

# Integrated Pest Management for Fruits and Vegetables: Insect and Mite Pests

Diane Alston, Entomologist

Master Gardener Entomology Lecture  
2014



**EXTENSION**  
**UtahStateUniversity**

# 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 Utah Pests website interface. At the top, there is a navigation bar with the text "EXTENSION Utah State University" on the left, "UTAH PESTS" in the center, and a logo on the right. 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".

On the left side, there is a "Google™ Search" box and a vertical menu with the following items: Home, Fact Sheets, Video Fact Sheets, Image Galleries, Slideshows, Utah Pests News, Quarterly Newsletter, Bees and Other Pollinators, In the News, and Contact Us. A Facebook icon is located below the menu.

The main content area features a large image of a green apple with a brown insect on it. Below this image are four promotional boxes:

- 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.
- 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 entries:

- 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)

Below the news section is a paragraph of 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: "Utah State University is an affirmative action/equal opportunity institution. © 2014 Utah State University Utah Pests"

# Fact Sheets

Arthropods and plant diseases:

232 fact sheets

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

**UTAH PESTS fact sheet**  
 Utah State University Extension  
 Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-19-07 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.

**Social Wasp General Description**

Social wasps, including yellowjackets, hornets and paper wasps, are common stinging insects in Utah (Fig. 1, 2). The wasps are related to ants and bees, which are also capable of stinging; however, yellowjackets are the most likely to sting. Less than 1% of people are allergic to wasp or bee stings; however, some people are fatally stung every year. Nearly 80% of all serious venom-related deaths occur within one hour of the sting. Most people will only experience a mild local reaction with redness, pain, swelling and itching at the sting site. If symptoms are more serious, a physician should be consulted. Some people may develop venom sensitivity after repeated stinging episodes over a short or long period of time.



Fig. 1. Yellowjacket!



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

**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.

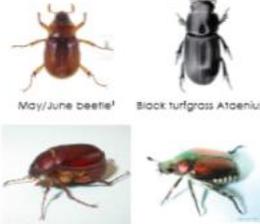
**Damage Symptoms**

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**

Adult scarab beetles are identified by size of pattern. Adults range in size from 2/8 - 7/8 of an inch, brown or black (Fig. 1). Scarab beetles are oval-shaped, and have clubbed antennae, a pair of hardened forewings called elytra, and a pair of membranous hindwings for flight. The feet are modified to help burrow in the soil to lay eggs. Adults are nocturnal and are only active at night.

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



May/June beetle!  
 Black turfgrass Ateanius!  
 Masked chafers!  
 Japanese beetle!

Fig. 1. White grubs are actually scarab beetles. Common scarab beetle adults are shown here (NOT TO SCALE).

**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

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Fig. 2. Common white grub body characters!  
 page 1

**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. 1. European earwig adult and nymphs.

**FEEDING HABITS AND INJURY**

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

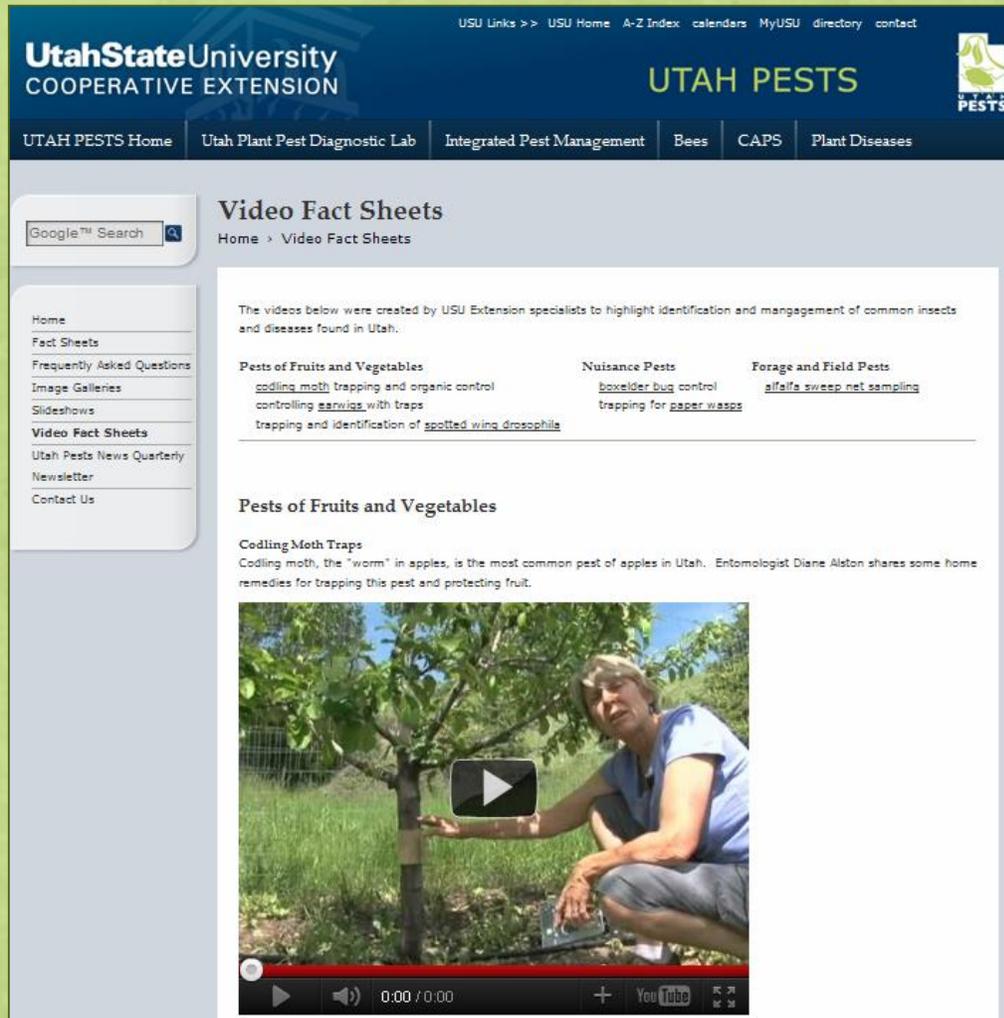
**LIFE HISTORY**

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.

# 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

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Frequently Asked Questions

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Slideshows

Video Fact Sheets

Utah Pests News Quarterly Newsletter

Contact Us

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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. VII, Fall 2013

### Bacterial diseases of tomato

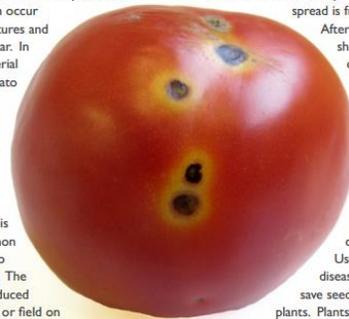
Infections on tomato fruits by bacterial pathogens often occur before fruit matures and symptoms appear. In Utah, two bacterial diseases of tomato have been found in the last two years: bacterial speck and bacterial canker.

Bacterial speck is the most common bacterial tomato disease in Utah. The disease is introduced into the garden or field on contaminated seed or infected transplants. It is caused by *Pseudomonas syringae* pathovar *tomato*. Infected ripe tomatoes have characteristic black spots with yellow halos. Fruit infections occur early in the season, but symptoms are not visible until fruit matures. Foliar symptoms are evident right after infection, consisting of brown spots that may also be surrounded by a yellow halo. If transplants show brown spots on leaves they should not be purchased or planted.

Transmission of bacterial speck occurs through contaminated seed, splashing water, and pruning tools. Plants grown from infected seed will develop brown spots on leaves soon after transplanting. Rain or irrigation water spreads bacteria, causing new infections on nearby plants. The bacteria can also spread from last year's crop residue, where it can survive for up to six months, or from asymptomatic weeds

in the Solanaceae family. A final mode of spread is from pruning tools. After cutting infected shoots, bacteria can be left behind on the blades, and may be transferred to healthy plants in subsequent cuts.

Management of bacterial speck is primarily through cultural practices. Use only certified disease-free seed, or save seeds from healthy plants. Plants with suspect symptoms should be submitted to the Utah Plant Pest Diagnostic Lab, and plants with positive diagnoses should be removed and destroyed



Bacterial speck causes black spotting with yellow halos.



On foliage, bacterial speck symptoms may be visible at any time of the season.

continued on next page

#### What's Inside

Challenges of Growing Heirloom Tomatoes

Preventing Invasive Pests

Kestrels on Farmlands

Pest Monitoring in Schools

Barriers and Exclusion for Arthropods

Self Defense in Plants

#### News Highlights

##### UPDATE ON INVASIVE INSECTS

The Cooperative Agricultural Pest Survey program reports that a few brown marmorated stink bugs have been found in Salt Lake County traps, and a single bug was found in Utah County in September, the first for that county. Spotted wing drosophila is just now showing up in traps in Davis County, in much lower numbers than in nearby states. Also in September, the emerald ash borer, a pest that has killed millions of ash trees in the eastern U.S., was identified in Boulder, Colorado.

#### NEW FACT SHEETS

Chinch Bugs  
Pest Monitoring Calendars  
for fruit trees

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

EXTENSION  
Utah State University

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UTAH PESTS  
Integrated Pest Management

UTAH PESTS

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

Google™ Search

Plant Pests by Crop  
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  
Contact Us

Spring Advisories are Here!

Small Fruits & Vegetables IPM Advisory

Landscape IPM Advisory

Tree Fruit IPM Advisory

Turf IPM Advisory

Subscribe now for the Utah IPM Pest Advisories  
Pest management info sent to your email 1 2 3

Subscribe to IPM Pest advisories  
HERE

Integrated Pest Management (IPM):  
"a comprehensive approach to pest control that uses a combined means to reduce the status of pests to tolerable levels while maintaining a quality environment."

In the News  
Pest Control with Stink Bug Saliva  
Mar 03, 2014  
Moths Trapped with Plant Pheromone  
Feb 28, 2014  
Adapting to Climate Change  
Jan 21, 2014

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

Free subscription  
Timely info on pest activity

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

Lots of images!  
IPM recommendations  
Effective pesticides

# Pest Diagnostics

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**Utah State University**  
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**UTAH PESTS**  
Utah Plant Pest Diagnostic Lab



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
- \$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

**Utah's Top 20 Arachnids**



1 2 3

**Submit a Sample**



**Fact Sheets**



**Events**

- Sep 18, 2011  
**What Works! 2011**
- Sep 20, 2011  
**Planning for a Low-Cost Holiday Season**
- More Events...

Utah Plant Pest Diagnostic Lab  
[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, with a small logo to its right. 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 in the top left.
- Left Sidebar:** A vertical 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". A Facebook icon is at the bottom of this sidebar.
- Central Content Area:**
  - Image:** A large image of several dark insects on a red apple.
  - Utah Plant Pest Diagnostic Lab:** A blue box with a microscope icon. Text: "Just \$7 gets your pest problem diagnosed or insect identified."
  - Integrated Pest Management:** A green box with a leaf icon. Text: "Your source for fruit, vegetable, and landscape pest problems."
  - School Integrated Pest Management:** A yellow-green box with a book icon. Text: "Teaching responsible pest management for a healthy learning environment."
  - Cooperative Agriculture Pest Survey:** A brown box with a clipboard icon. Text: "CAPS protects Utah agriculture through statewide monitoring of invasive pests."
- Right Sidebar:**
  - In the News:** A section with three news items:
    - "2014 Farm Bill, No limit on Forestry Pesticides?" dated Mar 03, 2014.
    - "Stink bug saliva proteins could lead to new control methods" dated Mar 03, 2014.
    - "Example of Invasive Bumblebee" dated Jan 27, 2014.
  - About Utah Pests:** A text block stating: "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!"

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Over 100  
slideshows posted

This one posted  
under  
"Home Yard and  
Garden"

# Diagnosis of Insects and Mites & Plant Injury

Plant Injury Symptoms

Common Insects & Mites

Structure/Morphology

# Insect Diagnosis



**Insect is present**  
(forest tent caterpillar  
on big tooth maple)



**Injury is present**  
(cankerworm on Gamble oak)

Friend or Foe?  
Which life stage is present?



**What type of injury?**  
**Is it insect injury or something else?**  
(Ips bark beetle-killed spruce trees)

# Insect Feeding Types

Chewing



Piercing-Sucking



Boring

Gall-Forming



Diagnosis



# Recognizing Common Insects

## Beetles

Hard wing covering  
Most diverse group  
Chewing mouthparts



Larvae – grub-like  
Chewing mouthparts

# Beetle Injury



Leaves: holes, skeletonizing, notching



Trunks:  
tunnels,  
girdling



Roots/Crowns:  
tunnels, chew off fine  
roots

Photo Courtesy: Shawn Steffan,  
Utah State University Extension

# Recognizing Common Insects

## Moths

Colored scales on wings  
Adults feed on nectar  
Good flyers  
Most are active at night



Corn Earworm, *Helioverpa zea*, adult moth.



Larvae – caterpillars  
Chewing mouthparts

# Caterpillar Injury



Tunnels in limbs and trunks



Holes chewed in leaves



Tunnels and holes in fruits

# Recognizing Common Insects

## Hemiptera - True Bugs

Half wing: front is leathery, back is membranous  
Inverted triangle on back  
Piercing sucking mouthparts

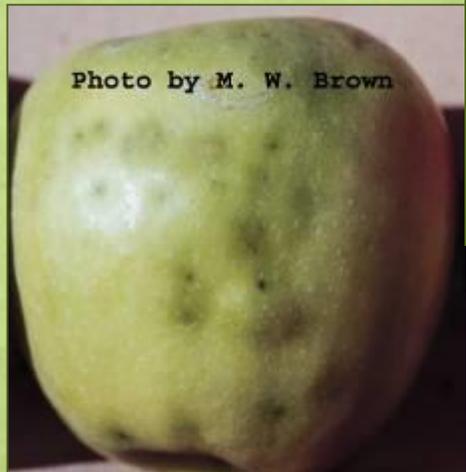


Nymphs – mini adults  
without wings

# True Bug Injury



Pitting and bumps:  
Cells killed in older  
fruits



Cat facing:  
Cells killed in young  
fruit



Xylem disruption or  
Toxin injected:  
Plant stunting and  
death

# Recognizing Common Insects

## More Sucking Bugs: Aphid, Scale, Whitefly, Mealybug, Leafhopper

Small

Soft bodied

Wax or covering

Many produce honeydew

Piercing sucking mouthparts



Many feed in phloem  
Nymphs - variable



# Aphid, Scale, Whitefly, and Mealybug, Leafhopper Injury

Leaf curling



Limb dieback



Leafhopper burn:  
Speckling/stippling



Leaf spots  
from dead  
cells

# Web-Spinning Spider Mites

## Rust Mites



# Developing an IPM Program for your Garden

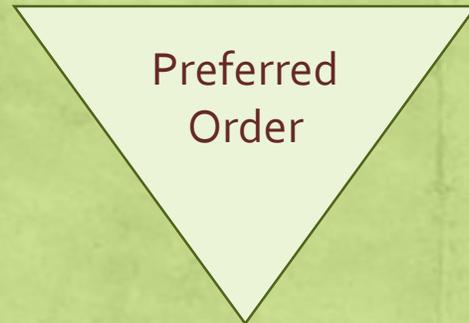
IPM

Sustainable

Organic

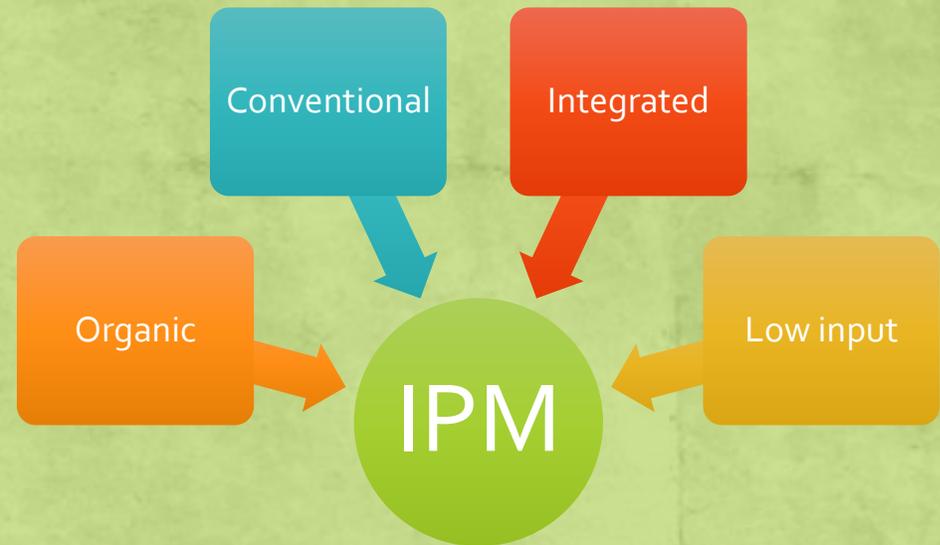
# IPM: Integrated Pest Management

- 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



# IPM Approach

- Comprehensive, practical
- Sustainable inputs
- Knowledge-based
  - Information-intensive



# 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



# 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



# 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

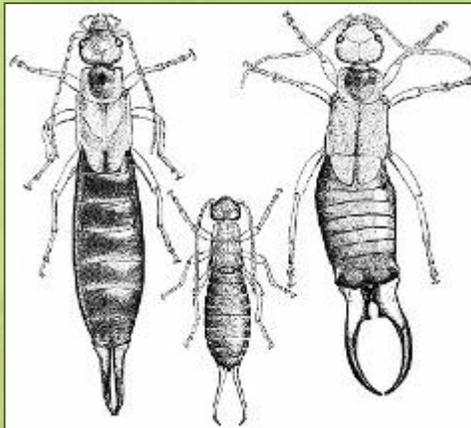
- Traps
  - Yellow jacket wasps, slugs, spiders
- Sticky bands
  - Trees and shrubs
- Row covers
- Diatomaceous earth



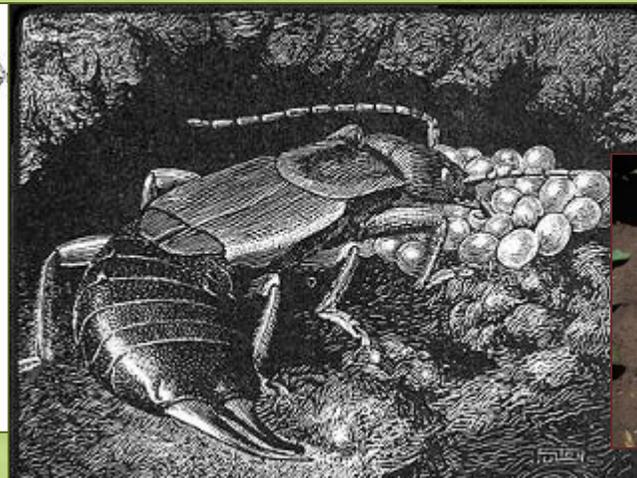
# Mechanical Control: Traps & Exclusion for Earwigs

- Avoid overuse of mulch and damp debris (earwigs hide during the day)
- Traps: fat-based baits, protected refugia
- Exclusion: Tanglefoot on base of trunks, stems

European earwig  
male (right)



Females brood their young



Sticky band



Refuge trap



Trap with  
bacon grease

# Mechanical Control: Exclusion of Cabbage Worms

- Caterpillars chew large holes in leaves; produce abundant frass (excrement)
- Exclusion: Row cover fabric – cover plants to prevent egg-laying



Floating  
row cover



Imported  
cabbage  
butterfly



Cabbage  
looper



# 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*



Parasitic wasps & flies



Predaceous true bugs & beetles



Lacewing

Common aphid predators



Syrphid Fly



Lady Beetle



Predaceous mites

# Misconceptions About Biological Control in the Home Garden

- Releasing insects is the best method
  - Lady beetles (or lady bugs)
  - Praying mantis
- Predatory insects will stay in your garden after release
- Other practices/activities don't matter



# Beneficial Insects Need a Diverse Diet & Shelter

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

Flowering plants  
Herbs  
Wildflowers

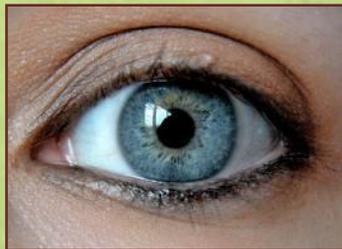


# Biological Control: Enhance Biodiversity

- Spatial diversity across the landscape
- Temporal diversity, throughout the season and from year to year
- Genetic diversity
- 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
fact sheet

Utah State University  
COOPERATIVE EXTENSION

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## Gardening for Native Bees in Utah and Beyond

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**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 (*Lavandula*: Lamiaceae).<sup>1</sup>



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

### 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     |                             |

# 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 (14 d), carbaryl (10-14 d), spinosad (7 d), malathion (7 d), Bt (3-5 d), CM virus (CydX; 7 d)
- **Sanitation:** pick up dropped fruit



Codling moth  
egg & 1<sup>st</sup> instar  
larva

# 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**



# Western Cherry Fruit Fly

- Larvae feed in sweet & tart cherries; female flies lay eggs in ripening fruit; fruit doesn't become soft enough for egg-laying until it turns salmon colored
- **Cultural controls:** Landscape fabric or barrier under tree canopy
- **Chemical control:** spinosad (7 d), malathion (5 d), carbaryl (7 d), pyrethrin (3 to 5 d)



# Fruit-Eating Wasps: Paper wasps



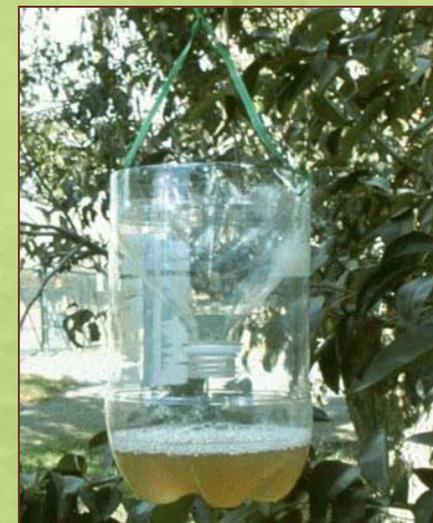
**European paper wasp (fruit-eater):**  
Thin waist, more black than yellow,  
Upside down umbrella-shaped nests



**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)



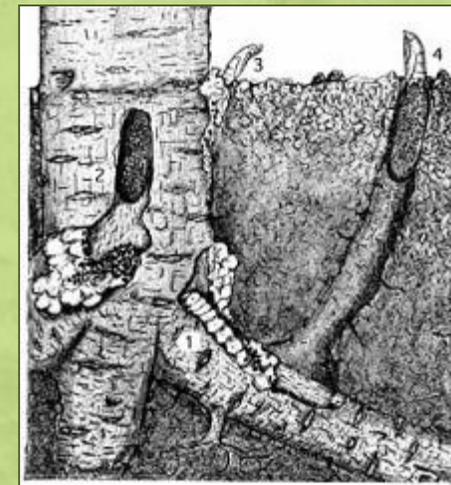
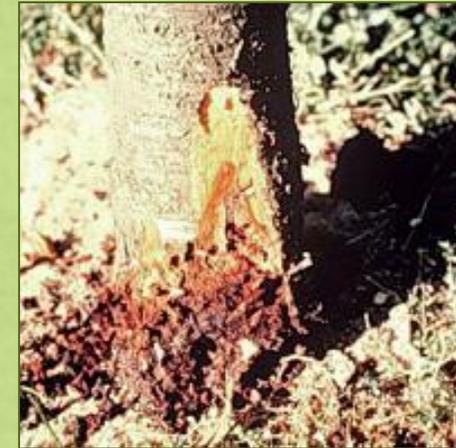
# San Jose Scale

- Scales encrust limbs; can kill limbs after several years of feeding; scales and feeding spots on fruit
- **Controls:** Dormant oil at green tip or pink
- Use sticky tape in May/June to time a spray for “crawlers”
- Horticultural oil, insecticidal soap, malathion, gamma-cyhalothrin, or pyrethrin



# Peachtree (Crown) Borer

- Female clear-winged moths lay eggs on lower trunk or in cracks in soil near the base; larvae bore into the cambium in lower trunk; trees may be girdled & die; adults begin activity in late June to early July in northern Utah
- **Control:** Trunk spray with carbaryl, permethrin, or gamma-cyhalothrin during first week of July; repeat every 2-3 weeks through August



# There are many other reasons that trees sap or bleed



"Black Knot" fungus canker



Winter injury + cytospora  
fungus canker

# Raspberry Horntail

- Stem-boring wasp
- Cane tips wilt; larvae tunnel within pith
- Prune infested canes
  - Floricane-bearing cultivars (summer-bearers): in early spring, prune out & destroy canes with hole in pith
  - Primocane-bearing cultivars (ever-bearers/fall-bearers): in early spring, prune out & remove/destroy infested canes
  - Summer pruning: remove tips of infested canes
- Parasitic wasps attack horntail larvae
- Chemicals – treat in early to mid May: acetamiprid, carbaryl, malathion, or pyrethrin



# VEGETABLE AND HERB INSECT PESTS



# 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



# Cabbage Worms

- Caterpillars chew large holes in leaves; produce abundant frass (excrement)
- Bt (Dipel, Thuricide), spinosad (Success, Entrust)– very effective
- Row cover fabric – cover plants to prevent egg-laying



Row cover

Cabbage butterfly (above)  
and cabbage looper (below)

# Leafminers in Leafy Veggies

- Adults – Small flies
- Larvae – White to cream maggots
- Winding trails on leaves, white blotches
- Scout regularly, >1 mine/leaf
- Natural enemies (Paper wasp)
- Row covers
- Spinosad (Success, Entrust) insecticide



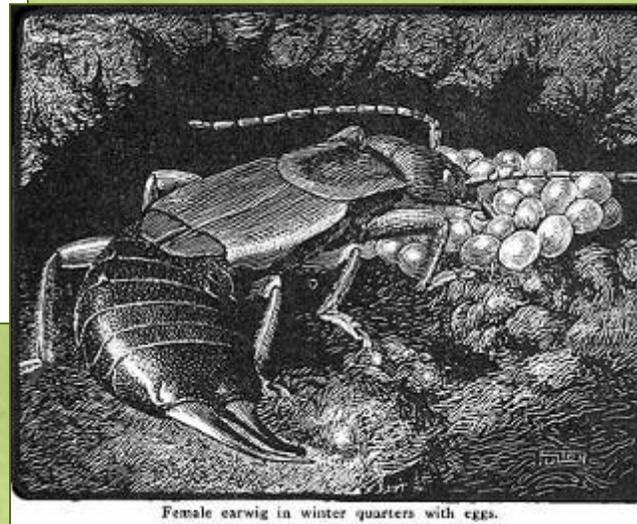
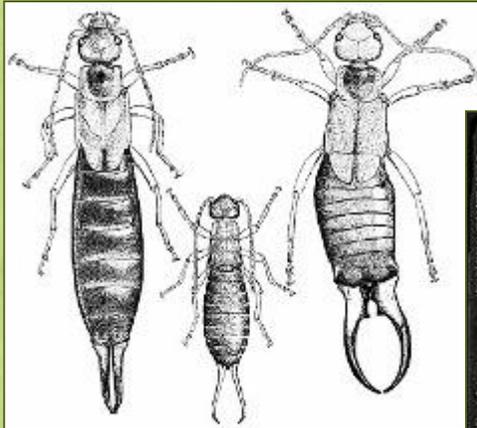
# Squash Bug

- 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



# European Earwig

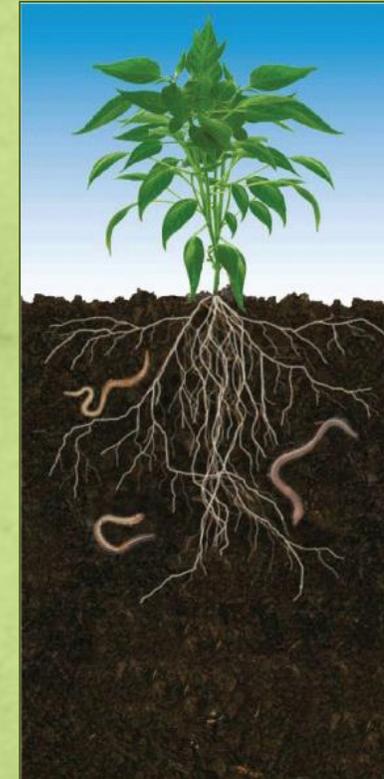
- **Cultural & mechanical controls:** avoid overuse of mulch and damp debris where they hide during the day
  - Traps: attractive odor/fat-based baits; place and remove rolled newspaper or cardboard; protected refugia
  - Exclusion: Tanglefoot on base of trunks, stems



Trap with  
bacon grease

# 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

# Invasive Insects

Two new pests in Utah: spotted wing drosophila & brown marmorated stink bug

Apple maggot – old, native pest becoming a problem?

# Spotted Wing Drosophila (*Drosophila suzukii*)

- ❖ Native to southeast Asia
- ❖ Established in Hawaii in 1980s
- ❖ Found in California in 2008
- ❖ First detected in Utah in 2010
- ❖ Threat to marketable fruit



Photo: Bev Gerdeman

# Fruits Hosts



# Identification of SWD



Female



Photo: Sheila Fitzpatrick

Male

SWD

Not SWD

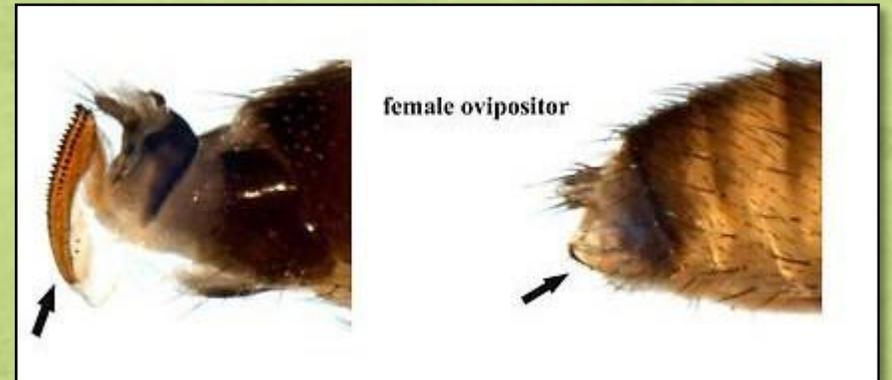


Photo: Martin Hauser

# Crop Damage



Oviposition scars

Small hair-like filaments



Secondary infections

Softened or collapsed fruit



Small larvae or pupae



# Brown Marmorated Stink Bug

(*Halyomorpha halys*)

- ❖ Native to eastern Asia
- ❖ Found in the eastern U.S. in late 1990s
- ❖ First detected in Utah in 2012
- ❖ Feeds on a broad range of plants
- ❖ Can be a major nuisance pest



Photo: Steve Ruark

# Host Damage



Photo: Tracy Leskey



Photo: Doug Pfeiffer



Photo: Nik Wiman

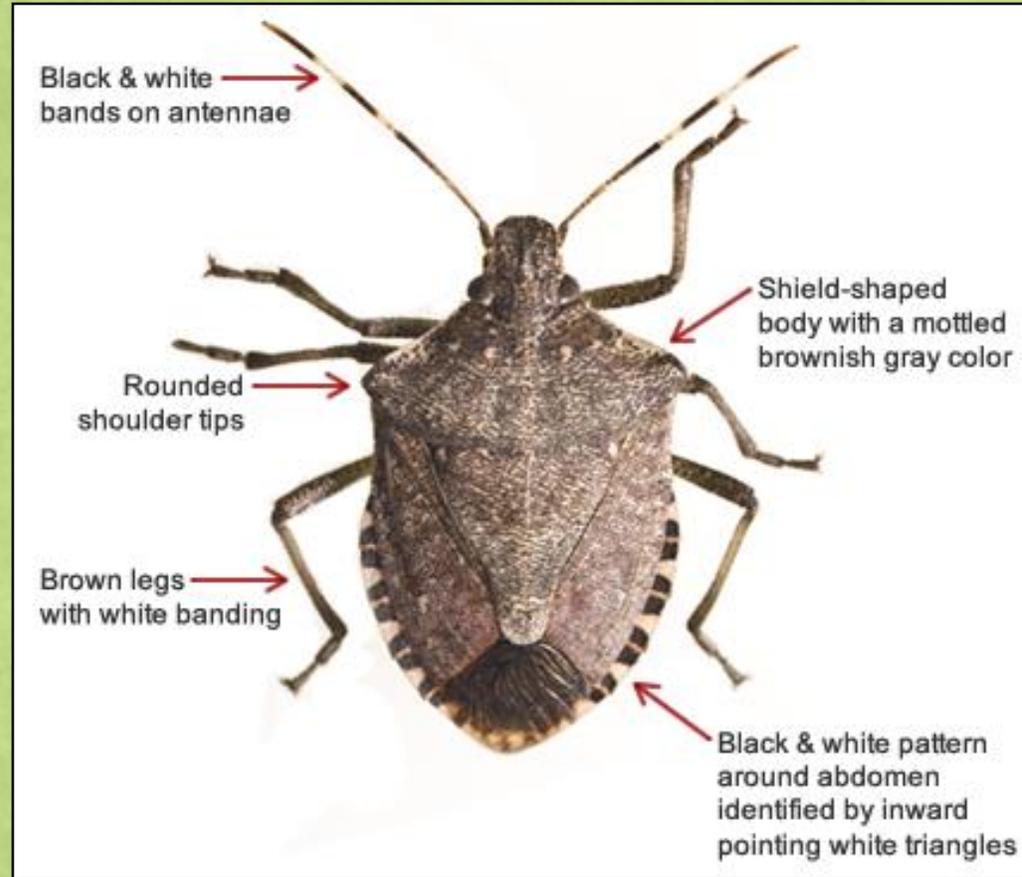


Photo: Steve Jacobs

# Identification of BMSB



Photos: David R Lance



# BMSB Lookalikes



Photo: Steven Valley

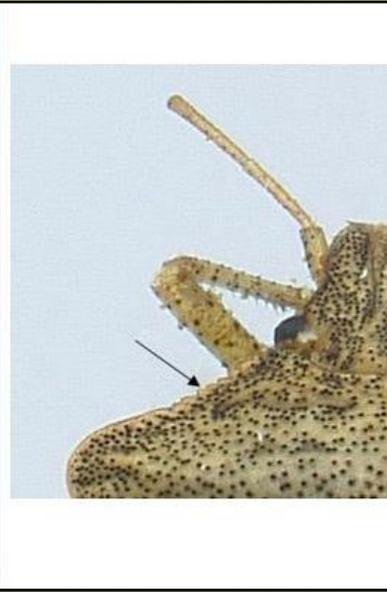
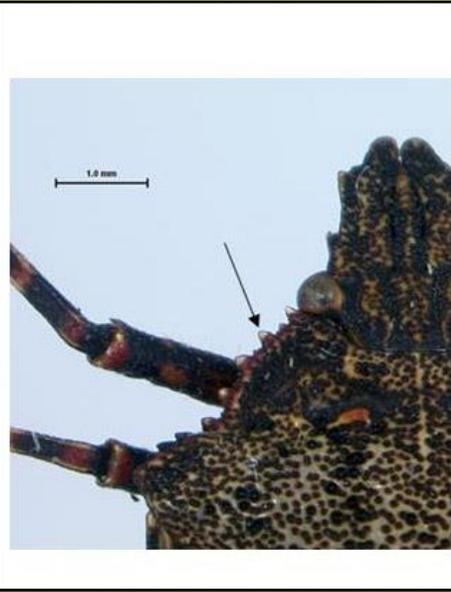


Photo: Antonia Guidotti



# Apple Maggot in Utah - 2013

- Home yard plum fruits
  - Apple injury, but no larvae found
- Quarantine pest (fruit export)
- Probably native to Utah (river hawthorn)



Apple maggot adult fly  
on domestic plum fruit,  
Salt Lake City, 2013

White spot on back  
Red eyes

AM larva inside  
plum fruit

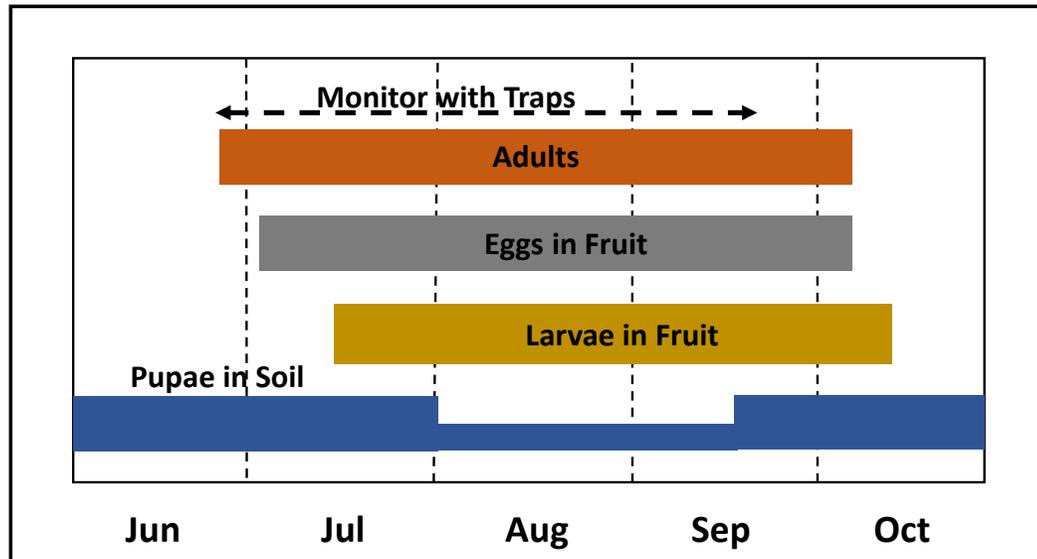


Breakdown of plum flesh  
from AM feeding



# Apple Maggot Life History

## Apple Maggot Life History in Utah



Broad host range: hawthorn, apple, crabapple, pear, plum, cherry, apricot, wild rose, mountain ash, cotoneaster, firethorn (*Pyracantha*)



Photo by Ty Harrison

Native hawthorn shrub: River hawthorn

# New Fact Sheet

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

- Educate home gardeners
  - Master Gardener Program
  - IPM Tree Fruit Advisory
  - Online resources
  - County Extension Offices
- Prevent establishment of AM in commercial orchards
  - Sanitation
    - Remove fruit post-harvest
    - Remove nearby hawthorn stands
    - Remove abandoned orchards



U T A H  
PESTS fact sheet

EXTENSION  
Utah State University

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## Apple Maggot

[*Rhagoletis pomonella* (Walsh)]

Diane Alston, Entomologist, and Marion Murray, IPM Project Leader

### Do You Know?

- The fruit fly, apple maggot, primarily infests native hawthorn in Utah, but recently has been found in home garden plums.
- Apple maggot is a quarantine pest; its presence can restrict export markets for commercial fruit.
- Damage occurs from egg-laying punctures and the larva (maggot) developing inside the fruit.
- The larva drops to the ground to spend the winter as a pupa in the soil.
- Insecticides are currently the most effective control method.
- Sanitation, ground barriers under trees (fabric, mulch), and predation by chickens and other fowl can reduce infestations.



**Fig. 1.** Apple maggot adult on plum fruit. Note the F-shaped banding pattern on the wings!



**Fig. 2.** Apple maggot larva in a plum fruit. Note the tapered head and dark mouth hooks.

Apple maggot (Order Diptera, Family Tephritidae; Fig. 1) is not currently a pest of commercial orchards in Utah, but it is regulated as a quarantine insect in the state. If it becomes established in commercial fruit production areas, its presence can inflict substantial economic harm through loss of export markets. Infestations cause fruit damage, may increase insecticide use, and can result in subsequent disruption of integrated pest management programs.

This fruit fly is primarily a pest of apples in northeastern and north central North America, where it historically fed on fruit of wild hawthorn. It was first detected in the western U.S. in Oregon in 1979, and has since been found in numerous locations in the Northwest. It was first detected in Utah infesting cherry orchards in Mapleton (Utah County) in 1983. An extensive survey conducted in Utah in 1985 found that it was widely distributed in northern and west central areas of the state where it was most likely feeding on fruits of river hawthorn (*Crataegus rivularis* Nutt.) and unmanaged cherry; implicating that it is native to the state.

In 2013, the Utah Plant Pest Diagnostic Laboratory diagnosed apple maggot in plum fruits (Fig. 2) from several home gardens in Salt Lake County. Cultivated fruit is more likely to be infested if native hawthorn stands are nearby which may support large fruit fly populations, and if fruit is not treated with insecticides. Adult trapping and use of a degree-day model (based on temperature) can be used to optimally time treatments for apple maggot.

### HOSTS

apple and crabapple (*Malus* spp., common cultivated hosts in eastern U.S.), hawthorn (*Crataegus* spp., native host), *Prunus* spp. (plum, cherry, apricot), pear (*Pyrus* spp.), wild rose (*Rosa* spp.), mountain ash (*Sorbus* spp.), cotoneaster (*Cotoneaster* spp.), and firethorn (*Pyracantha* spp.)

Tree  
Fruit  
Insects