UTAH PLANT HEALTH

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UtahStateUniversity

Utah IPM Program and Utah Plant Pest Diagnostic Laboratory

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NEW MEDIA

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Grasshoppers in Field Crops: 2026 Outlook

Grasshoppers are common in rangelands and agricultural fields, causing economic losses of forage and field crops. Although approximately 400 species occur in the western U.S., only about 15 are responsible for most damage. Spur-throated grasshoppers are the most common in Utah, and include the two-striped, migratory, red-legged, and differential (shown above) grasshoppers. Their extra tough mandibles allow them to feed on a broad range of grasses, forbs, and woody plants, making them highly adaptable and damaging pests. Grasshopper outbreaks are favored by below-average precipitation, reduced snowpack, and above-average spring temperatures that enhance egg survival, accelerate development, and increase movement from rangelands into cultivated fields.

These voracious insects consume plant biomass equivalent to their body weight every day. Early-season feeding delays crop establishment and reduces yield and grain production. Damage typically begins along field edges adjacent to rangeland or weedy habitats and spreads within fields as nearby vegetation becomes depleted.

2026 Grasshopper Season

While a statewide outbreak is not anticipated, localized infestations may occur where drought-stressed rangelands border irrigated cropland, previous-year populations were high, suitable habitat exists along weedy field margins, and warm,

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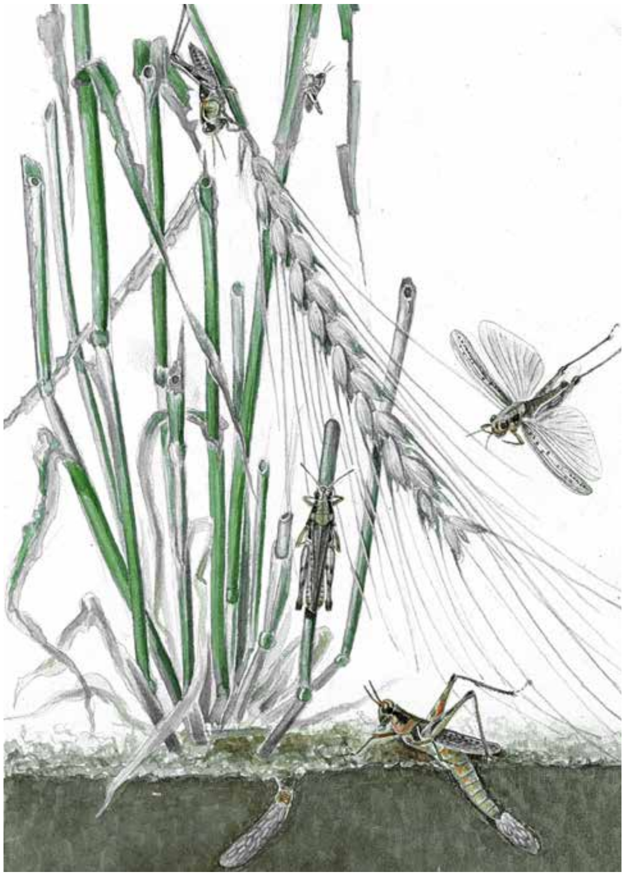
dry conditions persist. The annual USDA rangeland grasshopper hazard map (shown on next page) identifies the highest outbreak risk in Utah's central and south-central rangelands, with moderate risk in southern and northeastern parts of the state. Although northern Utah is classified as lower risk, we have observed increased grasshopper activity since early June in alfalfa, wheat, and corn fields in some counties, including Box Elder.

MORMON CRICKETS are often mistaken for grasshoppers. This insect is not a true cricket but instead a flightless, shield-backed katydid with longer antennae. Unlike typical grasshoppers, Mormon crickets can form massive migratory bands that travel long distances across rangelands and agricultural fields, consuming vegetation and reducing forage production. Both pests thrive under warm, dry conditions and can cause significant economic and ecological damage when populations reach high densities.

Drought-stressed rangelands can also encourage movement into irrigated crops, hay fields, and other areas with green vegetation. Producers can use the grasshopper forecast map and U.S. Drought Monitor to identify higher-risk areas and scout susceptible crops regularly from June through August, particularly along field edges adjacent to rangelands, pastures, roadsides, and unmanaged vegetation.



Life stages of migratory grasshopper (*Melanoplus sanguinipes*).
Image courtesy of Art Cushman, USDA Systematics Entomology Laboratory, Bugwood.org

Understanding the life cycle can help with grasshopper management. In late summer and fall, females lay eggs in pods (group of eggs clumped together) within the upper few inches of undisturbed soil. The eggs overwinter and hatch in the following spring when soil temperatures reach approximately 50–55°F. Newly hatched nymphs resemble small wingless adults and pass through five developmental stages (instars) before becoming adults. Adults are highly mobile and can disperse considerable distances in search of suitable host plants. Migratory grasshopper (*Melanoplus sanguinipes*), differential grasshopper (*M. differentialis*), red-legged grasshopper (*M. femurrubrum*), and two-striped grasshopper (*M. bivittatus*) are the most commonly occurring grasshoppers in Utah.

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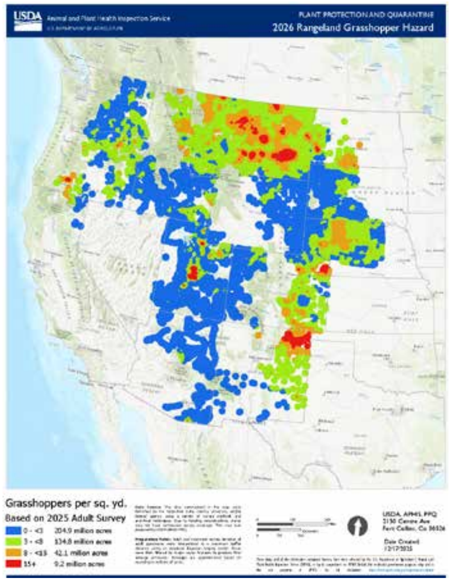
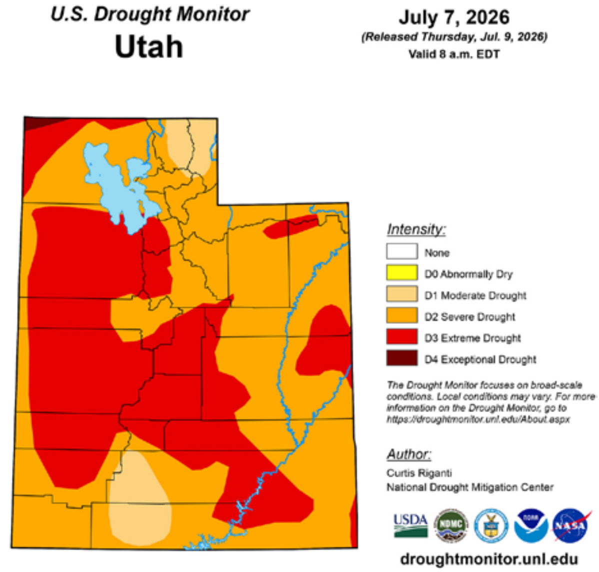
2026 USDA rangeland grasshopper hazard map (left) and U.S. Drought Monitor map for Utah (right).





Management

Managing grasshoppers requires a season-long approach:

- Monitor for nymphs in May through July starting in field margins, roadsides, fence rows, and adjacent rangelands. Determine population size by counting grasshoppers within one yd^2 sampling area in at least eight locations per field.
- Base an insecticide treatment on crop value, yield potential, forage prices, field conditions, and thresholds. Early detection is critical because young nymphs are easier to control than highly mobile late-instar nymphs and adults. Border treatments may be sufficient when infestations are concentrated along field edges. Common active ingredients include carbaryl, diflubenzuron, and pyrethroids, depending on crop and label restrictions. Always follow label directions and consider potential impacts on pollinators and natural enemies.

Thresholds for Treating Grasshoppers

Rangeland	8–15 grasshoppers per yd^2
Alfalfa	5–10 grasshoppers per yd^2 in seedlings, or 15–20 per yd^2 with active defoliation in established stands. A lower threshold may be justified in high-value seed alfalfa.
Small grains (wheat, barley, oats)	8–14 grasshoppers per yd^2
Corn	Treat at seedling stage when feeding is causing significant leaf injury, especially along field margins.

- Manage weeds along field margins and other unmanaged areas that provide food and egg-laying sites.
- Plant early and provide proper fertilization and irrigation.
- Natural enemies, including birds, spiders, predatory beetles, robber flies, parasitoids, and entomopathogenic fungi, suppress populations but do not prevent outbreaks.

—— Subodh Adhikari, Extension Entomologist

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Irrigation Water and Harmful Algal Bloom Risk

Author, Clare Entwistle, is an Extension Water Quality Specialist at Utah State University. She conducts community-based research and extension activities to address water quality challenges statewide, with interests in nature-based solutions to address non-point source pollutants and understanding barriers to implementing management practices to improve water quality. More about Extension water quality projects.

This article is a summary of our USU Extension fact sheet on HABs and Food Safety.

Harmful algal blooms (HABs), also called cyanobacteria or blue-green algae, naturally occur in water bodies worldwide. Their growth is driven by a range of factors such as warming water temperatures and increasing nutrient availability. Cyanobacteria can produce harmful toxins that threaten drinking water, irrigation source water, and recreational waters across Utah.

HABs are becoming more prevalent in ponds, lakes, and reservoirs, appearing earlier in the growing season and being observed at higher elevations. The warm, dry winter conditions Utah experienced this past year may further increase bloom risk this summer. Many of the water bodies threatened by HABs serve as irrigation sources, making HABs a concern for agriculture. Understanding the potential impacts on plant health and food safety is necessary to minimize the risks associated with HABs.

HABs and Produce

Microcystins are the most common and well-researched toxin associated with freshwater HABs. They are colorless, odorless, tasteless, and relatively stable in water, making detection difficult without testing. Irrigation with microcystin-contaminated water may reduce crop

Examples of HABs: globule-type (top), pea soup-type (middle) and spilled paint-type (bottom).
All images courtesy of Utah Department of Water Quality (DWQ)

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performance, contaminate soils, and introduce toxins into edible plant tissues. Unlike foodborne pathogens, these toxins cannot be eliminated by boiling, cooking, or washing the food prior to ingestion.

Previous research has shown that exposure to microcystins can reduce germination in some crops like tomatoes. Researchers have also seen lower overall yields in some crops like rice and cucumbers when they were exposed to high concentrations (>100 µg/L) of microcystins at different growth stages. Studies have observed accumulation of microcystins in the edible tissue of some leafy vegetables (e.g. spinach, lettuce, and celery), fruit vegetables (e.g. tomatoes, peppers, and eggplants), and root vegetables (e.g. carrots and radishes), indicating a broad risk across multiple crop types.

While accumulation of microcystin concentrations in plant tissue varied across different varieties of produce studied, most of the vegetables screened in this study found a moderate to high level of health risk upon consumption after being irrigated with microcystin-contaminated irrigation water.

The early research shows that crop response and level of toxin accumulation vary by crop type, concentration of microcystins, and what time in the growing season the crop is exposed. While more research is needed, current evidence indicates that producers should be cautious when irrigating during an active HAB as water may negatively affect both crop productivity and food safety.

Reducing Risks from HABs

All producers, whether operating a commercial or hobby farm, can take steps to reduce HAB risks to human, crop, and livestock health. Many large irrigation water sources are monitored throughout the spring and summer to help protect recreators. Producers should regularly check the Utah Department of Environmental Quality's (UDEQ) HAB advisory website to see if their source water is impacted. If there is an advisory, it is recommended to avoid consuming crops that were watered during blooms. Alternate water sources should be used until the advisory has been lifted.

However, HABs can also form in canals and small ponds used for irrigation. These water sources are not typically monitored by the State. Users should visually check water sources for signs of a bloom during the growing season. Blooms most often appear in various shades of green or blue, but the appearance and texture of HABs can vary. Blooms may resemble spilled paint, green globules, surface scum, foam, floating mats, or grass clippings. A few examples of HABs are shown on the previous page, and USU Extension and UDEQ have a range of photos available to help identify potential HAB variations, though testing is still the most reliable method. If a HAB is suspected, an alternative water source should be used for irrigation and stock watering.

When possible, water testing is recommended to help inform producers of potential risks. Producers can collect and submit water samples for microcystin analysis and other cyanotoxins through the Utah Department of Agriculture and Food (UDAF) Laboratory Services. If a HAB is confirmed, UDAF can also provide guidance on crop irrigation risks based on results.

Many environmental conditions that drive HAB formation are projected to intensify, suggesting HAB risk will increase. Long-term risk reduction focuses on reducing factors that can increase HAB occurrence, where possible. One step we can take is limiting nutrient inputs that fuel HABs. Excess fertilizers, improper management of animal waste or septic systems, and soil erosion all contribute to potential nutrient inputs in nearby water sources. Improving land stewardship can reduce nutrient runoff and help decrease the frequency and severity of HABs over time.

American Plum Borer Detected in Utah Orchards

This summer, several moth specimens resembling the American Plum Borer (APB), *Euzophera semifuneralis* Walker, were found on sticky traps in multiple locations. Molecular identification confirmed that adult moths were APB, but as of July 2026, larvae and trunk damage have not been observed in orchards. Eight adults were identified: one from Grand County and seven from five orchards in Utah County. 1 trapped in Grand County, and 7 trapped from 5 orchards in Utah County. Moths were mainly found in peaches, but also in tart cherries and apples.

Adult moth of American plum borer, *Euzophera semifuneralis*.
Left: Specimen collected in Utah County on sticky liner.
Right: Specimen from the northeastern region.
Right image courtesy of Dr. David Biddinger

APB is native to North America and is considered a pest of fruit and nut trees. In the northeastern region of the U.S., such as New York, Michigan, or Virginia, the wood-boring insect has caused significant damage, specifically to tart cherries, as mechanical harvest creates openings for APB larvae to enter the cambium.

In June, the Plant Health team set up delta traps with pheromone lures in Utah County and Box Elder County to further investigate the spread, abundance, and seasonality of this pest. The team will also monitor trunk damage for larval activity.

The pest likely established several years ago, since it has been identified in several locations that are far apart from each other.

What Does APB Look Like?

APB is a moth from the family Pyralidae. Eggs are white-brownish to pinkish-red and laid next to open wounds in the bark. Larvae vary in color from greenish white to reddish purple. They develop through seven instars, reaching 1 inch at maturity. Pupae are protected in a silken cocoon and measure about 0.5 inches long. Adult moths are grayish-brown to reddish-brown in color with a wavy vertical band of black and brown markings on their forewings. Specimens collected from Utah are less reddish-brown and more grayish-brown than the one collected from the eastern region.

What Do We Know About its Life Cycle?

Based on research from eastern states, APB completes two to three generations in one year. APB overwinters as a larva (grub) under loose bark. In spring, around bud swell, larvae become active and start pupating within a white silken cocoon. Females lay eggs next to fresh wounds in the bark. Larvae bore into the cambium via the nearby wound, as they cannot penetrate intact bark.

The first-generation completes development from early May to the end of June. Adult emergence of

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Immature stages of the American plum borer, *Euzophera semifuneralis*.
Top: Eggs with different coloration depending on maturity.
Bottom: Larva with red-purple coloration.
Images courtesy of Dr. David Biddinger

the second generation overlaps with first-generation larval development and begins in early July and peaks in mid-July. The second-generation flight lasts longer than the first one and usually happens from June through September. In eastern tart cherry orchards, the second generation is the most devastating as egg-laying occurs during mechanical harvest, providing an abundance of fresh trunk wounds for females to oviposit.

What Plants Does it Feed On?

APB host range includes at least 15 families of fruit, nut, ornamental, and forest trees. It prefers trees from the *Prunus* genus, such as tart cherry, sweet cherry, peach, plum, nectarine, and almond. It can also be a minor pest in walnut, pecan, olive, and apple.

What Damage Does it Cause?

APB is a cambium feeder (i.e., it feeds on the thin layer of tissue found between bark and wood). Females are attracted to fresh wounds in the bark, such as shaker harvester wounds, pruning cuts, cankers, and grafts. Because larvae feed horizontally, they can girdle the trunk, branches, or scaffolds. Drought can exacerbate feeding damage and affect tree vigor. Larvae can also worsen canker damage by spreading spores from one tree to another.

How is it Managed?

Monitoring

In spring and early summer, look under barks nearby wounds and check for dark brown reddish frass or white silken cocoons. Moth flight can be monitored with a pheromone trap consisting of a pheromone lure placed on a sticky liner inside an orange or red plastic delta trap. It is important to know that the commercial lures available only attract males. Three traps per 10 acres are recommended.

Cultural practices

Minimizing trunk damage caused by mechanical harvesting, cankers, and pruning activities is important to reduce APB infestation.

Chemical control

In Michigan, it has been estimated that when more than six moths per trap/week are found in three traps, the insect is likely to cause economic damage. Applying insecticides to the trunk around the egg-laying period (late April to May) can help reduce populations. A second application may be needed in mid-summer, but restrictions regarding the pre-harvest interval must be taken into account. Pyrethroids (i.e., esfenvalerate, fenpropathrin, zeta-cypermethrin) and other compounds can be used for commercial orchards. Please check the USU fact sheet for more information on registered materials.

— Emilie Demard, Extension Entomologist

Fungicide Resistance in Apple and Cherry Powdery Mildew: Why It Matters and How to Prevent It

Powdery mildew is one of the most common fungal diseases affecting apples and cherries in Utah. Unlike many fungal pathogens, powdery mildew thrives without rainfall, making it well adapted to our climate. Several fungicide options provide excellent control. However, repeated use of products from the same fungicide mode-of-action class can lead to fungicide resistance, a major problem in disease management.

What Happens When a Pathogen Becomes Resistant?

Fungicides work by interfering with essential processes in fungal cells. Many newer fungicides are "single-site" fungicides, meaning they target one specific enzyme or metabolic pathway. While these products are highly effective, they also place strong selection pressure on pathogen populations.

Resistance is not caused by the fungicide itself; rather, fungicides select for the low-frequency individuals of the powdery mildew fungus that naturally possess genetic mutations that allow them to survive the fungicide. When the same fungicide is used repeatedly, susceptible individuals are eliminated while the resistant ones carrying the mutation survive and reproduce. Over time, resistant strains become more common in the orchard until the fungicide no longer provides control.

Why Is Powdery Mildew Especially Prone to Resistance?

Powdery mildew fungi are considered high-risk pathogens for developing fungicide resistance because of several biological characteristics.

- They produce enormous numbers of spores during the growing season. Each spore represents another opportunity for genetic mutations to occur.
- Powdery mildew fungi complete multiple generations each season. This rapid reproduction allows resistant individuals to quickly increase in frequency.
- Infections often require repeated fungicide applications throughout the season to protect new growth. Frequent use of the same fungicide class increases selection pressure.
- Many of the fungicides used to manage powdery mildew, including demethylation inhibitors (Group 3), succinate dehydrogenase inhibitors (Group 7), and strobilurins (Group 11), are single-site fungicides that carry moderate to high resistance risk if overused. Multi-site protectants such as sulfur have a much lower risk of resistance because they affect several cellular processes simultaneously.

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How Do Scientists Test for Fungicide Resistance?

Leaf discs with powdery mildew, exposed to various fungicides to test for resistance. The top row shows that the fungicide worked and the bottom row, it did not - showing that the fungus can grow in the presence of the fungicide, and is resistant.
Image courtesy of Božena Sedláková; in: Fungicide Resistance in Cucurbit Powdery Mildew Fungi. InTech

The simplest method to test for resistance is to grow collected fungal isolates on leaf discs treated with different fungicide concentrations and comparing fungal growth on treated and untreated tissue. Strong growth on treated tissue would equate to resistance.

Molecular methods provide quicker and more accurate results. The process starts with extracting DNA from powdery-mildew-infected leaves and then looking for specific mutations known to confer resistance to particular fungicide classes. For example, researchers commonly screen for mutations in the CYP51 gene associated with Group 3 resistance, sdhB for SDHI for Group 7 resistance, and cytb for Group 11 resistance.

At USU, researchers on the Plant Health Team began a 3-year study in spring 2026, testing apple and cherry powdery mildew isolates from commercial orchards. To date, resistance has been found in one apple location to the Group 11 fungicides.

What Is the Current Status of Resistance in Apple and Cherry Powdery Mildew?

Apple powdery mildew, caused by *Podosphaera leucotricha*, has developed reduced sensitivity to Group 3 fungicides in several apple-producing regions around the world. However, in the U.S., no resistance has been reported (aside from the recent findings by USU). For example, a recent two-year survey of commercial orchards across New York analyzed 160 apple powdery mildew samples from 43 orchards, finding no known resistance mutations associated with Groups 3, 7, or 11 fungicides. Researchers emphasized, however, that continued monitoring is important because resistance can develop if selection pressure increases.

Cherry powdery mildew (*Podosphaera cerasi)* outbreaks have become more common in the West in the last decade. Unlike apple powdery mildew, confirmed fungicide resistance has been widely documented. One example is that researchers in Washington identified resistance to Group 11 fungicides in multiple locations.

Preventing Fungicide Resistance

Fortunately, fungicide resistance can be prevented, or at the very least, delayed, by following best management practices:

- Rotate fungicides among different groups instead of making repeated applications from the same group.
- A rule of thumb is the “3-2 Rule”. Three: Never apply the same class of fungicides more than three times per season. Two: Never apply the same class of fungicide more than twice in a row.
- Fungicides with a low risk of resistance developing include sulfur, horticultural oil, neem oil, and potassium bicarbonate.
- Most fungicides work best preventively and should be applied before disease establishment or at the sign of the first infection. Widespread outbreaks are difficult to manage and require more sprays than applying preventively.

— Marion Murray, IPM Specialist

Invasive Weed: Dyer's Woad

As its name suggests, people have used leaves of dyer's woad (*Isatis tinctoria*) to dye fabric indigo blue. This plant is native to southeastern Russia and was introduced to the eastern U.S. by early European settlers in the 17th century. In the eastern U.S., it never became invasive, but when it was accidentally introduced into the West where the soil and climate are more similar to its native range, it spread rapidly due to a lack of natural enemies, outcompeting native grasses.

Dyer's woad is a mustard belonging to the Brassicaceae family. It most commonly grows as a biennial but in some settings, may behave like a short-lived perennial. Seeds germinate in spring, and the plant forms a basal rosette during the first year of growth. Bloom occurs in the second year (as a biennial) or a few years later (as a short-lived perennial). In May and June, the flower stalk is covered in small yellow flowers. Seeds are then borne in ½- to ¾-inch long seedpods that are initially green and blacken as they mature. Each plant can produce up to 500 seeds. Plants die after seeding.

Identification characteristics include bluish-green leaves with a prominent, white mid-vein, flowering stem with alternate and sessile leaves, clusters of small yellow flowers, and purplish-black, wing-like seeds on dead stalks.

Due to its rapid spread, it is listed as a class 'B' noxious weed in several western states including Utah, Idaho, Washington, California and Montana. This classification prohibits the sale of seeds and the cultivation of dyer's woad in these states to protect agricultural productivity and avoid environmental/ecological damage.

Managing dyer's woad has been a challenge in the West. It has a very deep (up to 5 ft) tap root and regrows if the top of the plant is removed or cut off (and flowering has not occurred). Hand-hoeing of small, infested areas is feasible. Where practical, the herbicide, 2,4-D, has some efficacy against woad in parts of the U.S.

— Claudia Nischwitz, Extension Plant Pathologist,
Cory Farnsworth, Professional Practice Extension Assistant Professor, and
Jake Forsgren, Cache County Noxious Weed Supervisor

Various stages of dyer's woad, including the first-year rosette stage (top), yellow flowers during bloom (middle), and seed pods after bloom (bottom).
Images courtesy of Jake Forsgren

IPM In The News

Stem-nesting Bees Can't Take the Heat

A team of researchers from several Australian universities found that certain bees native to Australia, particularly stem-nesting species, are highly vulnerable because they cannot escape extreme heat. Unlike ground-nesting bees, they lack thermal refuges, making them more susceptible to rising temperatures. The research also showed that tropical bee species, despite being adapted to warm climates, are especially at risk. The findings, published in *Nature Communications*, suggest that behavioral traits such as nesting strategy, play a key role in determining species survival.

Sterile Fly Combats New World Screwworm

Efforts to control the New World screwworm (NWS, *Cochliomyia hominivorax*), a parasitic fly that feed on living tissue of livestock, are relying on the sterile insect technique (SIT). The SIT involves mass-rearing NWS, sterilizing the males, and releasing them, where they mate with wild females, producing no offspring. This approach provides an environmentally-friendly and highly targeted control strategy that helps protect livestock industries and reduce economic losses.

Massive Ground-nesting Bee Aggregation Discovered

A study by Cornell University scientists, published in *Apidologie*, documented an enormous aggregation of the native mining bee (*Andrena regularis*) in a New York cemetery, with an estimated population of 5.5 million individuals. The bees pollinate crops and wild plants and have potentially occupied the site for decades. The discovery highlights the ecological importance of ground-nesting bees and the need to preserve their habitats.

IPPM Faces Practical Hurdles

Balancing pest control with pollinator protection remains a persistent challenge. A review article published in the *Journal of Integrated Pest Management* notes that pest pressure and pollinator needs vary widely across crops, regions, and seasons, limiting one-size-fits-all recommendations and that evidence for efficacy of integrated pest and pollinator management (IPPM) is finite and mixed. In addition, higher costs and uncertain economic returns may discourage adoption of the practice, highlighting the need for more practical, field-based research to make IPPM a reliable decision-making framework.

Hybrid Honey Bees Show Resistance to Mites

Honey bee colonies in the U.S. have experienced steep losses—up to 62% in 2025—largely due to varroa mite. Scientists at the University of California, Riverside, published in *Scientific Reports* studied 236 colonies of a locally-adapted hybrid population of honey bees in southern California, which are a mix of western European, eastern European, Middle Eastern, and African lineages. These bees carried about 68% fewer mites and were far less likely to require chemical treatments than bee colonies started from a commercial-stock honey bee queen. The authors suggests that resistance begins at the larval stage, as mites were less attracted to developing bees. While not fully resistant, these hybrids could support breeding efforts to improve colony survival and reduce reliance on chemical controls.

Biological Control of Spotted-Wing Drosophila

Management efforts for the invasive spotted-wing drosophila (*Drosophila suzukii*) are now focused on biological control, according to a collection of papers in *Journal of Economic Entomology*. Many researchers are evaluating two Asian parasitoid wasps,

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Featured Picture of the Quarter

One of the many insects that is common this summer (due to Utah's warm winter) is the European lecanium scale. It is an immobile insect that sucks sap from a wide variety of hosts, including ornamental cherry. Shown at left are the larger-sized females, each producing up to 5,000 crawlers (offspring) that are feeding heavily and producing copious honeydew this summer.

— Image by Marion Murray, IPM Specialist

IPM in the News, continued

Ganaspis kimorum and *Leptopilina japonica*, as potential long-term biocontrol agents. Several surveys have found that *L. japonica* has become naturally established in many U.S. states (including Washington) and releases of *G. kimorum* are showing encouraging establishment in some mid-Atlantic states. Scientists are still assessing both species' overall impact on pest populations and how they integrate with existing management programs.

New Disease-resistant Citrus Rootstock

Citrus greening disease (CGD), caused by the bacterium *Candidatus* Liberibacter asiaticus, has devastated U.S. citrus production, reducing Florida's output to less than 5% of its early 2000s peak. To help combat CGD, the U.S. EPA has approved CarriCea T1, a gene-edited citrus rootstock. CarriCea T1 works by making precise edits to the plant's existing genes, disrupting the infection process without introducing foreign DNA.

PLANT HEALTH people and programs are supported by: