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UTAH PESTS QUARTERLY

Utah Plant Pest
Diagnostic Laboratory

USU Extension

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Status of the Samurai Wasp (*Trissolcus japonicus*) in Utah

Brown marmorated stink bug (BMSB, *Halyomorpha halys*) has been a highly successful invasive pest in North America not only due to its wide host range of over 300 plants, but also the lack of naturally-evolved enemies. In its native range of Asia, BMSB is primarily controlled by parasitoid wasps that lay their own eggs within stink bug eggs, killing the pest. To manage this pest, efforts have focused on biological control through Utah native parasitoids as well as a recently introduced exotic parasitoid. Management of BMSB with insecticides has had limited success.



Female *Trissolcus* wasp investigating a lab-reared BMSB egg mass with adjacent stink bug kairomone lure.

The samurai wasp (*Trissolcus japonicus*) is the primary parasitoid of BMSB in Asia and has already shown the potential to control Utah BMSB populations since its initial detection in Salt Lake City in 2019. Yellow sticky card surveys in 2020-2022 have demonstrated that the samurai wasp has spread beyond Salt Lake county to Box Elder, Cache, Davis, Utah, and Weber counties.

Urbanization and Groundcovers

Our research team investigated the effects of the surrounding landscape type, orchard groundcover, and BMSB presence on abundance of the exotic samurai wasp and native parasitoid wasps (see graph, next page). We found that the samurai wasp exhibited a strong association with BMSB, following its seasonal activity patterns and reliance on urban landscape resources. Floral groundcover in orchards, including herbaceous weeds, wildflowers, and strip-cropped flowering plants, provided resources that were significantly beneficial for enhanced abundance of native *Trissolcus* parasitoid wasps.

Experimental Attractants

Additionally, we explored the potential of lures (rubber septa) containing stink bug chemicals (kairomones) to attract and retain the samurai wasp in sites with BMSB (see image above). A field study documented BMSB egg parasitism by native and exotic parasitoids. *Trissolcus euschisti* is abundant in Utah and the only native wasp that parasitized BMSB egg masses in our study. This native attacked 7.6% of egg masses deployed, similar to the exotic samurai



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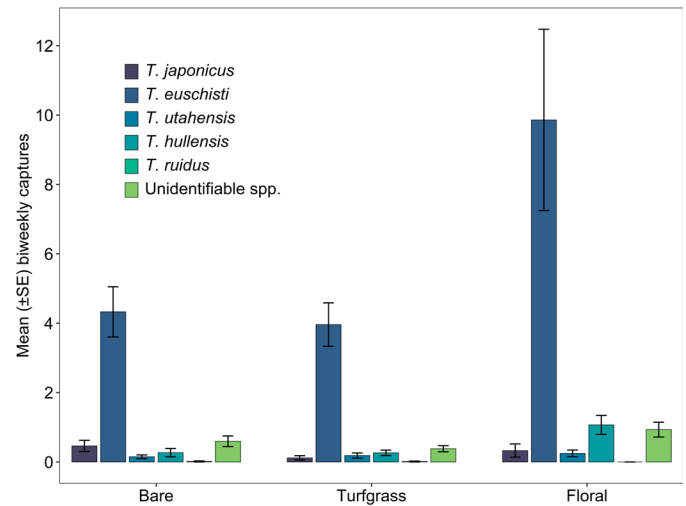
wasp which attacked 5.4%. However, only 2% of the BMSB eggs produced live *T. euschisti* adults compared to 78% for samurai wasp adult emergence. These results demonstrate that management efforts should focus on the release and conservation of samurai wasp rather than Utah native parasitoids.

In a lab study, we found that a blend of two chemicals used in the lures was most effective in attracting samurai wasps. Our results support the use of stink bug lures to attract this Asian wasp to reduce BMSB populations. Additional research is needed to fine-tune the optimal chemical ratios and release rates of lures. This approach could provide benefits of increased accuracy of estimating samurai wasp populations in agricultural areas, and estimate parasitism rates as the samurai wasp spreads to new locations in Utah and throughout the U.S.

Parasitoid Interactions

To further investigate the role of the samurai wasp in biological control of BMSB in Utah, we studied interactions, competitive or facilitative, between parasitoids attacking BMSB eggs. BMSB egg masses were first exposed to female samurai wasps and then to female native *T. euschisti* to assess if initial parasitism by the exotic wasp would enhance parasitism by the native wasp. Preliminary results suggest that the samurai wasp, unfortunately, does not facilitate successful parasitism by the native wasp, and further, successful samurai wasp development in BMSB eggs could be reduced by the interaction of the two wasp species. Future research on the behavioral and physiological interactions of these parasitoids may shed light on the possible benefits or detriments samurai wasp brings to native parasitoids in the effective biological control of BMSB in Utah.

Commercial Orchard Ground Covers Influence Abundance of Stink Bug Parasitoid Wasps



Influence of commercial orchard groundcover type (bare ground, turfgrass, and floral) on mean captures of parasitoid wasps on yellow sticky cards from May-September, 2021, in eight orchard sites. “Unidentifiable spp.” represents *Trissolcus* wasps that were unidentifiable to species. The native wasp, *T. euschisti* was the most abundant, and was enhanced by floral groundcovers. The Asian parasitoid, *T. japonicus* (samurai wasp), had low abundance and was not enhanced by floral groundcovers.



Left: *T. euschisti* female (circled) guarding an unsuccessfully parasitized BMSB egg mass.
Right: BMSB egg mass successfully parasitized by the samurai wasp (note the dark color of the eggs indicating a wasp is developing inside).

— Kate Richardson, MS Graduate Student; Zachary Ross, Undergraduate Student; Diane Alston, Entomologist; and Lori Spears, Invasive Species Coordinator

Southern Blight



Iris leaf showing necrotic lesions caused by *Sclerotium rolfsii*.



Iris leaf showing white mycelium caused by *S. rolfsii*.



Yellow-brown, mustard-like fruiting structures (sclerotia) are a key feature for identifying *S. rolfsii*.

Southern blight is caused by the fungus *Sclerotium rolfsii* (syn. *Athelia rolfsii*). It is a soilborne pathogen but can also occur on rhizomes, bulbs, or tubers. The fungus grows in hot temperatures and wet conditions. As the common name for the disease suggests, it frequently occurs in the southern U.S. where summers are hot and wet. However occasionally, the disease occurs in more northern states under the right conditions.

In Utah, the disease is rarely found. The summer of 2022 was very hot (mid-90s to low 100s Fahrenheit) with frequent storms, creating a wetter and more humid environment over consecutive days. An iris sample was sent to the Utah Plant Pest Diagnostic Lab (UPPDL) with necrotic lesions on the leaves. Several lesions had white mycelium containing yellow-brown fruiting structures that resembled mustard seeds. There are many other fungal pathogens with white mycelium; however, on the iris, the mycelium was fast-spreading. That, and the seed-like fruiting structures (sclerotia) are the classic identifying characteristics of this pathogen and thus did not require us to conduct DNA sequencing.

Southern blight has over 500 known hosts including many bulb, rhizome, and tuber crops such as dahlia, peony, iris, carrot, onion, and potato. It can also cause a crown rot of herbaceous plants like pepper, tomato, zinnia, petunia, and hydrangea.

Management of southern blight is difficult. Ideally, preventing the introduction of the pathogen into a garden or field is best but infections can go unnoticed for several seasons. The sclerotia can survive for many years in the soil, until a suitable host and the right environmental conditions allow for infection. If it is introduced on plant material and discovered early, destroying the infected plant and removing about three inches of soil around its root zone can stop the spread. If the pathogen is established in the soil, improving drainage can reduce disease incidence. There are no resistant varieties available. Fungicides containing azoxystrobin can be used as a protectant on some host plants, following the label.

— Claudia Nischwitz, Extension Plant Pathologist



Southern blight symptoms on a carrot.



S. rolfsii causing crown rot on a pepper plant.



S. rolfsii causing crown rot on a tomato plant.

External Parasites Most Likely Encountered in Home Chicken Flocks in Utah

Dr. David Frame is the [Extension poultry specialist](#) for USU and is a board-certified poultry veterinarian. He has received national awards for his poultry extension work and served on the General Conference Committee of the National Poultry Improvement Plan, an official advisory committee to the U.S. Secretary of Agriculture. Before beginning his professional career in poultry, Dr. Frame extensively raised and showed exhibition chickens.

We are fortunate that only a few external parasites affect domestic poultry in Utah. Three species of mites and two species of lice comprise the most likely encountered pests. Owners should be aware of these and know how to detect, treat, and control infestations as early as possible.

Northern Fowl Mite (*Ornithonyssus sylviarum*)

The northern fowl mite infests layers, turkeys, exhibition birds, and pheasants. It is the mite most likely encountered in cooler seasons of the year. The life cycle from egg to adulthood occurs in as little as one week. The entire life cycle takes place on the host; however, blood-engorged adults can survive in the litter and other off-bird sites for as long as a few weeks. Detection is made by examining the vent area of individual birds. Gray salt- and pepper-like moving particles around the vent is indicative of infestation.

Red Mite or Roost Mite (*Dermanyssus gallinae*)

Red mites are not as commonly encountered in Utah as northern fowl mites. Life cycle is seven to ten days. Red mites feed on the birds at night and hide in crevices during the day. They can survive for at least four weeks off the host. Red mites can be detected by examining individual birds at night using a flashlight, or by careful inspection of dark cracks and crevices in the coop during the day. Moderate red mite infestation can reduce egg production, cause weight loss, and produce anemia; severe infestations have been known to cause mortality.



Northern fowl mite (*Ornithonyssus sylviarum*)

Treatment and Control of Northern Fowl Mite and Red Mite

Because these mites have similar life cycles and ecological niches, treatment is basically the same. Direct acaricide application to every bird, paying particular attention to the vent area and under wings and back, is the preferred method of treatment. Use a permethrin-based powder or other poultry-approved product. Please follow manufacturers' guidelines for safe application and personal safety. It is important to apply once weekly for at least three weeks to catch the parasites at the stage of their life cycle when they are susceptible to treatment.

After treating the entire flock for at least three weeks, remove all birds and dispose of the litter (bedding). Spray the entire coop, cracks and crevices, nests boxes, and perch areas with an approved insecticide according to the manufacturer's directions for personal safety. This is a particularly important step in the control of red mites. Screen out wild birds and rodents, which may serve as reservoirs and assist in the spread from flock to flock.

While working with mite-infested chickens, it is likely that a few mites will crawl onto the handler. These "hitch-hikers" can be easily removed with a quick shower and change of clothes. However, it is recommended that immuno-compromised individuals or persons who are allergic to acarids consult with their physician before handling infested birds.

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Lice

Louse species that infest domestic poultry are the chicken body louse (*Menocanthus stramineus*) and the shaft louse (*Menopan gallinae*). They do not suck blood, but rather chew and feed on dry skin, feather debris, and quills.

The entire life cycle of three to five weeks occurs on the host. Mild to moderate infestation causes scabby irritated skin; if severe enough, feather deformity may result.

An infestation can be detected by examining under the wings for adults and nits. White egg packets can be found around the base of feather shafts, often on the underside of neck area.

Treatment and Control of Louse Infestation

Control is the same as for mites, making sure the entire flock is treated. Lice may infest other bird species; therefore, screening out wild birds is an important part of the control program.



Louse infestation present on chicken.



Cockerel showing severe louse infestation.

Scaly Leg Mite (*Knemidocoptes mutans*)

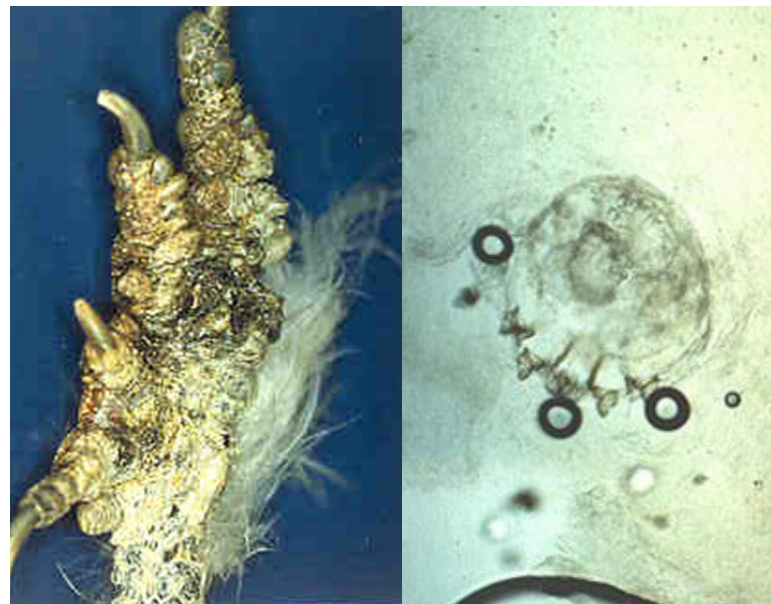
The last parasite to be discussed is the scaly leg mite (*Knemidocoptes mutans*). Hosts include many domestic and wild bird species. Introduction into the home flock occurs by adding newly acquired mite-infested poultry or by allowing wild birds access to the flock.

Knemidocoptes is a microscopic-sized burrowing mite that gets underneath the scales of the shanks and feet causing irritation leading to abnormal thickening. It is typically seen in older birds but may occur at any age.

Early infestation appears as enlarged scales protruding from the shanks or feet. If not promptly treated, a more severe condition may result in irreversible lameness and deformed feet.

Treatment and Control of Scaly Leg Mite

Control is quite effective and is accomplished by working petroleum jelly under the scales. This causes suffocation of the mites. This treatment will need to be repeated weekly for a few weeks until no new cases are apparent. If infestation has not caused extensive damage, the enlarged scales are reversible with consistent treatment over time. It is important to treat the entire flock, even if the rest of the birds look healthy. Prevention is accomplished by protecting the flock from contact with wild birds and not re-introducing mite-infested poultry.



Left: Scaly leg mite (*Knemidocoptes mutans*) on foot.

Right: microscopic view of scaly leg mite

Peculiar Pest Finds of 2022

Every season, the Utah integrated pest management program connects with vegetable producers and hobby growers across the state by scouting pests on farms and community gardens. The summer of 2022 revealed several peculiar pests and abnormal damage in some crops that we don't normally see affected.

Fungus Gnat Larvae Kill Seedlings

In early spring, we observed considerable feeding damage on cotyledons of vegetable transplants at a greenhouse in Cache County. It was caused by the larval stage of fungus gnats, which usually only damage roots. Adults are small, long-legged flies commonly found within greenhouses and other interior settings. The gnats are considered a nuisance, while the larvae may damage plant roots when burrowing through the soil in search of food (fungi and other organic matter). The damage to the vegetable transplants was due to cotyledons touching the soil surface during early germination, allowing access for the larvae to feed. Most of the damaged seedlings died shortly after and required reseedling.



Potatoes Suffer from Scab

In September, growers of a few small farms in Millard County reported seeing scab on harvested potatoes. Common scab is caused by the soil-borne bacteria *Streptomyces scabies*. This bacterium creates lesions on the tuber, resulting in an unmarketable and inedible potato. Plants first become susceptible to *Streptomyces scabies* infection during the early stages of tuber development. Management for common scab with antibiotics is not recommended and instead, growers are encouraged to implement cultural IPM practices to reduce wounding and improve soil drainage.



continued on next page

Weevils Compromise Sunflower Stability

A farm in Cache County grew a “wall” of sunflowers this season to serve as a trap crop to deter pests away from the adjacent vegetable production. Sunflowers are attractive to a wide variety of generalist pests and beneficials. However, a few are sunflower-specific pests. Sunflower stem weevils were identified inflicting damage to the flowers. Larvae were found tunneling within the lower stem, causing weakness and breakage. Adults are 1.75-inch long and gray with white markings. They have black eyes, snouts, and antennae. They lay their eggs within the stems.



Yellow-Bellied Marmots Wreak Havoc

The chubby-cheeked, large-toothed yellow-bellied marmot is a rodent related to ground squirrels and native to the Intermountain West. They typically live in the mountains but can also be found in grassy valleys. Throughout the summer, a farm in Cache County observed a family of yellow-bellied marmots living under a shed and hiding in adjacent debris piles at a vegetable farm.

Unfortunately, these marmots strayed from their usual diet of grasses and forbs and developed a taste for the brassica crops on the farm (cabbage, broccoli, kohlrabi, and cauliflower). Throughout June, an estimated 60% of the two 200' cabbages rows received a bite out of the head. This left the cabbages unmarketable and susceptible to insect pests and pathogen infection.

For management, reference your local laws and regulations to determine what is legal in terms of marmot management, removal, and relocation.



Mining Uncharted Territory

Many Utah gardeners are familiar with leafminers, which are the larval stage of various insects who feed on plants by creating easily visible mines within the tissue. This results in aesthetic damage for ornamental plants and loss in sales of some agricultural crops. The most common garden crops severely affected by leafminer damage include Swiss chard, spinach, and other leafy greens. However, this season in Salt Lake County, we observed leafminer damage on kohlrabi (*Brassica oleracea*). We collected the maggot identified it via molecular tools as vegetable leafminer (*Liriomyza sativae*). This species' primary hosts include the plant families Cucurbitaceae, Fabaceae, and Solanaceae. They are primarily distributed throughout the southern U.S. as they are unable to overwinter in colder regions. These factors make our leafminer in kohlrabi a peculiar find!



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— Nick Volesky, Vegetable IPM Associate

Watch For These Hungry Caterpillars

Spongy moth (*Lymantria dispar dispar*) – formerly known as gypsy moth – is one of Utah’s most “unwanted” invasive pests. The name “spongy moth” refers to the spongy appearance of the insect’s egg case. This pest was introduced to the U.S. in the late 1800s, and now occurs in the Northeast and parts of the Midwest. Although it has previously been detected in Utah (and some other western states), it is not currently known to occur here.

The larvae (caterpillars) consume the foliage of more than 300 tree and shrub species including apple, birch, oak, aspen, poplar, willow, and hawthorn. Larvae are most active during May and June. They can be distinguished from other caterpillars by having five pairs of blue spots followed by six pairs of red spots lining the back and long, tan bristles. Adult moths do not feed and are present between early June and early October. Egg masses are present beginning in mid-summer and then overwinter and hatch in the spring.

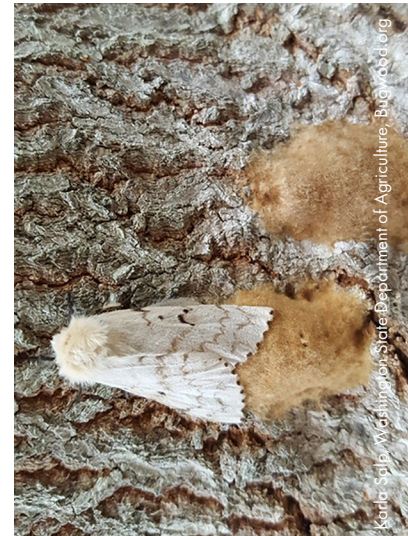
Healthy trees that are infested with spongy moth can usually tolerate one to two years of defoliation, but repeated attacks can weaken the tree and cause mortality. In heavily infested urban areas, spongy moth can also be a nuisance as the different life stages can be found on many outdoor surfaces, including trees, houses, patio furniture, and vehicles.

To help prevent the spongy moth from arriving and establishing in Utah, avoid moving firewood from its area of origination. Because of the risk of introduction (via egg masses) on firewood, the Utah Department of Agriculture and Food (UDAF) implemented a state quarantine which prohibits firewood imports from quarantined areas of the U.S. and Canada, unless the shipment is certified as heat-treated or meets other precautionary standards. Buying local firewood is the simplest way to ensure that you are not moving invasive species to new areas.

Besides firewood and other plant products, the spongy moth is easily spread by travelers, and people are encouraged to be on alert for them, especially when



Spongy moth larva (caterpillar)



Spongy moth adult female with egg masses

traveling from quarantine areas (click [here](#) for map) to non-quarantine areas. In fact, the USDA requires that residents inspect and remove all life stages of the insect from outdoor household items, such as patio furniture and lawn equipment, prior to moving from an infested area. A self-inspection checklist and additional information can be found at the [“Your Next Move Spongy Moth-Free”](#) website.

Note that the spongy moth is closely related to other species and subspecies that occur in Asia (e.g., *L. dispar asiatica*, *L. dispar japonica*, *L. albescens*, *L. postalba*, and *L. umbrosa*), and these are collectively referred to as “flighted spongy moth complex.” This name was chosen because the adult females are capable of sustained flight, whereas spongy moth females are not. The species within the complex are not known to be established in the U.S. but are of great concern to our forests because of their broad host range and flight capabilities which would likely facilitate their spread and establishment.

The Utah Pests group at USU Extension works closely with the USDA and UDAF to prevent, detect, monitor, and control invasive populations within the state, in part through the [Utah Cooperative Agricultural Survey \(CAPS\) program](#). Contact Dr. Lori Spears (lori.spears@usu.edu) if you suspect that these or other invasive plant pests are present in the state. Early detection helps state and federal authorities in Utah manage pests, and citizen involvement is key to program success.

————— Lori Spears, Invasive Species Specialist

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Plant a Pest-Free Parking Strip

The parking strip between the sidewalk and road requires some thoughtful considerations for planting due to the tough growing conditions. The soil is often rocky, compacted, low in organic matter, and highly alkaline. There are power lines, salt from snow-melt, and most importantly, water restrictions. Plants growing in the strip will be under plenty of stress, so picking pest-resistant options is essential. Luckily, there are a many plants that will thrive under these conditions while also benefiting pollinators and providing shade and beauty. Below are some of my favorites.

Perennials

all hardy to zone 4

Sulphur buckwheat (*Eriogonum umbellatum*)

There are many varieties of this native plant, and they all thrive in hot, dry conditions. The summer-time flowers of some are fluorescent yellow globes on 10-inch stems, above a mound of neat and compact foliage. Some plants may be affected by high alkalinity.

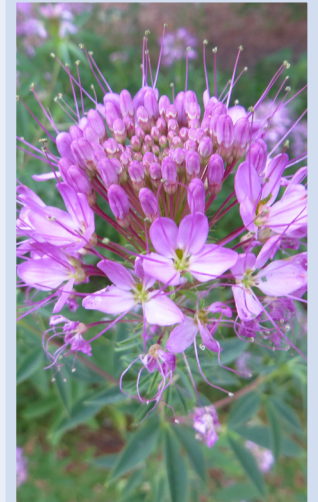


Missouri primrose (*Oenothera macrocarpa*)

The deep green foliage is beautiful, and the large yellow flowers are a bonus. This plant blooms from late spring through mid-summer and is maintenance-free. It does spread by seed, but is not aggressive and easy to pull up.

Rocky Mountain bee plant (*Cleome serrulata*)

If you don't mind a "messy" garden, this native annual is for you. It blooms from early summer through early fall, and lives up to its name as a top pollinator attractant. However, the plants can get tall and a bit floppy. It self-seeds, and needs very little watering. Pull up plants at the end of the season.



Rubber rabbitbrush (*Ericameria nauseosa*)

This is the native plant you see along low mountain slopes with yellow flowers in late summer, when very few other plants are blooming. It needs almost no water all summer and attracts hundreds of bees and butterflies. Cut them back, as they can spread via seed.

Russian sage (*Salvia yangii*, previously *Perovskia atriplicifolia*)

The tall spikes of long-lasting purple flowers attract a wide range of pollinators in summer. This plant needs very little water all season and thrives in poor soil. Cut back at the end of the season.



continued on next page

Deciduous Trees

less than 25' in height
hardy to zone 4 unless noted



Amur Maackia (*Maackia amurensis*)
Not only is this tree tolerant of poor soil, heat, drought, alkalinity, and is pest-free, but it also fixes nitrogen. It is small to medium-sized with velvety-green compound leaves, nice bark, and white, spiky flowers in mid-summer.



Japanese tree lilac (*Syringa reticulata*)
Can be sold as multi- or single-stemmed, this tree has clean, deep green foliage and highly fragrant, creamy white flowers in summer. Highly tolerant of heat, winds, and alkaline soils.

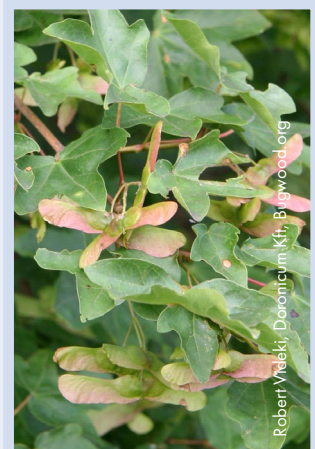


Smoketree (*Cotinus* spp.)
Smoketrees are drought- and ph-tolerant, and sold as a multi-stemmed shrub or single-stemmed tree. Several cultivars are available, with clean, rounded, velvety foliage ranging from green to purple to yellow. In summer, "puffs" of flowers engulf the tree for several weeks.

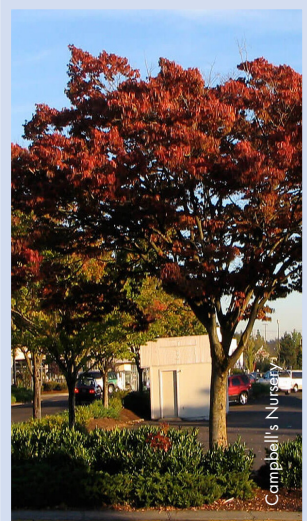
Crabapple (*Malus* spp.)
Yes, crabapples are very common, but there are several cultivars that are drought-tolerant, alkaline-tolerant, and disease resistant. Those with these traits that also have smaller or no fruit include Coralburst, Cinderella, Radiant, Robinson, Royal Raindrops, and Zumi Calocarpa.



Hedge maple (*Acer campestre*; zone 5)
This is a small, rounded tree with dense, clean foliage that tolerates dry, alkaline soils. Postelense is a variety that grows much shorter (8-10' tall) with spreading branches and leaves that emerge a stunning shade of yellow in spring.



Zelkova (*Zelkova serrata*)
The tree that was originally sold to replace the American elm is now known to be a great street tree. A few varieties are shorter than the species. City Sprite reaches 24' tall and 18' wide with bright green summer foliage and buttery yellow fall foliage. Wireless spreads wider, at 23' tall and 36' wide, and has bright red fall color.



Marion Murray, IPM Specialist

Find more favorites here:

[Conservation Garden Park Plant Database](#) - Searchable database of plants grown at the site (Jordan Valley Water Conservancy District)

[Native Plants for the Intermountain West](#) - Website with a plant list and nursery list (WERA1013)

[Tree Browser](#) - Customizable search of over 245 trees (USU)

[USU Botanical Gardens and Utah House](#) - Publication of plants grown at the site (USU)

[Water-Wise Plant Lists for Salt Lake City](#) - Publication of plant lists broken out by watering needs (Salt Lake City Public Utilities)

IPM In The News

Ambrosia Beetles and Fungal Symbionts

Ambrosia beetles are bark-boring insects that introduce symbiotic fungi as they enter trees. Sometimes these fungi are pathogenic and cause severe tree diseases such as wilt. A research team led by Nagoya University in Japan found that the dominant species of symbiotic fungi differed between lab-reared and wild ambrosia beetles (*Euwallacea interjectus*). These findings, published in *Diversity*, suggest that our understanding of the beetle's relationship with symbiotic fungi is more complex and dynamic than originally understood. Scientists can use this new information to better understand artificial control measures for fungal wilt diseases that are spread by ambrosia beetles.

Almond Defenses Against Bacterial Disease

Xylella fastidiosa is an aggressive bacterial species that has caused devastating epidemics in several important crops including almonds, olives, and grapevines. Research led by the University of Girona in Spain have demonstrated a promising treatment for infected plants. They discovered that peptides (molecules with a chain of up to 50 amino acids) are a promising treatment. Their study, published in *Phytopathology*, found that peptide delivery through endotherapy ("plant vaccine") significantly decreased the pathogen population and disease symptoms in greenhouse-grown almond plants. These findings serve as an important step in controlling diseases in crops affected by this bacterium and offers a possible future of sustainable crop production and disease management.

Investigations of a Deadly Bacterial Disease

The Florida citrus industry has seen a 70% decline in orange production since the introduction of Huanglongbing (citrus greening) in 2005. A close relative of the citrus greening pathogen, *Candidatus Liberibacter solanacearum* (CLso), is a newly-emerging pathogen of tomato and potato. Both diseases are spread by an insect vector. Researchers at University of California-Davis published in *Molecular Plant-Microbe Interactions* that proteins secreted from CLso (called effectors) can target various parts of the plant cell such as the chloroplast, and can travel from one plant cell to another, which could explain how *Liberibacter* can manipulate the plant while remaining restricted to the phloem. This research provides the foundation of understanding how we can manage this disease better in the future.

Complex Crop Rotations Offer Drought Resilience

Complex crop rotations have been shown to boost levels of soil nitrogen. An international research team led by University of New Hampshire reports that these same crop rotations can benefit soil nitrogen even during droughts, when application of nitrogen fertilizers can be less effective. The team found that nitrogen "pools" in the mineral-associated soil organic matter contains small organic molecules, like amino acids, that stick to mineral or clay particles. Under limited water, plants can tap into this pool. This study concludes that greater crop diversity can lead to soil resilience that allows for plants to survive during drought conditions.

Specialized Protein Complex Protects Wheat

One of the most economically significant pathogens of wheat is stem rust, and the discovery several years ago of a protectant gene has been highly successful in breeding programs. How the gene protects against stem rust has been unknown until Max Planck Institute scientists published a study in *Nature*. The researchers succeeded for the first time in resolving the structure and describing the immune function of a "resistosome" gene from wheat. Scientists hope this new discovery will assist in improving crop resistance through the engineering of plant resistance proteins.

Impending Expansion of Stink Bug Habitat

The invasive brown marmorated stink bug feeds on nearly 170 different plants including crops and ornamentals. It has been detected in 46 states and considered a pest in 15 of them. A changing climate could increase its spread. Washington State University researchers developed a model, published in *Pest Management Science*, that reveals that changing weather could increase the suitable habitats for this stink bug. When examining the data of a three-year monitoring effort combined with potential climate scenarios, they found that the suitable habitat range could increase by 70%, particularly as a northward shift. Although this shift is dependent on future climate conditions, researchers urge growers to familiarize themselves with the brown marmorated stink bug even if it has not been identified in their fields before.

Featured Picture of the Quarter



This interesting symptom was seen on a farm in Cache County. It was diagnosed as target cluster, a rare physiological condition that occurs on the rind of mature watermelons. The spiraling “targets” have a corky texture, can be as large as one inch in diameter, and occur singly or in groups.

Since the 1990's, scientists have made many attempts at identifying pathogenic bacteria or viruses but the cause of target cluster remains unknown. The symptom is sometimes mistaken for a ringspot virus (Tobacco ringspot virus, Watermelon mosaic virus, or Papaya ringspot virus) but is purely aesthetic and does not cause economic loss.

— Image by Nick Volesky,
Vegetable IPM Associate

New Publications, Websites, Apps, and More

[Scaling Sustainable Biochar Research & Commercialization for Agriculture & Conservation: A Summary from a Stakeholder Convening](#) is a publication by multiple sources that summarizes how sustainably-produced and applied biochar will reduce greenhouse gas emissions to mitigate climate change and build healthy, high functioning soils.

[Pest Quest](#) is an online board game developed by Michigan State University researchers where users take on various farm roles of to bring peace and profit to a pest-plagued farm.

[Industrial Hemp Production](#) is a new publication by ATTRA Sustainable Agriculture that offers a practical

primer for farmers who want to try their hand at growing industrial hemp.

[How to Reduce Synthetic Fertilizer Use](#) is a toolkit released by ATTRA Sustainable Agriculture to help guide farmers and ranchers who want to transition to organic-based production.

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