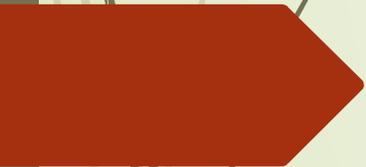


# Integrated Pest Management for the Garden & Landscape: Insect and Mite Pests



Diane Alston, Entomologist

Utah State University

Master Gardener Entomology Lecture

2016



# USU Extension Pest Management Team



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IPM Coordinator

# Utah Pests Online Resources

[www.utahpests.usu.edu](http://www.utahpests.usu.edu)

One-stop shopping  
for pest management  
information

The screenshot shows the homepage of the Utah Pests website. At the top, there is a navigation bar with the text "EXTENSION UtahStateUniversity" and "UTAH PESTS" along with a logo. Below this is a secondary navigation bar with links: "UTAH PESTS Home", "Utah Plant Pest Diagnostic Lab", "Integrated Pest Management", "School IPM", and "Cooperative Agricultural Pest Survey".

The main content area is divided into several sections:

- Search:** A "Google™ Search" box.
- Home:** A list of links including "Home", "Fact Sheets", "Video Fact Sheets", "Image Galleries", "Slideshows", "Utah Pests News", "Quarterly Newsletter", "Bees and Other", "Pollinators", "In the News", and "Contact Us".
- Utah Plant Pest Diagnostic Lab:** A blue box with a microscope icon and the text "Just \$7 gets your pest problem diagnosed or insect identified."
- Integrated Pest Management:** A green box with a leaf icon and the text "Your source for fruit, vegetable, and landscape pest problems."
- School Integrated Pest Management:** A yellow-green box with a book icon and the text "Teaching responsible pest management for a healthy learning environment."
- Cooperative Agriculture Pest Survey:** A brown box with a folder icon and the text "CAPS protects Utah agriculture through statewide monitoring of invasive pests."
- In the News:** A white box with a list of news items, including "Predators, Parasites, Pests, and the Paradox of Biological Control" (Jan 20, 2015), "Insect Communication" (Jan 13, 2015), and "A Taxonomic Toolkit Ends a Century of Neglect For a Genus of Parasitic Wasps" (Dec 15, 2014).
- About:** A white box at the bottom right explaining that "UTAH PESTS" is a group of Extension entomologists and plant pathologists that helps solve thousands of plant pest issues.

At the bottom of the page, there is a footer with the text: "Utah State University is an affirmative action/equal opportunity institution. © 2015 Utah State University Utah Pests".

# Fact Sheets

**UTAH PESTS fact sheet** Utah State University extension  
Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-11-07 May 2007

## Yellowjackets, hornets and paper wasps

Erin Hodgson, Extension Entomology Specialist  
Alan Roe, Insect Diagnostician

### What You Should Know

- Yellowjackets, hornets and wasps are closely-related social wasps commonly found in Utah.
- All social wasps are capable of repeatedly stinging without dying if they feel threatened.
- Bees are often blamed for most stings, but about 90% of all stings are likely caused by yellowjackets.
- Most social wasps are predatory of other insects and considered beneficial.
- Although providing natural insect control, social wasps can be considered nuisance pests when near humans.



Fig. 2. Bald-faced hornet?

### Social Wasp General Description

- Have three well-separated body regions, a distinct waist and two pairs of clear wings.
- Care for their young and develop a caste system different from bees living together.
- Regenerate a new nest every year because only queen overwinters; honey bee colonies overwinter together every year.
- Create their nests out of a wood and saliva paste.
- Capture prey with their legs and jaws and use stings for defensive purposes only; this is different than soil wasps that subdue prey with stinging (e.g., spider wasps).
- Go through complete metamorphosis (i.e., egg, larva, pupa, adult); adults and larvae have chewing mouthparts, and larvae are legless.
- Capable of multiple stings because they have "smooth" stingers; bees have barbed stingers (Fig. 2).



Fig. 1. Yellowjacket?



Fig. 3. Honey bee (left) and wasp (right) sting

**UTAH PESTS fact sheet** Utah State University extension  
Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-104-07

## White grubs

Erin Hodgson, Extension Entomology Specialist

### What You Should Know

- White grubs are the larval stage of scarab beetles.
- Several different kinds of white grubs are found in Utah.
- White grubs prefer to feed on turfgrass roots.
- Healthy turfgrass can mask white grub feeding.

### Damage Symptoms

White grubs chew off the turfgrass roots near surface or just below the thatch layer. Early white grub damage include grass wilting or however, the initial feeding injury often goes until brown patches of turf start to develop. Feeding damage can be most apparent in summer when grubs are nearly fully developed. Patches of dying turf can quickly join together if density is extremely high.

### Description

Grub-damaged turfgrass becomes loosely of the soil as the roots are consumed. Heavily infested turfgrass can feel spongy and easily pull over soil surface. Drought conditions can make it appear worse.

Adult scarab beetles are identified by size and pattern. Adults range in size from 3/16 - 1" or tan, brown or black (Fig. 1). Scarab beetles are oval-shaped, and have clubbed antennae. A pair of hardened forewings called elytra, the sole is dark, but the body is usually creamy. White grub species identification is often not because the cultural control practices are management of hairs and spines on the parts of the grub, called the raster, is a distinguishing between species (Fig. 2).



May/June beetle? Black turfgrass Atoenius?  
Masked chaffer? Japanese beetle?



Fig. 1. White grubs are actually scarab beetles. Common scarab beetle adults are shown here (NOT TO SCALE).  
Fig. 2. Common white grub body characters?

**UTAH PESTS fact sheet** Utah State University COOPERATIVE EXTENSION  
Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-144-11 August 2011

## European Earwig (Forficula auricularia)

Diane G. Alston, Entomologist • Andrew Tebeau, Graduate Student

### Do You Know?

- The European earwig is an omnivore; it feeds on detritus, fungi, plants, and insects.
- Earwigs can injure the buds, leaves, flowers, and fruits of a broad range of plants, including fruits, vegetables, and ornamentals; they can be a nuisance pest by entering buildings.
- Earwigs are active at night and seek protected shelter during the daytime.
- Optimal management is a balance of protecting plants from injury while reaping benefits from biological control and organic matter decomposition.

The European earwig (Order Dermaptera, which means "skin wings" to describe their leathery wings) (Fig. 1) is native to Europe, western Asia, and parts of Africa. The common name "earwig" comes from a myth that the insect would climb into the ears of humans and chew into the brain, but this is false. The European earwig was first introduced into Utah in the early 1900s. Establishment and population growth have been remarkably successful in northern Utah. It has become an insect of concern and interest because of its abundance and omnivorous feeding behaviors that make it both a pest and beneficial insect.




Fig. 2. Clockwise from top left: injury to peach fruit, earwig inside 300 pit of peach fruit, injury to new growth of ornamental tree, and injury to a flower.

### LIFE HISTORY

Two biotypes of the European earwig occur in the U.S., which differ by location (western vs. eastern states), life history, and European origin. In the western U.S., the European earwig has two or more generations per year, and populations tend to build to their highest densities in mid to late summer.

### Adult - Overwintering, Dispersal, and Damaging Stage

- Bronze brown body with a red-brown head; 1/2 to 3/4 inch long.

The diverse diet of earwigs includes primitive plants (mosses, lichens, and algae), vascular plants, fungal spores, small invertebrate animals, and decaying organic matter. As opportunistic predators, they provide a benefit by preying upon plant pests such as aphids, scales, caterpillars, maggots, and mites. In contrast, their herbivorous eating behavior makes them a common pest in agricultural crops, home gardens, and landscapes; they often require intervention to reduce their damage to plants. They can also be a nuisance when they seek shelter in homes and workplace buildings.

The European earwig can feed upon and damage a broad range of agricultural products that may include tree fruits, berries, vegetable fruits, leafy vegetables and herbs, grasses, grains, and ornamentals. They prefer ripe fruits over firm, premature fruits. Earwigs feed on the buds, flowers, fruits, and leaves causing direct plant damage, reduced crop yields, and aesthetic injury (Fig. 2). They will occasionally damage a variety of stored food products.





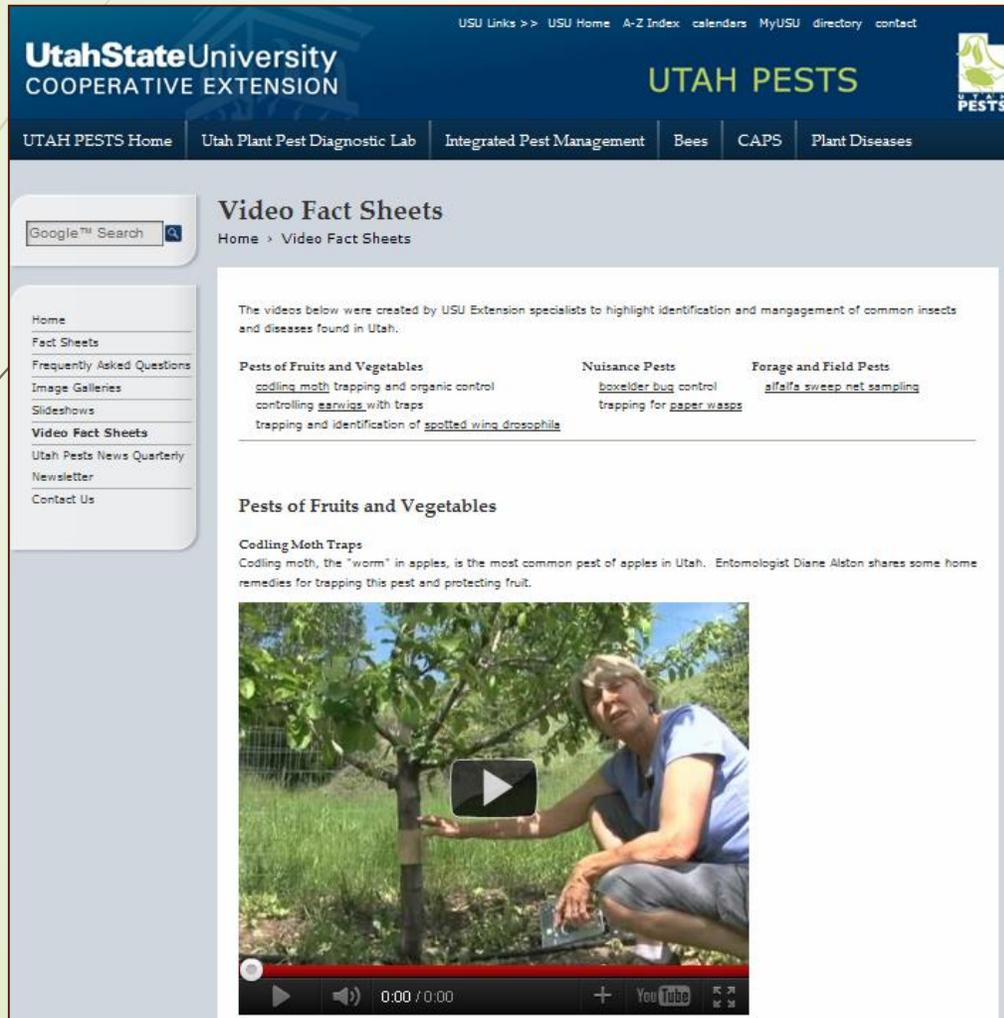
Fig. 1. European earwig adult and nymphs.

Arthropods and plant diseases:

>230 fact sheets

Health-related  
Forage & field crops  
IPM (general)  
Natural enemies  
Nuisance  
Ornamental  
Pantry  
Pollinators  
Small fruit  
Structural  
Tree fruit  
Vegetable

# Video Fact Sheets



Utah State University  
COOPERATIVE EXTENSION

UTAH PESTS

UTAH PESTS Home Utah Plant Pest Diagnostic Lab Integrated Pest Management Bees CAPS Plant Diseases

Google™ Search

Home  
Fact Sheets  
Frequently Asked Questions  
Image Galleries  
Slideshows  
Video Fact Sheets  
Utah Pests News Quarterly  
Newsletter  
Contact Us

Video Fact Sheets  
Home > Video Fact Sheets

The videos below were created by USU Extension specialists to highlight identification and management of common insects and diseases found in Utah.

**Pests of Fruits and Vegetables**  
[codling moth](#) trapping and organic control  
controlling [sawflies](#) with traps  
trapping and identification of [spotted wing drosophila](#)

**Nuisance Pests**  
[boxelder bug](#) control  
trapping for [paper wasps](#)

**Forage and Field Pests**  
[alfalfa sweep net sampling](#)

**Pests of Fruits and Vegetables**

**Codling Moth Traps**  
Codling moth, the "worm" in apples, is the most common pest of apples in Utah. Entomologist Diane Alston shares some home remedies for trapping this pest and protecting fruit.



0:00 / 0:00 YouTube

4-7 min how-to videos

homemade insect traps

low toxicity pest management options

insect identification

insect monitoring

# Utah Pests Newsletter



## UTAH PESTS News

Utah Plant Pest Diagnostic Laboratory and USU Extension Vol. IX, Winter 2015

### A New Disease of Potato and Other Solanaceous Plants Reported in Utah

The non-culturable bacterium '*Candidatus Liberibacter solanacearum*' is a pathogen that causes zebra chip disease of potato. The bacterium is transmitted by potato psyllids (*Bactericera cockerelli*). These insects are very small and look like black, winged aphids. They have characteristic white bands on their backs that can be seen with a hand lens or dissecting microscope. In the field, a hand lens is also required to see the eggs and nymphs. The potato psyllids have been present in Utah for a long time, but the bacterium was detected for the first time in a potato sample in 2013, and again in 2014.

The exterior of potato tubers affected with zebra chip appear perfectly healthy. It is not until the tubers are sliced for cooking that the typical brown striations can be seen. They are even more pronounced when fried, giving this disease its name.

Aboveground symptoms can be more noticeable. Foliage will become chlorotic (yellow)

continued on next page

#### What's Inside

Spotlight: Emerald Ash Borer Update  
Our Favorite Websites, Books  
Orchard Research at Capitol Reef National Park  
New and Increasing Pests in Turf and Alfalfa  
Seed Selecting  
Volunteering  
IPM in the News

#### News Highlights

##### URBAN AND SMALL FARMS CONFERENCE

Vegetable production, irrigation, good agricultural practices, marketing, organic research and more!  
February 18 - 20 at the Viridian Center, West Jordan, UT. For more information and to register, to go: [diverseag.org](http://diverseag.org).

##### NEW FACT SHEETS

Damping-off  
Emerald Ash Borer  
Walnut Husk Fly

[utahpests.usu.edu](http://utahpests.usu.edu)

Free, quarterly newsletter  
Current pest topics  
New research results  
Useful resources  
Sign up to subscribe at  
[www.utahpests.usu.edu](http://www.utahpests.usu.edu)

# Pest Advisories (integrated pest management)

The screenshot shows the website for UTAH PESTS Integrated Pest Management. The header includes the Utah State University logo and navigation links like 'USU Links >> USU Home A-Z Index calendars MyUSU directory contact'. The main navigation bar has 'UTAH PESTS Home', 'Utah Plant Pest Diagnostic Lab', 'Integrated Pest Management' (highlighted), 'School IPM', and 'Cooperative Agriculture Pest Survey'. A search bar is on the left. A central banner advertises the '2014 Invasive Insect Field Guide for Utah' with the text 'The 2014 Invasive Insect Field Guide for Utah is now available.' Below this is a 'Subscribe to IPM Pest advisories HERE' button. To the right, an 'In the News' section lists articles: 'New Hope for Fighting Major Fungal Disease in Durum Wheat' (Jan 19, 2015), 'Pathogen Competition' (Jan 08, 2015), and 'Newly Discovered Assassin Bug Was Incognito, But Now It's Incognita' (Dec 23, 2014). A sidebar on the left lists 'Plant Pests by Crop' with categories like Fruit IPM, Vegetable IPM, Landscape IPM, Field Crops IPM, Pest Advisories, Fact Sheets, Image Galleries, Slideshows, Utah IPM & SA Mini-Grant Program, Pesticide Information, Weather Info, Resources and Links, and Contact Us. A Facebook icon is at the bottom left.

[www.ipm.usu.edu](http://www.ipm.usu.edu)

Free subscription

Timely info on pest activity

1. Tree fruit advisory
2. Small fruit & vegetable advisory
3. Landscape ornamental advisory
4. Turfgrass advisory

-insects, mites, diseases, nutrient deficiencies, environmental stress

Lots of images!

IPM recommendations

Effective pesticides

- home garden & commercial

# Pest Diagnostics

USU Links >> USU Home A-Z Index calendars MyUSU directory contact

**EXTENSION**  
UtahStateUniversity

**UTAH PESTS**  
Utah Plant Pest Diagnostic Lab

UTAH PESTS Home Utah Plant Pest Diagnostic Lab Integrated Pest Management School IPM Cooperative Agricultural Pest Survey

Google™ Search

Home  
Fact Sheets  
Frequently Asked Questions  
Image Galleries  
\$7.00 Diagnosis  
Recent Pests  
Alfalfa Hay Testing  
Tick Survey  
Contact Us

**Current Pest Issues**  
Top 20 Insects  
Top 20 Arachnids  
Bed Bug Travel Tips  
Hobo Spiders

**Recent Pests**  
*Hobo Spider Questions?*  
Click Here! 1 2 3

**Submit a Sample**

**Fact Sheets**

**Events**  
Feb 23, 2015  
**How to Avoid Falling for a Jerk (or Jerkette)**  
Feb 23, 2015  
**How to Avoid Falling for a Jerk (or Jerkette)**  
More Events...

Utah State University is an affirmative action/equal opportunity institution. © 2015 Utah State University Utah Plant Pest Diagnostic Lab

ext home site map ext directory

Utah Plant Pest Diagnostic Lab  
\$7 Diagnosis

[www.uppdl.usu.edu](http://www.uppdl.usu.edu)

# Look for this slideshow and others at [utahpests.usu.edu](http://utahpests.usu.edu)

The screenshot shows the homepage of the Utah Pests website. At the top, there is a navigation bar with the Utah State University logo and the text "EXTENSION Utah State University". To the right of the logo, there are links for "USU Links >> USU Home A-Z Index calendars MyUSU directory contact". The main header area features the text "UTAH PESTS" in large green letters, accompanied by a small logo of a plant with a pest. Below the header is a secondary navigation bar with links for "UTAH PESTS Home", "Utah Plant Pest Diagnostic Lab", "Integrated Pest Management", "School IPM", and "Cooperative Agricultural Pest Survey".

The main content area is divided into several sections:

- Search:** A Google™ Search box is located on the left side.
- Navigation Menu:** A vertical list of links on the left includes: Home, Fact Sheets, Video Fact Sheets, Image Galleries, Slideshows, Utah Pests News, Quarterly Newsletter, Bees and Other Pollinators, In the News, and Contact Us.
- Utah Plant Pest Diagnostic Lab:** A section with a microscope icon and the text: "Just \$7 gets your pest problem diagnosed or insect identified."
- Integrated Pest Management:** A section with a leaf icon and the text: "Your source for fruit, vegetable, and landscape pest problems."
- School Integrated Pest Management:** A section with a book icon and the text: "Teaching responsible pest management for a healthy learning environment."
- Cooperative Agriculture Pest Survey:** A section with an envelope icon and the text: "CAPS protects Utah agriculture through statewide monitoring of invasive pests."
- In the News:** A section on the right with three news items:
  - [2014 Farm Bill, No limit on Forestry Pesticides?](#) (Mar 03, 2014)
  - [Stink bug saliva proteins could lead to new control methods](#) (Mar 03, 2014)
  - [Example of Invasive Bumblebee](#) (Jan 27, 2014)
- About Utah Pests:** A section at the bottom right with the text: "UTAH PESTS' is a group of Extension entomologists and plant pathologists that helps to solve the thousands of plant pest issues that concern Utah citizens every day. The UPPDL identifies, the IPM Program educates, and the CAPS Program investigates. Open one of the websites to get answers!"

At the bottom of the page, there is a footer with the text: "Utah State University is an affirmative action/equal opportunity institution. © 2014 Utah State University Utah Pests".

Over 100  
slideshows posted

This one posted  
under  
“Home Yard and  
Garden”



# Developing an IPM Program for your Garden and Landscape

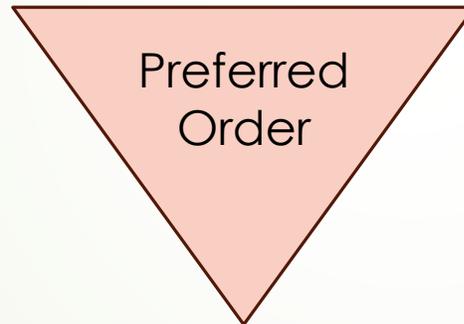
IPM

Sustainable

Organic

# IPM: Integrated Pest Management

- ▶ Plan ahead (use preventive strategies where possible)
- ▶ Use multiple pest management tools
  - ▶ Cultural
  - ▶ Mechanical
  - ▶ Biological
  - ▶ Chemical
- ▶ Treat only if needed (thresholds)
- ▶ Environmentally, economically, and socially sustainable



# Keystone to IPM - Monitoring: Target & Timing

- Target susceptible life stages
  - Usually eggs and/or young
- Time the control for weak points in their life cycle
  - For severe and recurring pests - early in seasonal cycle when life stages are synchronized and before substantial injury has occurred
  - For occasional pests - wait and see if pest will be abundant

Squash bug  
eggs & nymphs



Using a hand  
lens



# Scouting for Pests

- Look at the big picture
  - Pattern of plant decline/injury
    - Pest injury tends to be aggregated
    - Can injury be associated with irrigation or other pattern?
- Look at new growth
- Check for root/crown problems
- Hand lens for small insects and mites
- Scout every 1-2 weeks

Raspberry  
horntail  
injury to cane tips



UC Statewide IPM Project  
© 2000 Regents, University of California

# Cultural Control: Healthy Plants – “Best Practices”

- Select plant species and cultivars adapted to the site
- Use good plant production practices
  - fertility, water, sunlight, etc.
- For annual plants, rotate location across years
  - avoid build-up of soil pests
- Stressed plants are more attractive and susceptible to pests



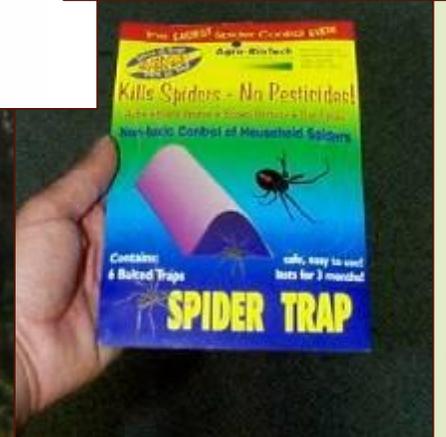
# Cultural Control: Sanitation

- Pick up / chop up dropped fruit
- Remove structures / sites where insects may overwinter (wood piles, garden debris, etc.)
- Prune out diseased limbs (cankers)



# Mechanical Control: Traps and Barriers

- Traps
  - Yellow jacket wasps, slugs, spiders
- Sticky bands
  - Trees and shrubs
- Row covers
- Diatomaceous earth



# Biological Control Insect Groups



## ➤ Predator

- consumes (kills) two or more individuals to complete its development



## ➤ Parasitoid

- consumes (kills) exactly one individual to complete its development



## ➤ Parasite

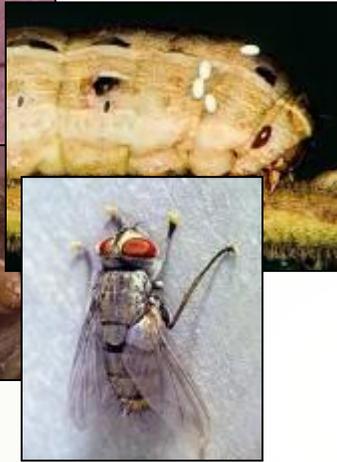
- consumes, but generally does not cause the death of one or more individuals; reduces growth rate & health of host

# Beneficial Insects & Mites

## Cast of Common Characters in the Garden



Parasitic wasps & flies



Predaceous true bugs & beetles



Common aphid predators



Predaceous mites

# Beneficial Insects



# Lady Beetles



# Lacewings



Green Lacewing



Brown Lacewing



Lacewing eggs  
are laid on stalks

Green  
Lacewing  
Egg Cluster

Green lacewings  
lay their eggs  
in clusters



Brown  
Lacewing  
Eggs

Laid singly

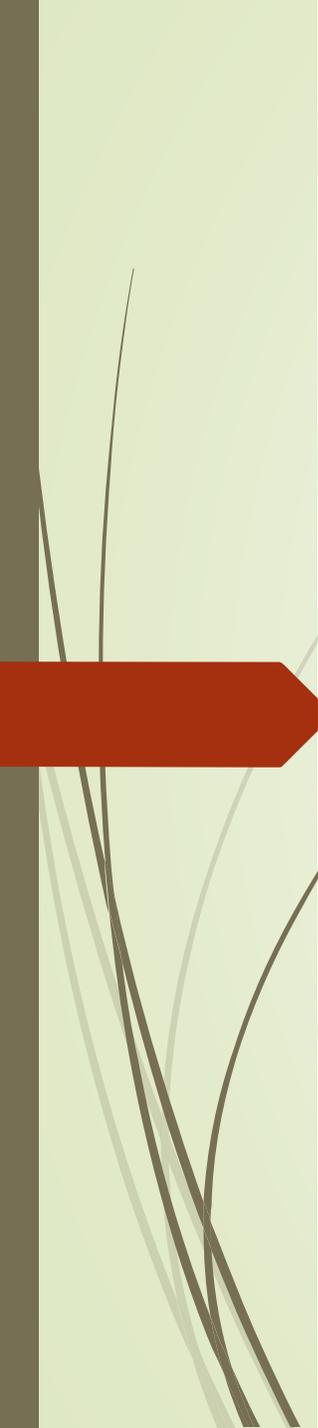


Lacewing  
larva  
preying on  
aphids

Siphoning  
mouthparts

# Syrphid Fly/Hover Fly







Syrphid or  
Hover Fly Adult

Mimic bees  
& wasps –  
black/yellow  
stripes on  
abdomen

Flies have  
large eyes



Feed on  
nectar  
at flowers

# Minute Pirate Bug



Adult



Nymph

# Predatory Mites

*Typhlodromus*  
Western predatory  
mite



*Balustium* mite

*Phytoseiulus*  
mite



# Parasitoids (Wasps, flies)



Ichneumon Wasp

Long ovipositor



# Parasitoids (Wasps, flies)



# Parasitoids



Wasps  
parasitizing  
insect  
eggs  
& scale

# Aphid Parasitoids



Aphid Mummies

# Misconceptions About Biological Control in the Home Garden

- Releasing insects is the best method - No
  - Lady beetles (or lady bugs)
  - Praying mantis
- Predatory insects will stay in your garden after release - No
- Other practices/activities don't matter - No



# Beneficial Insects Need a Diverse Diet & Shelter

- Protein and sugar food sources
  - Protein
    - Insect prey, pollen, bird droppings
  - Sugar
    - Nectar, plant nectaries, aphid honeydew
- Shelter & varied habitat

**Flowering  
plants  
Herbs  
Wildflowers**

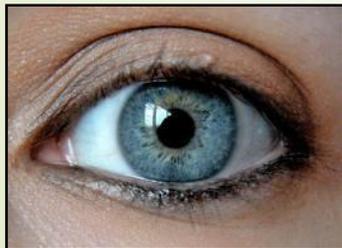


# Biological Control: Enhance Biodiversity

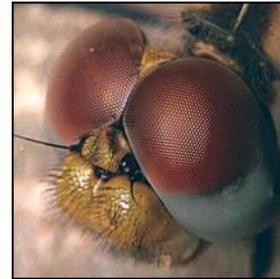
- Diversity across the landscape
- Diversity throughout the season and from year to year
- Needs to be the right kind of diversity!!



# The Attractive Garden



**Color**  
**Texture**  
**Design**  
**Variety**  
**Function**



**Plant Diversity**  
**Continuous Bloom**  
**Nectar & Pollen**  
**Shelter**  
**Variety of Insect Prey**  
**Water & Mud**



# Native Pollinators



# Gardening for Pollinators & Beneficial Insects

[www.utahpests.usu.edu](http://www.utahpests.usu.edu) — Fact sheets: Insects-Beneficial



**UTAH**  
**PESTS** fact sheet



Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory    ENT-133-09    September 2009

## Gardening for Native Bees in Utah and Beyond

James H. Cane  
Research Entomologist, USDA ARS  
Pollinating Insect-Biology, Management, Systematics Research

Linda Kervin  
Logan, UT

### Do You Know?

- 900 species of native bees reside in Utah.
- Some wild bees are supero-pollinators of Utah's tree fruits, raspberries, squashes, melons and cucumbers.
- Few of our native bees have much venom or any inclination to sting.
- Our native bees use hundreds of varieties of garden flowers, many of them water-wise.
- A garden plant need not be native to attract and feed native bees.



Fig. 1. Corder bee (*Anthidium*) foraging at lavender (*Lavendula*: Lamiaceae).<sup>1</sup>

Utah is home to more than 20 percent of the 4,000+ named species of wild bees that are native to North America. Except for bumblebees and some sweat bees, our native bees are solitary, not social, many with just one annual generation that coincides with bloom by their favorite floral hosts. In contrast, the familiar honeybee is highly social, has perennial colonies, and was brought to North America by settlers from Europe. Regardless of these differences, however, all of our bees need pollen and nectar from flowers. The sugars in sweet nectar power their flight; mother bees also imbibe some nectar to mix with pollen that they gather. Pollen is fortified with proteins, oils and minerals that are essential for the diets of their grub-like larvae back at the nest.

Our flower gardens can become valuable cafeterias for local populations of diverse native bees. In our cities and towns, native plant communities have been displaced by pavement, buildings and lawns. In the countryside, grain and hay crops likewise



Fig. 2. A pollinator garden can also be water-wise. Purple *Penstemon strictus*, front, firecracker penstemon (*P. eatonii*), center, and blue fax (*Linum perenne*), background, combine to make a pleasing design.<sup>1</sup>

## Garden Plant Recommendations for Wild Bees of North America

This table contains nearly 200 garden plant genera with species whose flowers are sought by wild bees of North America.

The Code column is useful for Utah gardeners. Some additional species not coded as G or U are suitable for Utah but only in the hot, southernmost climates (e.g. *Larrea* or creosote bush).

- G - grows in Utah
- U - Utah native
- W - water-wise
- F - food product

Form tells whether the usable species in the genus are

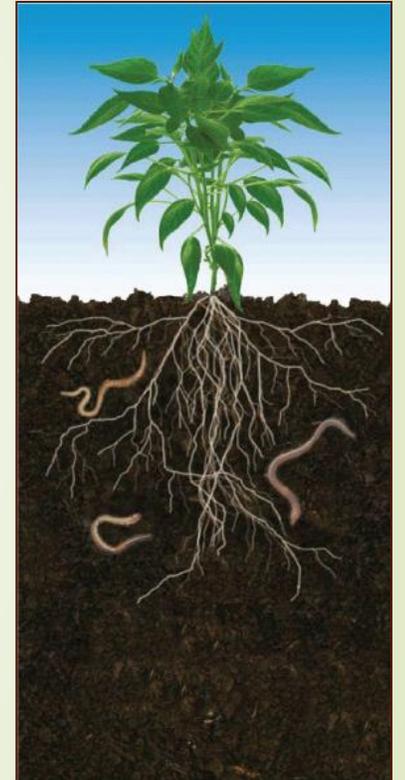
- A - annual
- P - perennial
- S - shrub
- T - tree

Plants in **bold italic>** are great choices for Utah gardeners.

Genus	Family	Common Name	Code	Forms	Notes
<i>Abelia</i>	CAPRIFOLIACEAE	abella		S	
<i>Acacia</i>	FABACEAE	acacia	W	ST	
<i>Acer</i>	ACERACEAE	maple	GU	T	
<i>Achillea</i>	ASTERACEAE	yarrow	GUW	P	<i>A. millefolium</i> weedy
<i>Aconitum</i>	RANUNCULACEAE	monkshood	GU	P	
<i>Agastache</i>	LAMIACEAE	hyssop	G	P	<b>see Fig. 10</b>
<i>Ajuga</i>	LAMIACEAE	carpet bugle	G	P	
<i>Allium</i>	LILIACEAE	ornamental onions	GUW	P	
<i>Althea</i>	MALVACEAE	hollyhock	G	P	not double-flowered
<i>Amelanchier</i>	ROSACEAE	serviceberry	GU	S	
<i>Amorpha</i>	FABACEAE	false indigo	G	S	
<i>Anchusa</i>	BORAGINACEAE	wild forget-me-not		AP	
<i>Anethum</i>	APIACEAE	dill	G	A	
<i>Aquilegia</i>	RANUNCULACEAE	columbine	GU	P	not double-flowered
<i>Arctostaphylos</i>	ERICACEAE	manzanita	GUW	S	

# Protect, Conserve & Promote Native Insects

- Diverse, healthy garden with flowering plants
  - Continuity in food & shelter in space & time
- Quality pollen & nectar
  - Wildflowers, herbs, fruit trees
- No toxic pesticides
  - Use cultural & mechanical pest management practices
  - Use selective, “soft” pesticides
- Tolerate some plant-feeding insects
  - Natural enemies must have food to survive



**Start from the bottom up – healthy soil**

# FRUIT INSECT PESTS



# Codling Moth

- Caterpillars bore into fruit
- Moths emerge in spring
- Eggs laid on fruit & leaves
- 1<sup>st</sup> instar larva bores into fruit w/in 24 hr
- **Chemical control: target newly hatched larva; timing based on moth trap catch info. & degree-days in your area**
  - **Tree Fruit IPM Advisory**
    - acetamiprid/Ortho (14 d)
    - carbaryl/Sevin (14-21 d)
    - gamma cyhalothrin/Spectracide (14 d)
    - spinosad (7 d)
    - malathion (7 d)
    - CM virus (CydX; 7 d)
- Sanitation: pick up dropped fruit



# Mechanical Control: Codling Moth



Pupate inside silken cocoons on trunk  
Corrugated cardboard band -  
“mass-trap” to reduce population



Fruit bags to exclude codling moth eggs  
Place bags over 3/4” diameter fruit

# Peach Twig Borer

- Over winter as young larvae on limbs; brown caterpillars burrow inside twigs from bloom to petal fall; 2<sup>nd</sup> & 3<sup>rd</sup> generations enter fruit, usually at the stem end
- **Delayed Dormant Spray: Dormant oil** + permethrin or gamma-cyhalothrin (by first pink) – targets twig boring OR At-Bloom Sprays: 2 Bt sprays (early & full to late bloom)
- **Fruit Protection:** same insecticides as for CM timed with trap catch and degree-day info. or apply at shuck-fall & repeat if needed
  - **Tree Fruit IPM Advisory**



# Fruit-Eating Wasps: Paper wasps



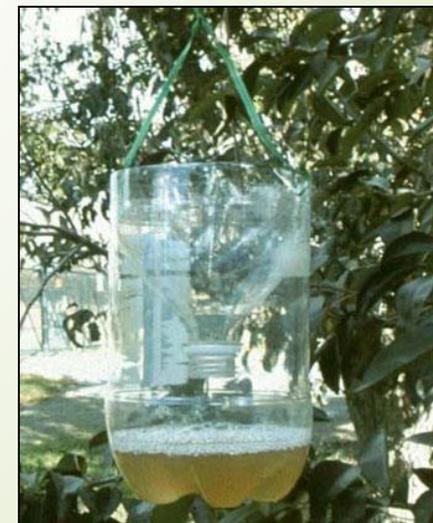
**European paper wasp (fruit-eater):**  
Thin waist, more black than yellow,  
Upside down umbrella-shaped nests



**Yellow jacket:**  
“Chunky” body, more yellow  
than black  
Paper nests in ground &  
under dense vegetation  
Aggressively defend nest  
(painful sting!)

# Wasp traps

- ▶ Place around perimeter of garden and yard and in spots slightly away from high human activity
- ▶ Yellow jacket – predator/scavenger
  - ▶ Commercial traps with heptyl butyrate bait
  - ▶ Homemade trap with raw meat
  - ▶ Locate ground nests in area - treat with insecticides & remove
- ▶ European paper wasp – fruit-eater
  - ▶ Homemade trap - liter plastic bottle with diluted fruit juice (1 part juice: 10 parts water) – ferment juice (1/4 tsp yeast) + 1/4 tsp liquid dish detergent (add piece of ripe fruit to excel fermentation)
  - ▶ Treat & remove nests



# Aphids

- Suck fluids from leaves & stems; curl leaves; produce sticky honeydew; black sooty mold growth
- Protect young trees, older trees can tolerate more aphid feeding
- **Controls: Dormant oil at green tip stage**
- Insecticidal soap, horticultural oil, azadirachtin, malathion
- **Biological control:** lady beetles, lacewings, syrphid flies, parasitic wasps



# Spider Mites

- Feed on leaves; produce webbing; injury appears as white speckles; severe feeding leads to bronzing
- Mites build up on broadleaf weeds (bindweed, knotweed, mallow, prickly lettuce); reproduce rapidly in hot weather
- **Cultural controls:** Avoid mowing, herbicides, drying of vegetation - prompts mites to move into trees
- Avoid multiple applications of pyrethroid insecticides (permethrin, gamma-cyhalothrin)
- **Biological control:** naturally occurring predatory mites & small lady beetle
- **Chemicals:** horticultural oil, insecticidal soap



# Aphid & Mite Mechanical Control

Stiff spray of water every 2-3 days until aphid or mite numbers decline

Best if initiated before leaves are tightly curled (aphids) or extensive webbing & leaf injury occurs (mites)



# VEGETABLE AND HERB INSECT PESTS



# Squash Bug

- Adults & nymphs suck fluids from plant leaves, stems & fruit
- “Sudden wilt” – disruption of xylem vessels
- Congregate in plant debris under plants
- **Cultural controls:** Remove garden debris in fall, nearby woodpiles or other protected sites (adults over winter)
- **Hand pick or destroy eggs & nymphs**
- **Chemicals:** spray when first detect nymphs, drench undersides of leaves & stems
- kaolin clay (Surround), malathion, carbaryl, neem oil



# Corn Earworm

- Caterpillars feed on new silks & ear tips; reduce pollination & damage ear tips; allow entry of molds & attract other insects (sap beetles, earwigs)
- **Cultural control:** Early crops avoid injury (silk before mid July)
- Protect young silk; difficult to control worms once inside ear tip
- **Chemicals:** carbaryl, permethrin, pyrethrin, neem oil, oils applied to silks (reapply every few days)



# Tomato Hornworm

- LARGE green caterpillars with horn on tail
- Feed on tomato, eggplant, potato
- Consume large amounts of foliage and buds in a short time period
- Remove by hand
- Chemicals: Bt (Dipel, Thuricide), spinosad, many others
- Parasitic wasp – white cocoons on caterpillars





# Landscape Ornamental Pests

# Bark Beetles



# Conditions that Promote Bark Beetles

- ▶ Drought
- ▶ Trees on dry, sloping sites
  - ▶ Tree stress
  - ▶ Dry soils in spring and fall
    - ▶ Supplemental irrigation is absent or inadequate
- ▶ Longer, hotter growing seasons
  - ▶ More bark beetle generations
- ▶ Warmer winters
  - ▶ Higher overwinter survival, more generations
- ▶ Cyclic populations of bark beetles
  - ▶ Established populations in an area
  - ▶ Spread from foci / sources



# Primary bark beetles in urban landscapes of Utah

- ▶ *Ips hunteri* & *I. pilifrons*
  - ▶ blue & Engelmann spruce
- ▶ *Ips pini*
  - ▶ ponderosa & lodgepole pine
- ▶ *Ips confusus*
  - ▶ pinyon & singleleaf pine
- ▶ Banded elm bark beetle
  - ▶ *Scolytus schevyrewi*
  - ▶ elm
- ▶ Shot hole borer
  - ▶ *Scolytus rugulosus*
  - ▶ apple, pear, cherry, hawthorn
- ▶ Black walnut twig beetle
  - ▶ *Pityophthorus juglandis*
  - ▶ black walnut



Ips have obvious spines on rear of outer wings



and a  
concave  
depression

Ips are tiny! 1/8 – 3/8 inch long

# Distinguishing characteristics of bark beetles



Spruce Ips galleries: “octopus arms”

How do they feed and tunnel in trees?



Elm bark beetle galleries: “radiating arms”



Adult Pinyon Ips hind end

Size, shape, and color & spine patterns on adults



Banded elm bark beetle adult

# Key Ips management strategy: Prevent tree stress

- ▶ Avoid dry planting sites
  - ▶ slopes, south-facing
  - ▶ fast-draining soils, inadequate irrigation
  - ▶ Provide deep irrigation
    - ▶ 2-4 inches water/month for established trees
- ▶ Avoid over-crowded plantings
- ▶ Avoid compacted soils
  - ▶ construction sites
- ▶ Prevent mechanical injuries
- ▶ Remove Ips-infested trees (foci)
  - ▶ remove infested wood
  - ▶ properly dispose: chip & dry, remove bark, burn



# Ips control: Insecticides

- ▶ Preventive application
  - ▶ when infested trees are in the neighborhood
- ▶ Save trees infested  $\leq 30\%$ 
  - ▶ Loss of central leader will permanently distort tree shape
- ▶ Apply insecticide to entire bole & interior of lateral limbs
  - ▶ Spring (March) before beetle flight
  - ▶ Daily temps  $>50^{\circ}\text{F}$
  - ▶ Kill beetles when chew thru insecticide-soaked bark
  - ▶ Fall (Sept)
- ▶ High pressure ( $\geq 250$  psi), drenching spray to run-off, professional applicator & equipment
  - ▶ Thorough coverage!

# Examples of effective insecticides

- ▶ Carbaryl (carbamate)
  - ▶ Carbaryl 4L, Sevin XLR
- ▶ Bifenthrin (pyrethroid)
  - ▶ Bifen XTS
  - ▶ Onyx
- ▶ Permethrin (pyrethroid)
  - ▶ Astro
  - ▶ Hi Yield 38 Plus<sup>Homeowner</sup>
- ▶ 1-2 applications per year
- ▶ To date, systemic insecticides have not shown good efficacy



# Sanitation: Treating infested wood

- ▶ Promptly remove wood from the landscape
  - ▶  $\geq 2$ -3 miles from host trees
- ▶ Check wood for live beetles
- ▶ Kill beetles within wood
  - ▶ Remove bark
  - ▶ Chip wood & spread to dry
  - ▶ Cover log pile with clear plastic
    - ▶  $> 130^{\circ}\text{F}$  for a month (summer)
  - ▶ Burn wood



Ips pupa, larva, and adult within gallery tunnels



Cover infested logs with clear plastic to kill bark beetles with heat

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Integrated Pest Management

Bees

Cooperative Agriculture Pest Survey

**UTAH PESTS fact sheet**

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## Bark Beetles

Ryan S. Davis, Arthropod Diagnostician, and Darren McAvoy, Extension Forestry Associate

### WHAT YOU SHOULD KNOW

- Bark beetles are a significant cause of tree mortality in the forest and urban environment.
- To protect high-value trees around homesites, use preventative trunk sprays of carbaryl, permethrin, and bifenthrin prior to beetle flight.
- Soil- and trunk-applied systemic insecticides (e.g., imidacloprid and dinotefuran) do not sufficiently protect trees from bark beetle attack.

### BIOLOGY

Bark beetles are one of the most destructive forest pests in the world. They are different than the larger longhorned and roundheaded/metallic woodboring beetles commonly infesting the inner wood of trees. The largest bark beetle, the red turpentine beetle (*Dendroctonus valens*), reaches only 8.3 mm in length. Because of their tiny size (Fig. 1), bark beetles are not effective tree killers as individuals. Instead, primary bark beetles work together, sending pioneer beetles to search for stressed or dying trees. When pioneer beetles find a weakened tree, they bore into and feed



on the thin phloem layer just under the bark. As they feed, chemicals from their food are converted into attractive chemicals, signaling to other beetles of the same species that a suitable host was found. Beetles that detect the airborne chemicals will fly to the stressed tree, bore into the phloem, create a mating (nuptial) chamber, mate, and hollow-out a parental gallery laying eggs as they progress. Usually, many beetles attack the same tree in a short period of time allowing them to overcome its defenses (e.g., resin in pines). This is called mass attack. After egg hatch, immature beetles (larvae) (Fig. 12) begin feeding outward from the parental gallery, girdling the tree. This larval girdling is the same as killing a tree by deeply scoring its entire circumference with a knife or

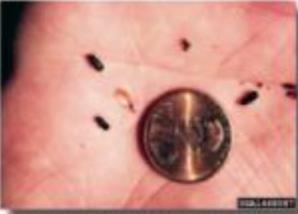


Fig. 1. Average size of an adult bark beetle compared to a penny.<sup>1</sup>

Fig. 2. Typical top-down debark pattern on pines infested by Ips beetles.<sup>2</sup>

# Scolytus spp.: Elm bark beetles



Banded elm bark beetle  
*Scolytus schevyrewi* (1/8 inch)



European elm bark beetle  
*Scolytus multistriatus* (1/16-1/8 inch)



Dying elm trees



Attack elm (American, Siberian, English, rock),  
*Prunus* spp., willow, Russian olive, possibly Zelkova

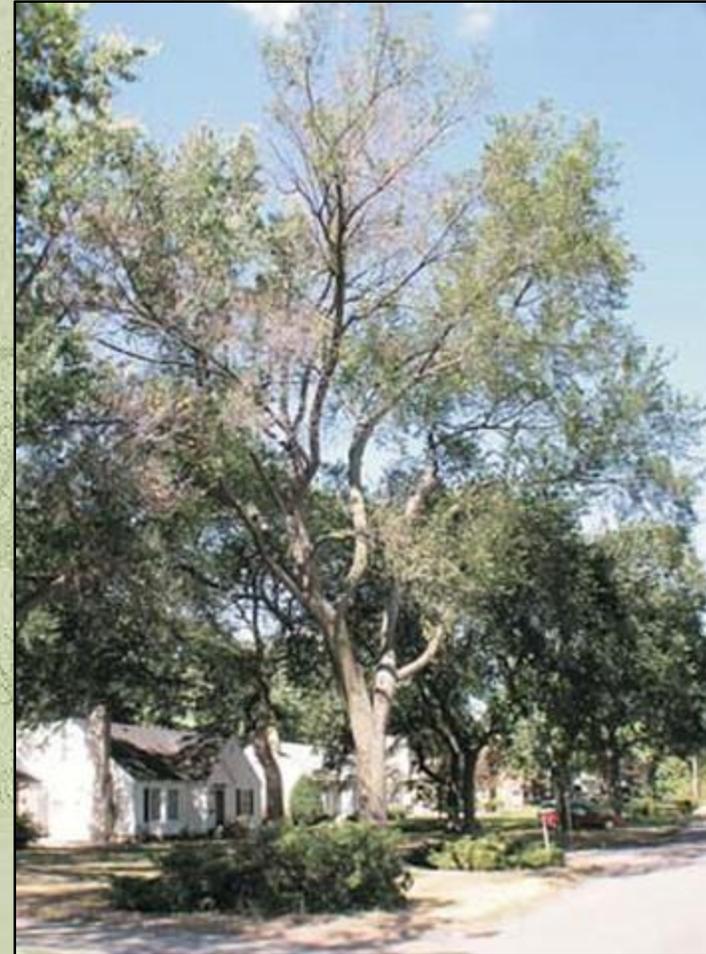
Vector Dutch elm disease (fungus)

Galleries with "radiating arms"  
External twig & branch crotch feeding



# Elm bark beetle & Dutch elm disease (DED) management

- ▶ DED resistant elm cultivars
  - ▶ 'Valley Forge', 'New Harmony', 'American Liberty', 'Princeton'
- ▶ Preventive insecticides
  - ▶ adult emergence: May-June (1-3 gens/yr)
  - ▶ canopy, limbs, and upper trunk
  - ▶ bifenthrin, cypermethrin, permethrin, carbaryl
- ▶ Prune out infected limbs
  - ▶ brown vascular tissue in limbs, twigs
- ▶ Sever root grafts between elm trees (fungus spread)



# Elm bark beetle & DED fact sheet

**UTAH PESTS fact sheet** Utah State University COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-147-11 September 2011

## Elm Bark Beetles and Dutch Elm Disease

Ryan S. Davis, Arthropod Diagnostician

**DID YOU KNOW?**

- Two major bark beetle species attack elm trees in Utah; both can transmit Dutch Elm Disease (DED), leading to tree death, decline, or chronic stress.
- Preventive treatments such as foliar insecticide applications, severing root grafts between trees, injectable fungicides, and proper pruning of affected areas can minimize transmission of DED.
- New, DED-resistant American elm cultivars are available for purchase; look for "Valley Forge" and "New Harmony" at your local nursery.

**INTRODUCTION**

Bark beetles (Family Curculionidae, Subfamily Scolytinae) are some of the most devastating insect pests in the world. Closely related to weevils, there are almost 500 species of bark beetles in North America alone, each with unique host plants, habits, and life cycles. It is crucial to accurately identify a suspect bark beetle before you consider treatment options.

In Utah, trees in the genus *Ulmus* (elm) can be attacked by bark beetles carrying Dutch Elm Disease (DED) (*Ophiostoma ulmi* and *O. novo-ulmi*), leading to tree death, or chronic illness and stress. This fact sheet will help you recognize the two major elm-attacking beetles in Utah and develop a control strategy for the beetles and DED.

Of the three major elm-feeding bark beetles, the European elm bark beetle, *Scolytus multistriatus*, and the banded elm bark beetle, *Scolytus schevyrewi*, are the major vectors of DED in Utah. The elm bark beetle (*Hylurgopinus rufipes*), native to eastern and central United States, is also briefly discussed.

**THE ELM BEETLES**

**Banded Elm Bark Beetle**  
**Scientific Name:** *Scolytus schevyrewi*  
**Range:** Utah and 22 other—mostly western and mid-western states—Russia, northern China, and central Asia.  
**Hosts:** American elm (*Ulmus americana*), Siberian elm (*U. pumila*), English elm (*U. thomasi*), and rock elm (*U. procera*) in North America; in various elms (*Ulmus* spp.) in Russia, China, and Asia; Russian olive, willows, woody plants in the pea family, and fruit trees in the genus *Prunus* are potential hosts.  
**Identification:** Small beetle three-four mm long with black bands across the wings (usually apparent) (Fig. 1); from the side, the rear of the beetle appears to have a "finger nail" shape and spine.

**Life History:** Two to three generations per year in Utah with adult flight beginning in early spring (April), continuing throughout the growing season.

**European Elm Bark Beetle**  
**Scientific Name:** *Scolytus multistriatus*  
**Range:** Contiguous United States into Canada; Europe.  
**Hosts:** American elm (*Ulmus americana*), Siberian elm (*U. pumila*), other elms (*U. pumila*), and possibly trees in the genus *Zelkova*.  
**Identification:** Small beetle two to three mm long without black bands across the wings (as compared to banded elm bark beetle); from the side, the rear of the beetle appears to have a "finger nail" shape and a spine (Fig. 2).  
**Life History:** Adult emergence roughly coincides with spring elm leaf-flush (mid May); there are 2-3 generations per year in Utah.



Fig. 1. Banded elm bark beetle (*Scolytus schevyrewi*) adults feeding on elm branch branches can transmit DED. Notice the band pattern on the wings.

[www.utahpests.usu.edu](http://www.utahpests.usu.edu)  
Fact sheets:  
Insects – Landscape Orn.

# Shothole Borer: *Scolytus rugulosus*

Hosts: *Prunus* spp.  
cherry, apple, pear, hawthorn  
< 1/16 inch diam holes  
1/8 inch long beetle



Entry holes with sap

Exit holes: "shothole"



- Cut out infested limbs
- Keep trees healthy
- Attack stressed trees
- Insecticides at peak adult flights:  
spring & fall

# Walnut twig beetle

## *Pityophthorus juglandis*

- Vectors tree-killing fungus
  - Thousand Cankers Disease
- Primary host: black walnut
  - can attack & kill other walnuts
- Primarily attack limbs  $\geq 3/4$  inch diam
- Colorado State Univ. Pest Alert (online)
- USU Fact Sheet
  - [www.utahpests.usu.edu](http://www.utahpests.usu.edu)

### PEST ALERT

#### Walnut Twig Beetle and Thousand Cankers Disease of Black Walnut

For at least the past decade, an unusual decline of black walnut (*Juglans nigra*) has been observed in several western states. Initial symptoms involve a yellowing and thinning of the upper crown, which progresses to include death of progressively larger branches (Figure 1). During the final stages large areas of foliage may rapidly wilt. Trees often are killed within three years after initial symptoms are noted. Tree mortality is the result of attack by the walnut twig beetle (*Pityophthorus juglandis*) and subsequent canker development around beetle galleries caused by a fungal associate (*Geosmithia morbida*) of the beetle (Figure 2). The name for this insect-disease complex is *thousand cankers disease* (TCD) of walnut.



Figure 1. Rapidly wilting black walnut in the final stage of thousand cankers disease.

#### Walnut Twig Beetle

**Distribution.** The walnut twig beetle is native 1928 from specimens collected in 1896 in the Amd County). In the 1992 catalog of Bark and Amd range of the insect was listed to include New M 3). This range appears to coincide largely with presumed original native host. There is also go native to southern California, where it would be walnut, *Juglans californica*. In Arizona walnut confining its development to overshadowed or inj



Figure 2. Walnut twig beetle (*Pityophthorus juglandis*) produced by

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UTAH PESTS fact sheet

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory August 2011

### Thousand Cankers Disease of Walnut (*Geosmithia morbida*)

Charles Hochwiler, Extension Plant Pathologist • Jason Inoué, PhD Project Leader

**What you should know**

- Thousand cankers disease is caused by the fungus *Geosmithia morbida*.
- It is transmitted by the walnut twig beetle (*Pityophthorus juglandis*).
- Other symptoms are visible, trees can die within 2 to 3 years.

**INTRODUCTION**

Thousand cankers is a newly recognized disease of walnuts caused by a fungus (*Geosmithia morbida*) that is spread by the walnut twig beetle (*Pityophthorus juglandis*) (Fig. 1). The beetle is endemic to the native range of Arizona walnut (*Juglans nigra*), black walnut (*J. nigra*), and California walnut (*J. californica*), and was first identified in Utah in 1986. Widespread mortality of black walnut in the early 2000s in Colorado first drew attention to the discovery of the pathogen-vector complex. The name of the disease comes from the numerous necrotic lesions (cankers, Figs. 4a and 4b) found on the cambium of infected trees (Reeser et al. 2009). The fungal associate of black walnut trees (Fig. 2) often within 2 years of the development of the tree symptoms (Christie and Reeser 2008).

**HOSTS**

Black walnut (*Juglans nigra*) and black walnut hybrids are very susceptible to *Geosmithia*. California walnuts (*J. californica*) and Persian walnuts (*J. regia*) are highly susceptible. Cankers do not seem to form on eastern walnuts (*J. nigra*) (Christie and Reeser 2008).

**SYMPTOMS**

It may take several years of insect and fungal attack before symptoms are visible, starting with yellowing leaves and thinning tree crown. As the disease progresses, foliage will begin to brown and eventually the tree dies (Fig. 1) (Reeser et al. 2009). Visible exit holes caused by the twig beetle can be found on the bark (Fig. 3).

Fig. 1. Walnut twig beetle (*Pityophthorus juglandis*)

Fig. 2. 400-year old black walnut killed in northern Utah

Fig. 3. Exit holes caused by the walnut twig beetle

# Thousand Cankers Disease Symptoms

- Yellowing & thinning of upper crown
- Death of progressively larger branches
- Rapid wilt of foliage (final stages)
- ~ 3 yrs to kill trees



*Geosmithia morbida* cankers and black walnut limb death

# Distribution of walnut twig beetle & thousands cankers disease



**Figure 3.** Distribution of the walnut twig beetle and thousand cankers disease. In green are states and the California county of Los Angeles with records of the species prior to 1960. States in orange have reported the insect since 1988. The recent (2010-2011) records from states east of the Mississippi are presently known only from limited areas: Tennessee/Knox County and surrounding areas; Virginia/Richmond; and Pennsylvania/Bucks County.

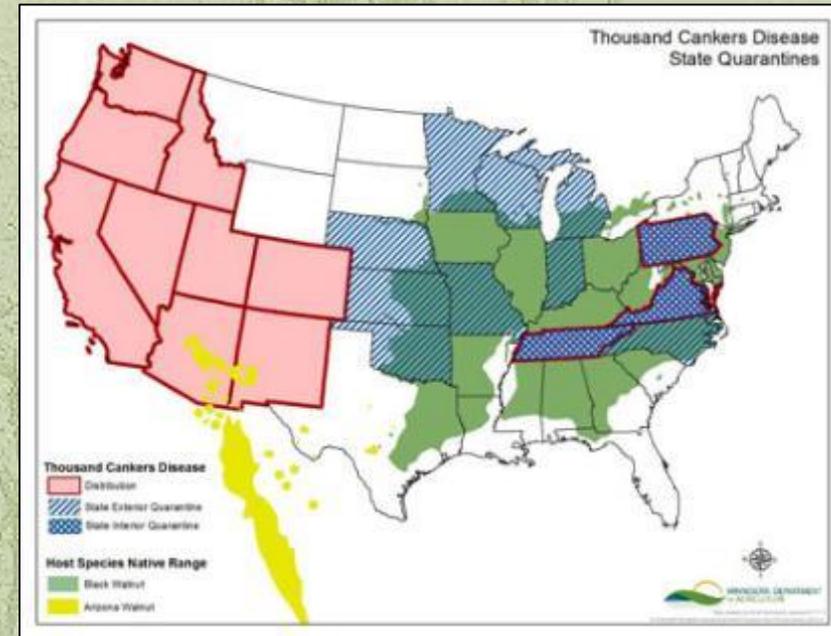
- Black walnut tree death in Utah first noticed in early 1990's
- First UT WTB specimen – 1988
- Arizona walnut, *Juglans major*, may be native host for WTB
- Earliest specimens: 1898 (NM)



Walnut twig beetle adult ~ 1/16 inch, yellowish-brown color

# Management of WTB and TCD

- No controls for fungus – prevention of beetle attack
- Preventive insecticides
  - Spring & summer – same products as for other BBs
- Sanitation
  - Pruning
  - Removal & disposal of infested wood
- Quarantines on transport of black walnut wood to some states



# Monitoring walnut twig beetle

- USFS Entomology Team developed pheromone trap
- Identified aggregation pheromone
- Pheromone-baited funnel trap
- Trapped WTB from Richmond (N) to Cedar City (S)
- Contech pheromone lure & funnel trap available from Forestry Distributing
  - [www.forestrydistributing.com](http://www.forestrydistributing.com)



Place traps ~10 ft high  
near host trees

# Bark Beetle Take-Home Points

- Prevention!!
  - Maintain tree health / prevent stress
    - Planting site, irrigation, protection
- Sanitation!
  - Promptly prune affected limbs or remove infested trees
  - Properly dispose of infested wood
    - Chip, tarp, burn, dispose  $\geq$ 3-4 miles
- Insecticides (preventive)
  - Timed for spring and fall (adult flight periods)
  - Good coverage, high pressure, soak bark



Mountain pine beetle has devastated Uinta Mountain pines in some areas

# Scale Insects



European  
Elm  
Scale

Soft Scales



Lecanium  
Scale



Oystershell  
Scale

Armored Scales

Black  
Pineleaf  
Scale



# Scale Infestation Symptoms



Twigs & limbs encrusted in scale  
insect bodies

Chlorotic leaves

Necrotic spots on leaves & fruit

Limb dieback when scales are  
abundant

Soft Scales: honeydew (because feeding in tree phloem)

# Scale Mechanical Control

- ▶ Prune out infested limbs
- ▶ Place sticky bands to trap the young “crawler” stage (late May – July; timing varies with species)
  - ▶ Primarily a monitoring tool



Tangletrap & duct tape sticky band



Black pineleaf scale crawlers



San Jose scale crawlers

# Scale Insecticides

- ▶ Dormant Oil Spray (2-4%)
  - ▶ Spring – at bud break – smothers overwintering scales
- ▶ Systemic soil drench or injection
  - ▶ Spring (Post-bloom)
    - ▶ Soft Scales – imidacloprid (Merit, Bayer Advanced, others)
    - ▶ Armored Scales – dinotefuran (Safari) – ornamentals only
- ▶ Target Crawlers
  - ▶ June to July (varies with species; sticky bands to monitor)
    - ▶ horticultural oil, insecticidal soap, carbaryl (Sevin), dinotefuran (Safari,) pyriproxyfen (Distance), buprofezin (Talus), azadirachtin (Azatin, Neem oil), synthetic pyrethroids (Tempo, Talstar, others), malathion

# High Alert for New Invasive: Emerald Ash Borer



# Emerald Ash Borer: Invasive – not in Utah, yet...

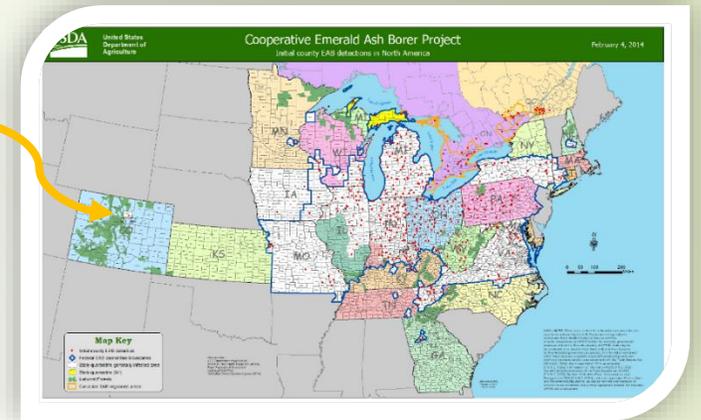


## Emerald Ash Borer is on our doorstep

- Native to Asia
- Flatheaded beetle (Buprestidae) (~1/2 inch)
- Larvae feed on inner bark disrupting water & nutrient transport
- First found in the U.S. in MI in 2002
- Killed nearly 60 million ash trees (~50 mill in southern Michigan)
- Attacks mature trees (olive family, Oleaceae)
  - Ash: all species of North American ash
  - White fringetree (*Chioanthus virginicus* L.)



Boulder, CO



# Larva



# Larval Tunnels - Injury



# Monitoring



# Monitoring



D-shaped  
exit hole

# Monitoring



# Knowing When or Whether to Treat

- No threshold has been set
- When present, trees should be protected
  - within two miles of attacked tree
- Protective trunk, branch & foliage sprays
  - Pyrethroids: bifenthrin, cyfluthrin, permethrin
  - carbaryl
- Systemics – inject, drench, or bark spray
  - dinotefuran
  - imidacloprid



# Management Practices

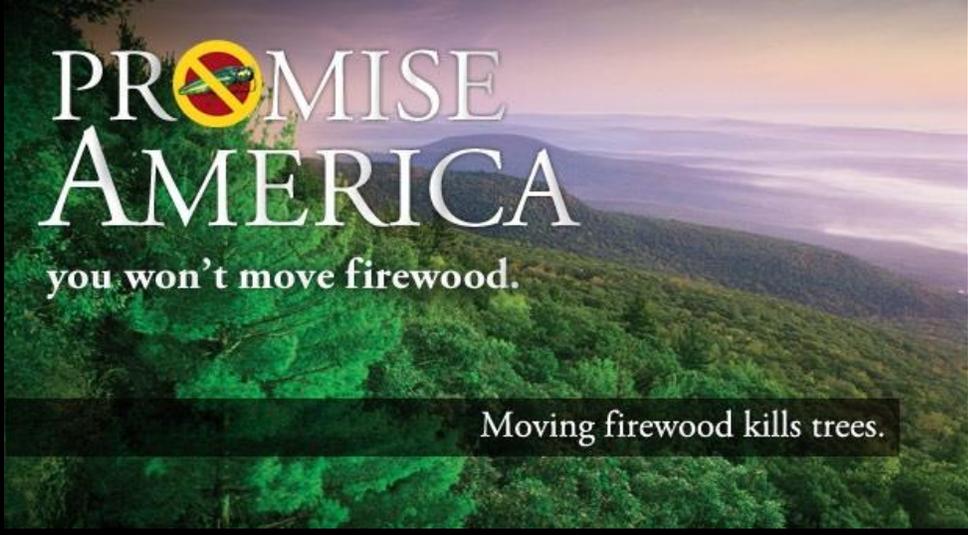
Don't move  
infested wood!





# Promise to Protect Our Sluggers.

Ash wood is used for all sorts of important things, including hand tools, furniture, guitars, hockey sticks — and baseball bats! Protect our national pastime! **Don't move firewood!**



# PROMISE AMERICA

you won't move firewood.

Moving firewood kills trees.

## DON'T MOVE FIREWOOD

Our forests are threatened by nonnative insects that can kill large trees. Three recently introduced insects—emerald ash borer, Asian longhorn beetle, and Sirex woodwasp—are wood-infesting species that can be transported to new areas on firewood. Once transported into new areas, these insects can become established and kill local trees. We must **STOP THE SPREAD** of these insects and protect our forests.

### How you can help:

- Leave firewood at home—do not transport it to campgrounds
- Use firewood from local sources.
- If you have moved firewood, burn all of it before leaving your area.



Inset photo: Asian longhorned beetle larva (courtesy of Thomas B. Denhart, New Jersey Dept. of Agriculture, www.forestimages.org)

## HELP STOP INVASIVE PESTS

For more information, visit the following Web sites:  
[www.massnr.org/pests](http://www.massnr.org/pests)  
[www.na.fs.fed.us/fhp](http://www.na.fs.fed.us/fhp)  
[www.aphtis.usda.gov/ppp/ep](http://www.aphtis.usda.gov/ppp/ep)  
[www.emeraldashborer.info](http://www.emeraldashborer.info)



USDA Forest Service  
Northeastern Area  
State and Private Forestry  
NA-PR-02-06  
April 2006  
[www.na.fs.fed.us](http://www.na.fs.fed.us)

The USDA is an equal opportunity provider and employer.

# Firewood ALERT

Help stop the spread of exotic pests

**BRING FIREWOOD INTO NORTH DAKOTA!**

## BURN IT WHERE YOU BUY IT

Stop the Emerald Ash Borer  
Don't Move Firewood > [StopTheBeetle.info](http://StopTheBeetle.info)

# DON'T MOVE FIREWOOD

A decorative graphic on the left side of the slide features several thin, dark grey lines representing grass blades. A solid red arrow points horizontally to the right, overlapping the base of the grass blades.

# Turfgrass Insects

# Turf Insect Pests – Turf IPM Advisory

Utah State UNIVERSITY extension

Turfgrass IPM Advisory



Seasonal Turfgrass Pest Update, Utah State University Extension, Fall 2014

## Turfgrass Integrated Pest Management

An integrative approach to the management of turfgrass insect pests, diseases and weeds is most effective. Often, prevention is the best strategy and management practices can help grasses to resist and recover from pest damage.

### News/What to Watch For

New information is available regarding billbug activity and management in the state, including a new insecticide option. We also have a new insect pest to contend with in Utah. Crane fly has been found in the state for the first time this year. Of course, routine fall management practices are also a priority now.

## Billbug: Activity in Turf and a New Insecticide Option

Billbugs (*Sphenophorus* spp.) are a primary pest of turfgrass in the Intermountain West. Adult weevils deposit eggs in turf stems. Larvae then emerge from the eggs and feed within the stems. Mature larvae feed on roots below ground, and eventually pupate with adults emerging from the soil.

Although the adults do feed on turf aboveground, the majority of turf damage results from larval feeding and is seen as severe discoloration resembling drought stressed turf, and in severe cases plant death.



-Photo by Lori Spears

Most of what we know about billbugs comes from research conducted in the eastern U.S., yet we find many differences in Utah and the Intermountain West. In the Intermountain West, there is a complex of three billbug species that occurs simultaneously including the bluegrass, hunting, and Rocky Mountain billbugs. In some isolated spots, the Phoenix billbug also occurs. In other regions of the U.S., only one and sometimes two of these species will be present as major pests.

Current predictive models for billbug activity do not appear to be a good fit for predicting billbug populations in the Intermountain West. For example, first occurrence of billbugs in Logan, UT in 2014 was more than one month earlier (60 degree days<sub>50</sub>; April 12) than what would be predicted by the current Base 50 degree day (DD) model<sup>®</sup> used in the east (280-352DD; May25-31). Recognizing these differences is key to improving the timing and resulting efficacy of management strategies that are available.



Summer Patch (*Magnaporthe poae*)

Favorable Conditions: moderately warm air temperatures (60-70°F) and high soil pH. Excessive N fertilization in the spring.

Summer patch (SP) damage appears as circular patches or rings from 6 inches to 3 feet in diameter. Patches are initially off-color and prone to wilt, eventually turning yellow or straw-brown. Outer edges of the patch are usually orange or bronze. Affected plants have rotten roots, rhizomes, and crowns and pull easily from the turf. **SP has been positively identified in Millard, San Pete and Salt Lake counties this summer/fall.**

### Cultural Practices

Fertilization with sulfur-coated products or ammonium sulfate can help moderate pH and minimize SP development. Practice deep and infrequent irrigation. Alleviate thatch buildup and compaction.

### Resistant Turfgrass Varieties

**Kentucky bluegrass:** Midnight, Everglade, Everest, NuDestiny, Granite Seed Co. Corsair, America, and Blue Velvet show resistance to SP, but are still susceptible under high disease pressure. Perennial ryegrass is immune to the disease.

### Fungicide Options\*

Azoxystrobin (Heritage), myclobutanil (Eagle), propiconazole (Banner MAXX, Propiconazole Pro), and azoxystrobin + propiconazole (Headway).



Necrotic Ring Spot (*Ophioplasma korrae*)

Favorable Conditions: cool (40-60°F) and moist conditions, may be compounded by drought and compaction.

Necrotic ring spot (NRS) primarily infects Kentucky bluegrass, though it may also be seen in annual bluegrass and tall fescue. The disease damages the roots and crowns of the grass plants and the first symptoms are small, light green patches of turf that get larger over time. Frequently the turf will survive the infection and re-grow in the center of the patches, giving them a ring-like ("frog eye") appearance. **NRS has been positively identified in Beaver, Cache, Davis, Salt Lake, San Pete, Utah, Wasatch, and Weber counties this summer/fall.**

### Cultural Practices

Maintain the highest mowing height possible and prevent drought stress. Core aerate once annually to reduce thatch and avoid over application of N fertilizers.

### Resistant Turfgrass Varieties

**Kentucky bluegrass:** Midnight, Award, NuDestiny, Blue Velvet, America, Jump Start, Everglade, Everest, Ginny II, and Langara show resistance to SP, but are still susceptible under high disease pressure. Perennial ryegrass is also highly resistant to the disease.

### Fungicide Options\*

Azoxystrobin (Heritage), myclobutanil (Eagle), propiconazole (Banner MAXX, Propiconazole Pro, Fertilome Liquid Systemic Fungicide), and azoxystrobin +

## Cyanobacteria (cont'd)

### Solutions

Eradication of cyanobacteria is not possible. However, increasing mowing height can reduce the problem. Grass will be less stressed and can tolerate the toxins better and the bacteria will not be able to crawl all the way to the tip of the grass where they cause the most damage.

When cyanobacteria are a severe problem three weekly applications of fungicides containing chlorothalonil can help control the problem. Fungicides with other active ingredients like myclobutanil or azoxystrobin are not effective.

More information can be found [http://www.paceturf.org/PTR/Documents/0008sj.pdf](http://www.paceturf.org/PTR//Documents/0008sj.pdf).

-Claudia Nischwitz, USU Extension Pathology Specialist



Chinch bug damage to turf. Image courtesy of Katie Wagner, Utah State University.

## Chinch Bugs (*Blissus* spp.)

We're continuing to see chinch bug activity this summer in several Utah counties. Typical chinch bug damage is comprised of patchy dieback that forms larger patches and in severe cases, complete lawn loss. Feeding damage can often mimic drought stress; however, chinch bug damage will not respond to increased watering as a drought-affected lawn would. Feeding damage is often worse on plants that are already affected by drought.

In Utah, chinch bugs seldom need insecticidal treatment unless the population has exceeded threshold levels and damage is evident. Effective insecticides include bifenthrin and other pyrethroids. Preventive management practices include proper irrigation, regular fertilization, reducing thatch via power raking and core aeration, avoiding the use of broad-spectrum insecticides that can reduce beneficial insects, and over-seeding or replanting a lawn using endophyte-enhanced grass seed (see Spring 2012 Turfgrass IPM Advisory).

-Ryan Davis, USU Arthropod Diagnostician

# White Grubs

- Immature stage of scarab beetles
- Eat turfgrass roots
- 3 kinds established in UT
  - May/June beetle
  - Masked chafer
  - Black turfgrass Ataenius
  - Japanese beetle – Orem eradication program



May/June beetle



Black turfgrass  
Ataenius



Masked chafer



Japanese beetle

Not to scale!

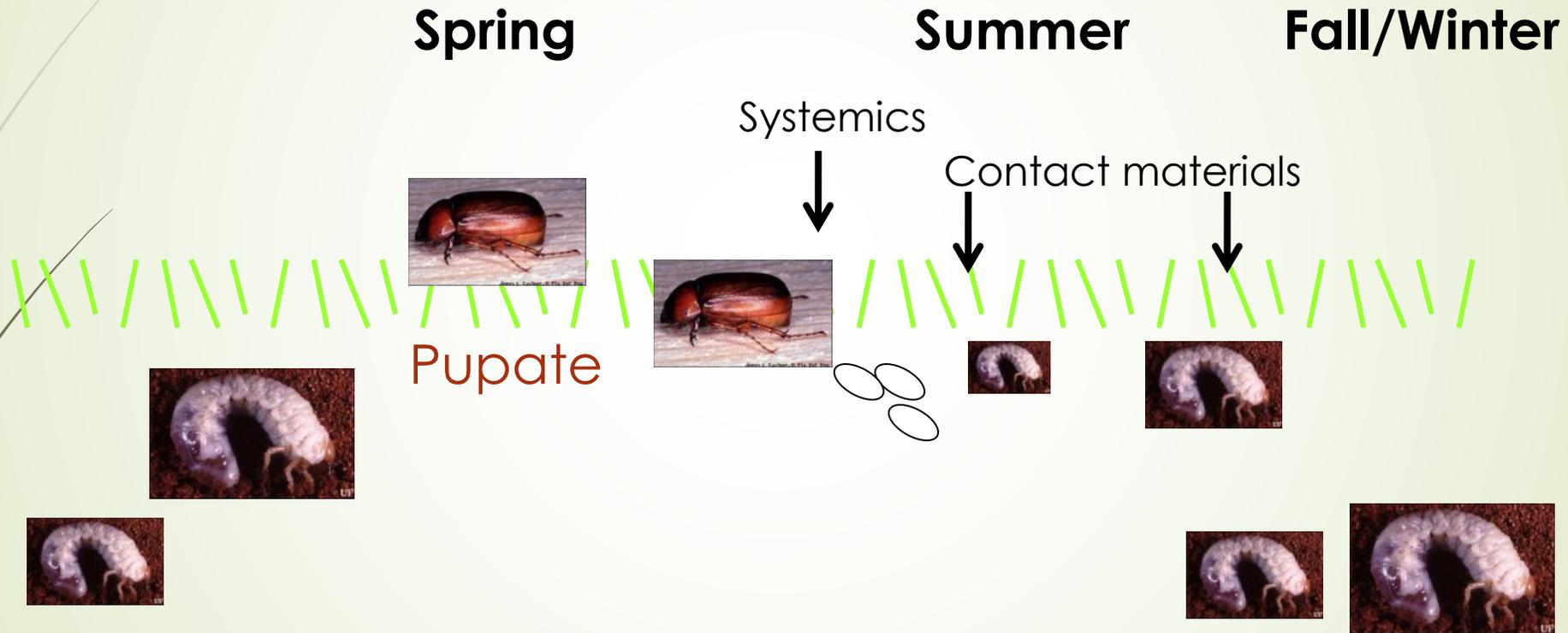
# White Grubs

- ▶ When mature, grubs range from 3/8 to 2 inches long
- ▶ C-shape when at rest
- ▶ 3-pairs of legs (obvious)
- ▶ Life cycle length
  - ▶ Several gens per yr – black turfgrass Ataenius
  - ▶ 1 gen per yr – masked chafer
  - ▶ 1 gen every 2-3 yr – May/June beetle
- ▶ Brown turf patches apparent in late summer
- ▶ Damaged turf feels “spongy”
- ▶ Turf pulls up easily from roots



# White Grubs

## 1-3-year life cycle



Can spend 1-2 years as  
2<sup>nd</sup> to 3<sup>rd</sup> instar larva

2<sup>nd</sup>-3<sup>rd</sup> instars move  
3" to 12" deep for winter

# White Grub Management

- ▶ Apply systemic insecticides in early summer before eggs hatch to allow adequate time for plant uptake
  - ▶ Acelepryn (chlorantraniliprole)
  - ▶ Arena (clothianidin)
  - ▶ Merit (imidacloprid)
- ▶ Apply contact insecticides in mid summer through early fall before the grubs move deeper in the soil zone to spend the winter
  - ▶ Broad-spectrum
    - ▶ Dylox (trichlorfon)
    - ▶ Sevin (carbaryl)
  - ▶ Selective, reduced-risk
    - ▶ Concern (azadirachtin)
    - ▶ Mach 2 (halofenozide)



# White Grub Management

**UTAH PESTS fact sheet** Utah State UNIVERSITY extension  
Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-104-07 March 2007

## White grubs

Erin Hodgson  
Extension Entomology Specialist

### What You Should Know

- White grubs are the larval stage of scarab beetles.
- Several different kinds of white grubs are found in Utah.
- White grubs prefer to feed on turfgrass roots.
- Healthy turfgrass can mask white grub feeding.

White grubs are the most widespread and destructive insect pest of turfgrass. White grubs are the immature form of scarab beetles. There are several established white grub species in Utah, including masked chafers, May/June beetles, and the black turfgrass Ataenius (Fig. 1). Most recently, Japanese beetles were detected in Orem, Utah, in 2006. These white grubs feed on turfgrass roots and are capable of causing significant economic damage. However, turfgrass can be successfully managed to prevent visible white grub damage with cultural control methods.

### Damage Symptoms

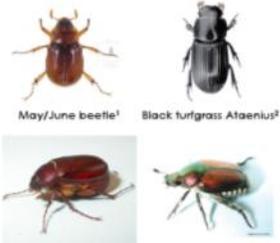
White grubs chew off the turfgrass roots near the soil surface or just below the thatch layer. Early signs of white grub damage include grass wilting or yellowing; however, the initial feeding injury often goes unnoticed until brown patches of turf start to develop. White grub feeding damage can be most apparent in the late summer when grubs are nearly fully developed. Small patches of dying turf can quickly join together if grub density is extremely high.

Grub-damaged turfgrass becomes loosely attached to the soil as the roots are consumed. Heavily damaged turfgrass can feel spongy and easily pull away from the soil surface. Drought conditions can make turfgrass injury appear worse.

### Description

Adult scarab beetles are identified by size and color pattern. Adults range in size from 3/16 - 1" and can be tan, brown or black (Fig. 1). Scarab beetles are stout, oval-shaped, and have clubbed antennae. Adults have a pair of hardened forewings called elytra and a pair of membranous hindwings for flight. The first pair of legs are modified to help burrow in the soil to lay eggs. Some adults are nocturnal and are only active at night.

Many of the white grub species established in Utah look similar to each other but vary in size. Mature grubs range in size from 3/8 - 2", in general, grubs are C-shaped and have three pair of thoracic legs (Fig. 2). The head capsule is dark, but the body is usually creamy white in color. White grub species identification is often not necessary because the cultural control practices are similar. The arrangement of hairs and spines on the posterior end of the grub, called the raster, is a distinguishing feature between species (Fig. 2).



May/June beetle<sup>1</sup> Black turfgrass Ataenius<sup>2</sup>  
Masked chafer<sup>3</sup> Japanese beetle<sup>4</sup>



Fig. 1. White grubs are actually scarab beetles. Common scarab beetle adults are shown here (NOT TO SCALE).  
Fig. 2. Common white grub body characters<sup>5</sup>

page 1

- Before applying insecticides, reduce thatch layer to  $\leq \frac{1}{2}$  in or aerate turf to increase penetration
- Apply  $\frac{1}{2}$  to  $\frac{3}{4}$  in water to move insecticides into the root zone
- Repeat irrigation every 4-5 days to continue chemical movement into the soil
- Long-lasting clean-up of white grubs often requires several years of treatment



# **Nuisance Bee Problems**

# Nuisance Bees: Sweat Bees

## Gardening and Landscaping Practices for Nesting Native Bees

James H. Cane, Research Entomologist, USDA ARS

### Do You Know?

- About 1,000 species of native bees reside in Utah; few of them are social.
- Some wild bees excel at pollinating Utah's tree fruits, raspberries, squashes, melons and cucumbers.
- Most of these native bees nest solitary underground.
- Others nest above ground in pithy or hollow dry stems, or in beetle burrows in sound dead wood.
- Simple landscaping and gardening practices can provide the essential nesting needs of many of our native bees.

Utah is home to about 1,000 named species of native bees, with several hundred species living in any one valley and adjacent montane habitats. Urbanization takes its toll on native bees, but many species can persist with a little help from gardeners and landscapers. Like birds, bees have two primary needs in life: Food (for a bee, pollen and nectar) to feed themselves and their offspring, and a suitable place to nest. An earlier fact sheet (*Gardening for Native Bees in Utah and Beyond*) offers a rich tapestry of garden flowers that provide bees with nectar and/or pollen. We know far less about accommodating the nesting needs of our native bees, but there are certain practices that favor or disfavor their nesting.



Fig. 1. Brilliant green Agapostemon bee emerging from a ground nest in a suburban lawn.



Fig. 2. Nest *Humulus* (soil heap) thrown up by the bee *Halictus rubicundus* nesting amid a decorative pebble mulch.



Fig. 3. Nest with cocoons of the bee *Hopifila sambuci* excavated in the pith of a dead sumac twig.



Fig. 4. Leafcutter bee cells in a mud nest built by dirt dauber wasps (photo courtesy of Diane G. Alston, Utah State University).

### GROUND NESTING

At least three-fourths of our native bee species nest in the ground. Among these, only some sweat bees and all bumblebees are social; the rest are solitary, meaning that each female has her own nest. Ground-nesters make a cylindrical nest tunnel. On flat ground, the entrance is typically centered in a small cone of excavated soil that remains until removed by rain or wind. Diverse insects also tunnel in soil, however, so to be certain that it is a bee's nest, the resident bee must be seen coming or going.

### Attractive Substrates

Nest sites of seemingly suitable soil can be created, but many years may pass before the site is discovered by a colonist bee. Moreover, nests of many bee species have never been seen or described. For these reasons, there is little experimental evidence to guide gardeners and landscapers in the creation of attractive soil substrates for bees. Recent research shows that at least one common ground-nesting bee, *Halictus rubicundus*, prefers to nest amid a sparse surface mulch of stream pebbles or cobbles rather than in mere bare ground (Figs. 2 & 5). Vertical banks of heavier soil, if at least a foot high, will attract nesting by some bees, especially various sweat bees. In nature, these bees like to nest in cut-banks of streams. Keeping some small patches of well-drained bare sunny soil surfaces can attract nesting too.



Fig. 5. A bare earth slope with nesting *Halictus rubicundus* bees was soddled in the fall to control erosion. Rather than sacrifice its nesting aggregation, however, a long strip of shallow rock pebble mulch was provided over bare soil. Several thousand emerging bees nested in the rock mulch strip the following spring.

### Landscaping Practices to Avoid

**Sprinkler irrigation.** Most advice about soil substrates for bees describes practices to avoid. In Utah, irrigation is ubiquitous. Bees seem able to perceive imminent rainstorms, and will race home ahead of the downpour. Consequently, when the rainstorm ends, females can dig

upwards and emerge from their nest to orient and continue foraging. In contrast, sprinkler irrigation offers no such warning cues to a foraging female. Females returning to an irrigated nest site are confronted with mud, altered visual landmarks, and obliterated nest entrances. Too often a poor female remains lost and ultimately abandons her nest altogether. Therefore, avoid overhead irrigation during daylight hours — water at night when mother bees are home, or use drip during the day.



Fig. 6. Landscaping fabric, which ground-nesting bees are unable to penetrate.

**Weed barrier fabric.** Impervious surfaces preclude ground-nesting. Pavement obviously is a problem, although surprisingly, some species readily use a gravel tire track or dirt road. Buried or surface weed-barrier fabric is just as impervious for a bee as pavement (Fig. 6). Use it judiciously, not ubiquitously. Weed barrier is impenetrable for all other burrowing invertebrates, too, notably earthworms. Soils beneath weed barriers become compacted and less permeable with time.

**Thick turf and mulch.** Bees generally will not nest in thick turf, presumably owing to its dense tangle of fine shallow roots. As with weed barrier, dense turf has its place. If you are already gardening for bees, then the gardens themselves can offer soil surfaces suitable for bee nesting, provided that they are not too thickly mulched. Thick mulches of bark, wood chips or loose gravel are likewise impenetrable for ground-nesting bees. This fact can be used to persuade bees to abandon an inconvenient nesting site by simply strewing the mulch in the autumn. The following year, bees can emerge through it unscathed, but will fly elsewhere rather than return to nest.

# Find this slideshow and others at [www.utahpests.usu.edu](http://www.utahpests.usu.edu)



for your attention...



Contact us



The screenshot shows the Utah Pests website homepage. At the top, it says 'EXTENSION Utah State University' and 'UTAH PESTS'. Below that is a navigation menu with links: 'UTAH PESTS Home', 'Utah Plant Pest Diagnostic Lab', 'Integrated Pest Management', 'School IPM', and 'Cooperative Agricultural Pest Survey'. The main content area features a search bar, a list of links (Home, Fact Sheets, Video Fact Sheets, Image Galleries, Slideshows, Utah Pests News, Quarterly Newsletter, Bees and Other, Pollinators, In the News, Contact Us), and four featured sections: 'Utah Plant Pest Diagnostic Lab' (Just \$7 gets your pest problem diagnosed or insect identified.), 'Integrated Pest Management' (Your source for fruit, vegetable, and landscape pest problems.), 'School Integrated Pest Management' (Teaching responsible pest management for a healthy learning environment.), and 'Cooperative Agriculture Pest Survey' (CAPS protects Utah agriculture through statewide monitoring of invasive pests.). On the right side, there is an 'In the News' section with three articles: 'Invasive Pests vs. Polar Vortex' (Nov 03, 2014), 'Customs Agent in Buffalo Intercepts Invasive Tortricid Moth' (Oct 17, 2014), and 'New Leafhopper Species' (Oct 07, 2014). At the bottom right, there is a paragraph about the Utah Pests group: 'UTAH PESTS' is a group of Extension entomologists and plant pathologists that helps to solve the thousands of plant pest issues that concern Utah citizens every day. The UPPDL identifies, the IPM Program educates, and the CAPS Program investigates. Open one of the websites to get answers!

Slideshows: Home Yard & Garden