after the beetle dies.

CLOVER ROOT CURCULIO

Clover root curculio (***top***) looks similar to alfalfa weevils but smaller and without distinct patterns on the wings. Larvae are small white grubs that scar roots. (***bottom***).

In a recent article in ***Hay and Forage Grower*** magazine, our neighbors to the north at the University of Idaho Extension brought up concern over another weevil in alfalfa that could be impacting yield and stand longevity. Unlike alfalfa weevil whose larvae feed on foliage, the clover root curculio has larvae that feed below ground on the roots of alfalfa.

The clover root curculio is a weevil that is smaller than the alfalfa weevil. The adult beetles do feed on foliage but

Beetles in Alfalfa, continued from previous page

Clover root curculio root damage.

the larvae are the major culprits of alfalfa damage. Larvae feed on the roots and first target small roots and nodules eventually moving to the tap root. By pruning lateral roots and scarring taproots the larvae can expose alfalfa to other disease problems. Symptoms from larval feeding may be mistaken for nutrient deficiencies or diseases that may come secondarily. Slow green-up and growth, and yellowing, are typical symptoms.

To diagnose these beetles, examine the roots to spot larvae and root damage. University of Idaho Extension recommends washing roots before examining them to clearly see feeding scars on the taproots.

Management is limited because no insecticides are registered in Utah for these beetles in alfalfa. Crop rotation to grasses or row crops other than soybeans may reduce populations. More research is required to determine the economic impact and develop management tactics for clover root curculio in the West.

-Ricardo Ramirez, Entomologist

GENERAL NEWS

Photo Contest on Facebook

Get connected with what's happening with the UTAH PESTS group on Facebook at: facebook.com/utahpests! Submit your prized plant pest photograph for a chance to win a "pest monitoring" package, including a copy of ***Gardening with Good Bugs*** by Erin Hodgson, a lighted hand lens, vials and forceps for collecting specimens, and more.

When submitting your image, clearly label that it is an entry in the contest in your post. The photo that gets the most "likes" by June 1 will be announced as the winner on your own Facebook page, on the Utah Pests page and the summer issue of ***UTAH PESTS News***.

Bumble Bee Workshop at USU

USU Extension and the USDA-ARS Bee Biology and Systematics Laboratory will be offering a bumble bee workshop in Logan on June 22. Topics to be covered will include bumble bee biology, conservation, rearing, and others. Cost is $35 and will include a light breakfast and lunch. For more information or to register, go to www.loganbeelab.usu.edu.

In the National News

BED BUG CONTROL ON THE CHEAP

Bed bugs have become a nation-wide concern. A new option for noninvasive treatment of household items that shows promise uses dry ice–which produces CO_2–to suffocate the insects. Carbon dioxide, at a concentration of at least 30 percent, was found to effectively kill bed bugs, as reported by Rutgers University entomologists. They placed bed bug-infested items into a plastic garbage bag with dry ice and sealed the bag to allow a fog of CO_2 to form. Results showed that three pounds of dry ice pellets in a heavy duty bag filled almost full of household items and sealed tight with string, killed every bed bug in the bag within 24 hours. A private company will be using these recommendations to develop a dry ice kit for killing bed bugs.

SCHOOL IPM PROVIDES HEALTHY SCHOOL ENVIRONMENTS

Oregon joined 15 other states (as of 2009) in mandating IPM in public schools. The new law requires districts to develop an IPM plan that includes protocols for regular monitoring and inspections, limitations on pesticide use, and maintaining a safe environment. Each school district must also designate an IPM coordinator who must complete six hours of training each year (provided by Oregon State University and funded by EPA). The university developed a model IPM plan to help the districts, as well as brochures, educational materials, and a training program for the schools and for pesticide applicators.

THE TONE OF SPIDER SILK

The mechanical properties and strength of spider silk allow this material to be used for a variety of applications, including violin strings. A Nara Medical University researcher in Japan wound thousands of strands of silk to create violin strings that resulted in a unique and resonant sound. The silk was obtained from 300 captive-bred golden orb weaver spiders (*Nephila maculata*). Each string was comprised of three bundles of silk, with each bundle using 3,000 to 5,000 individual strands twisted together. The strings withstood more tension than the most commonly used aluminum-coated nylon strings.

HIGH-YIELD IPM FARMS CAN BE MORE GREEN THAN ORGANIC

An Oxford University study published in the journal, Agricultural Systems, shows that farms using IPM to produce high yields can potentially use less energy and generate lower greenhouse gas emissions per acre than both organic and conventional farms. The IPM farms emphasized integrated management practices, such as using crop rotation, organic fertilizers, cover crops, and minimal pesticides, to maximize crop yields. One of the differences with organic growers is that organic farms need to use more land to grow the same amount of food, whereas, acre for acre, that land on IPM farms can be used for alternative uses like forest land or energy crop production.

"SPEEDY" PLANT REACTION TO NEARBY STRESSED PLANTS

Genetic engineers in Mexico have studied the long-known mechanism that allows healthy plants to sense stress or disease in nearby plants and then increase resistance. They exposed lima beans to varying concentrations of two plant-produced odor compounds (nonanal and methyl salicylate) that enhance resistance to bacterial disease. They found that the nonanal significantly induced resistance within 6 hours of exposure, but it took 24 hours for the methyl salicylate to cause significant changes in resistance in the lima beans. Plant-to-plant signaling, in this instance, likely involved the accumulation of odors in the receiving plant over a period of time (up to 24 hr).

MANAGING ZEBRA CHIP WITH IPM

Zebra chip is a potato disease of tubers that results in aesthetic browning of fried potato chips. It was found in Texas in 2000, and has since spread to most potato growing regions in the western U.S. A multi-disciplinary team recently identified the zebra chip bacterium, *Liberibacter solanacearum,* in infected tubers, and found that it is vectored by the potato psyllid. New research will focus on managing the psyllid using integrated practices such as kaolin clay that disrupts psyllid feeding, mineral oil, biological control with the fungus, *Metarhizium anisopliae*, and developing potatoes with resistance.

Useful Publications and Websites

EPA launched a resource directory for child care providers that includes IPM guidelines for childcare centers and fact sheets with information on commonly used toxic cleaning products and pesticide impacts on children.

Purdue University and Midwest Cover Crops Council have produced a $5 pocket guide to help farmers choose the most appropriate and economical cover crops.

"My Food Fight" is a new iPhone app that provides a game-like environment to promote organic gardening.

Featured Picture

Spring came early this year, as did peach bloom. Some growers were caught by surprise and had to prune during bloom, creating a carpet of pink on the orchard floor.

But winter temps didn't exit so easily, and heavy frosts damaged peach, apricot, and sweet cherry blooms in many areas of northern Utah. The full extent of damage will not be realized until later in the season.

-Image by Marion Murray

Calendar of Events

May 21-25, Department of Defense (DoD) Workshop: Strategic Management of Invasive Species in the Northwest United States, Portland, Oregon

June 3-6, Entomological Society of America North Central Branch Meeting, Lincoln, Nebraska

June 17-22, 6th International Weed Science Congress, Hangzhou, China

Jun 19-21, Sudden Oak Death 5th Science Symposium, Petaluma, California

June 24-29, 13th International Symposium on Virus Diseases, Thon Hotel Ski, Norway

Jun 27-29, American Phytopathological Society Pacific Division Meeting, Sacramento, California

Jul 31-Aug 3, American Society for Horticultural Science 2012, Miami, Florida

Aug 4-8, American Phytopathological Society Annual Meeting, Providence, Rhode Island

Aug 22, All About Bees Workshop, Kaysville Education Center, Kaysville, Utah

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