

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



Dr. Ricardo Ramirez
Entomologist



Dr. Claudia Nischwitz
Plant Pathologist



Marion Murray
Plant Pathologist
IPM Project Leader



Ryan Davis
Arthropod Diagnostician
Utah Plant Pest Diagnostic Lab



Dr. Lori Spears
Entomologist
Invasive Pest Survey



Dr. Diane Alston
Entomologist
IPM Coordinator

Utah Pests Online Resources

www.utahpests.usu.edu

One-stop shopping
for pest management
information

The screenshot shows the homepage of the Utah Pests website. The header features the Utah State University Extension logo and the text "UTAH PESTS" in large green letters. A navigation bar includes links to "UTAH PESTS Home", "Utah Plant Pest Diagnostic Lab", "Integrated Pest Management", "School IPM", and "Cooperative Agricultural Pest Survey". A search bar with "Google™ Search" is located on the left. Below the search bar is 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, and Contact Us. The main content area is divided into four colored boxes: "Utah Plant Pest Diagnostic Lab" (blue) with a microscope icon, "Integrated Pest Management" (green) with a leaf icon, "School Integrated Pest Management" (yellow) with a book icon, and "Cooperative Agriculture Pest Survey" (brown) with a folder icon. Each box contains a brief description of its services. On the right side, there is a "In the News" section with three articles: "2014 Farm Bill, No limit on Forestry Pesticides?" (Mar 03, 2014), "Stink bug saliva proteins could lead to new control methods" (Mar 03, 2014), and "Example of Invasive Bumblebee" (Jan 27, 2014). At the bottom, a footer states: "Utah State University is an affirmative action/equal opportunity institution. © 2014 Utah State University Utah Pests".

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

UTAH PESTS

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

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Utah Plant Pest Diagnostic Lab
Just \$7 gets your pest problem diagnosed or insect identified.

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Your source for fruit, vegetable, and landscape pest problems.

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CAPS protects Utah agriculture through statewide monitoring of invasive pests.

In the News
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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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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
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.

Social wasps, including yellowjackets, hornets and paper wasps, are common stinging insects in Utah (Figs. 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.¹



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

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 forms 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. 3).

UTAH PESTS fact sheet
Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-10-07

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.

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 Atheta (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.



May/June beetle¹ Black turfgrass Atheta²
Masked chafers³ Japanese beetle⁴

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.

Grub-damaged turfgrass becomes loose to the soil as the roots are consumed. Heavily damaged turfgrass can feel spongy and easily pull out soil surface. Drought conditions can make it appear worse.

Description

Adult scarab beetles are identified by size and pattern. Adults range in size from 3/16 - 1 1/2" or tan, 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 (or 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 skin is dark, but the body is usually creamy. White grub species identification is often not possible because the cultural control practices are an arrangement of hairs and spines on the posterior of the grub, called the raster, is a distinguishing feature between species (Fig. 2).



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

Fig. 2. Common white grub body characters¹

page 1

UTAH PESTS fact sheet
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 split pit of peach hull, injury to new growth of ornamental tree, and injury to a flower.¹

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

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

Video Fact Sheets

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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
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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.



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

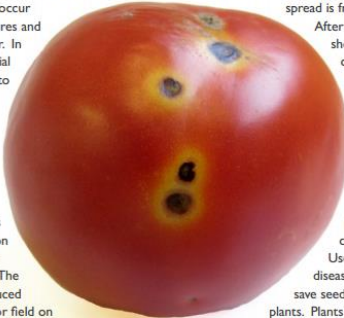
Infections on tomato fruits by bacterial pathogens often occur before fruit matures and symptoms appear. In Utah, two bacterial diseases of tomato have been found in the last two years: bacterial speck and bacterial canker.

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

Free, quarterly newsletter
Current pest topics
New research results
Useful resources
Sign up to subscribe at
www.utahpests.usu.edu

Pest Advisories (integrated pest management)

The screenshot shows the homepage of the Utah State University Extension UTAH PESTS Integrated Pest Management website. The header includes the Utah State University logo, navigation links (USU Links >> USU Home, A-Z Index, calendars, MyUSU, directory, contact), and the UTAH PESTS logo. A secondary navigation bar lists: UTAH PESTS Home, Utah Plant Pest Diagnostic Lab, Integrated Pest Management (highlighted), School IPM, and Cooperative Agriculture Pest Survey. The main content area features a Google search bar, a sidebar with '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), and a central 'Spring Advisories are Here!' section. This central section includes four advisory tiles: 'Small Fruits & Vegetables IPM Advisory' (with images of tomatoes and peppers), 'Landscape IPM Advisory' (with a green leaf), 'Tree Fruit IPM Advisory' (with a green apple), and 'Turf IPM Advisory' (with grass). Below these is a subscription prompt: 'Subscribe now for the Utah IPM Pest Advisories. Pest management info sent to your email' with buttons 1, 2, and 3. To the right is an 'In the News' section with three articles: 'Pest Control with Stink Bug Saliva' (Mar 03, 2014), 'Moths Trapped with Plant Pheromone' (Feb 28, 2014), and 'Adapting to Climate Change' (Jan 21, 2014). At the bottom left is a Facebook icon. The footer states: 'Utah State University is an affirmative action/equal opportunity institution. © 2014 Utah State University Integrated Pest Management'.

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 Plant Pest Diagnostic Lab

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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

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

Submit a Sample

Fact Sheets



Utah Plant Pest Diagnostic Lab
www.uppdl.usu.edu

Look for this slideshow and others at utahpests.usu.edu

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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



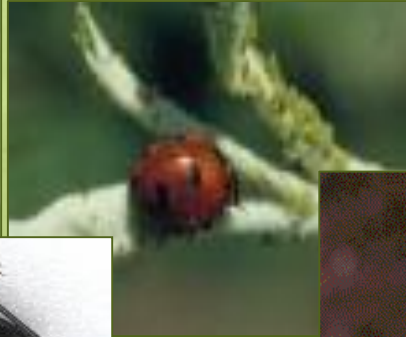
Diagnosis



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

Recognizing Common Insects

Moths

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



Corn Earworm, *Helicoverpa 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

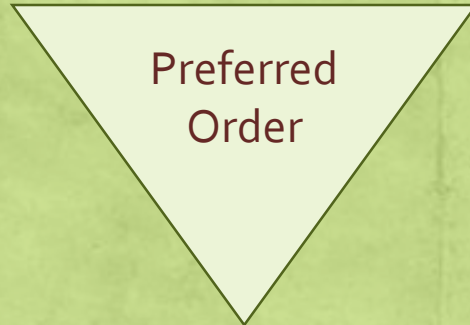
IPM

Sustainable

Organic

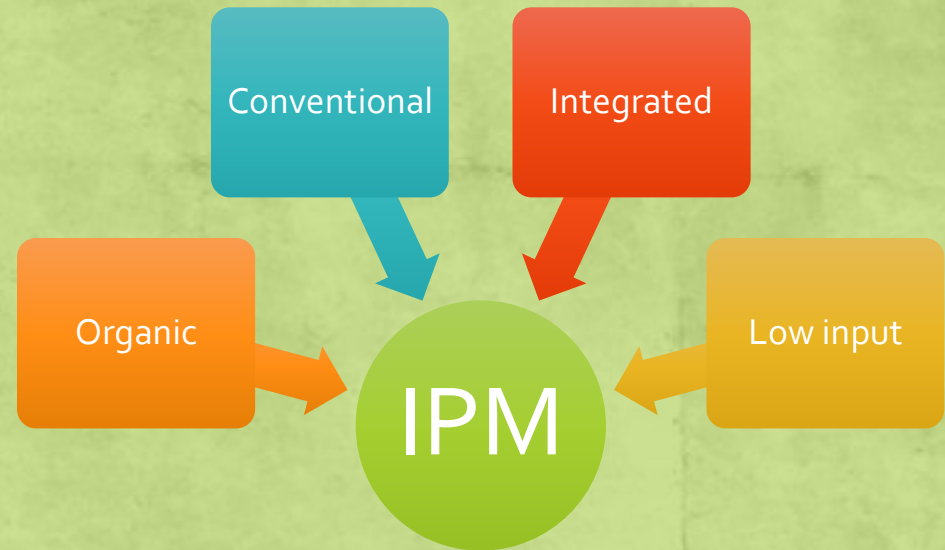
IPM: Integrated Pest Management

- 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



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

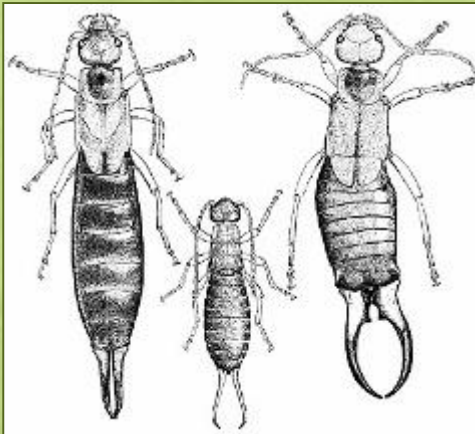
- Traps
 - Yellow jacket wasps, slugs,
 - spiders
- Sticky bands
 - Trees and shrubs
- Row covers
- Diatomaceous earth



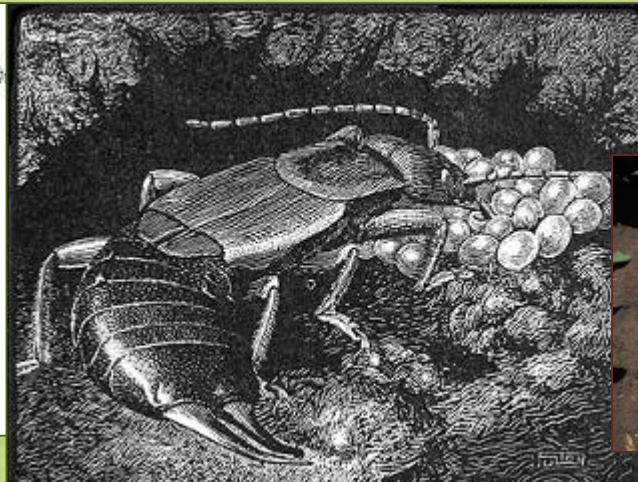
Mechanical Control: Traps & Exclusion for Earwigs

- 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

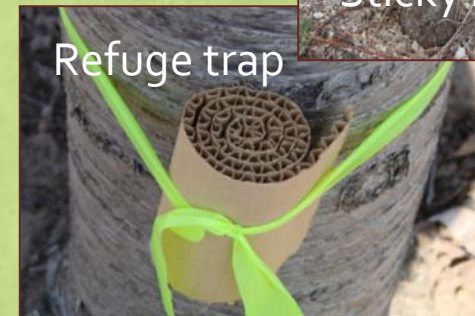
European earwig
male (right)



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

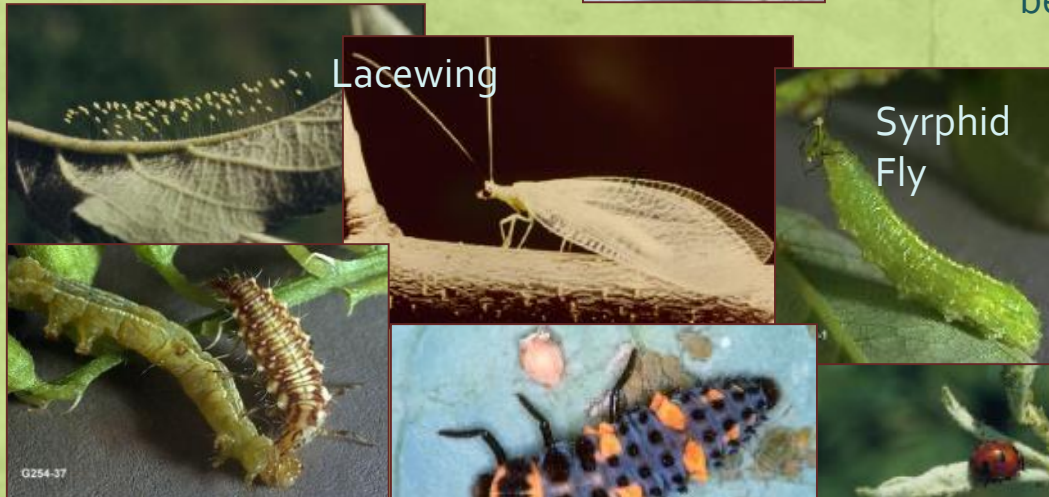
Cast of Common Characters



Parasitic
wasps & flies



Predaceous
true bugs &
beetles



Lacewing

Syrphid
Fly



Common aphid
predators



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 — 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 Kevin
Logan, UT

Do You Know?

- 900 species of native bees reside in Utah.
- Some wild bees are super 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. Carder bee (*Anthidium*) foraging at lavender (*Lavendula*: Lamiaceae).¹

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 honey-bee 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; frecklecracker penstemon (*P. eatonii*), center; and blue flax (*Linum perenne*), background, combine to make a pleasing design.¹

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	see Fig. 10
<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
- 1st 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 & 1st 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; 2nd & 3rd 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



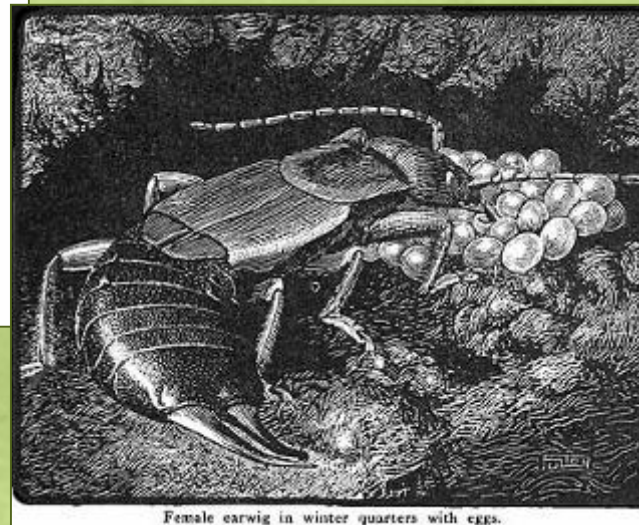
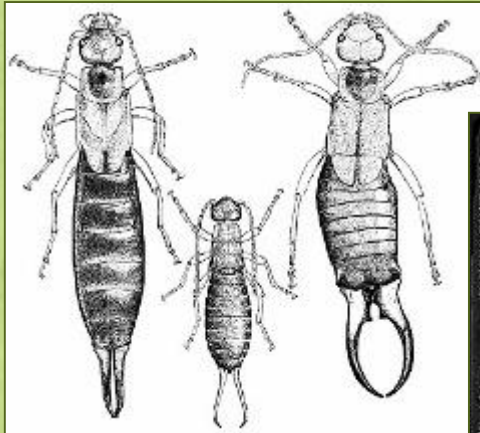
Squash Bug

- 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

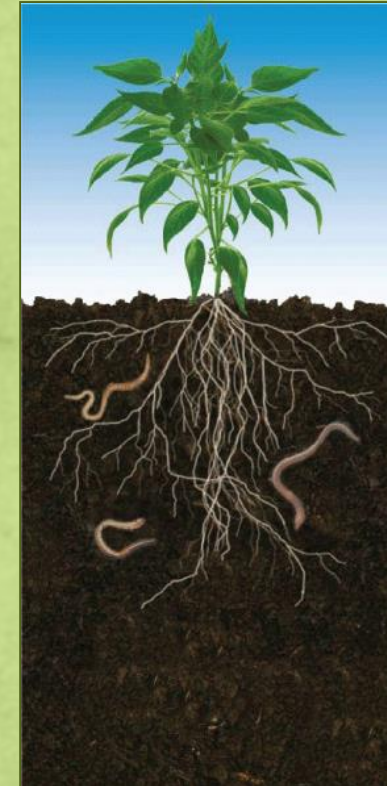
- **Cultural & mechanical controls:** avoid overuse of mulch and damp debris where they hide during the day
 - Traps: attractive odor/fat-based baits; place and remove rolled newspaper or cardboard; protected refugia
 - Exclusion: Tanglefoot on base of trunks, stems



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

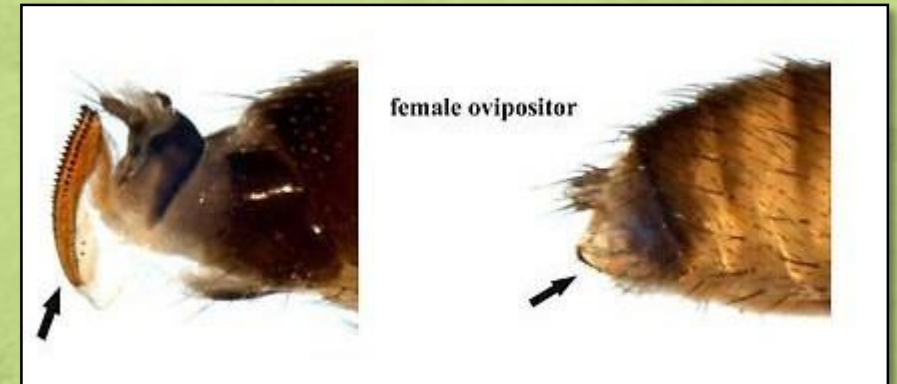


Photo: Martin Hauser

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

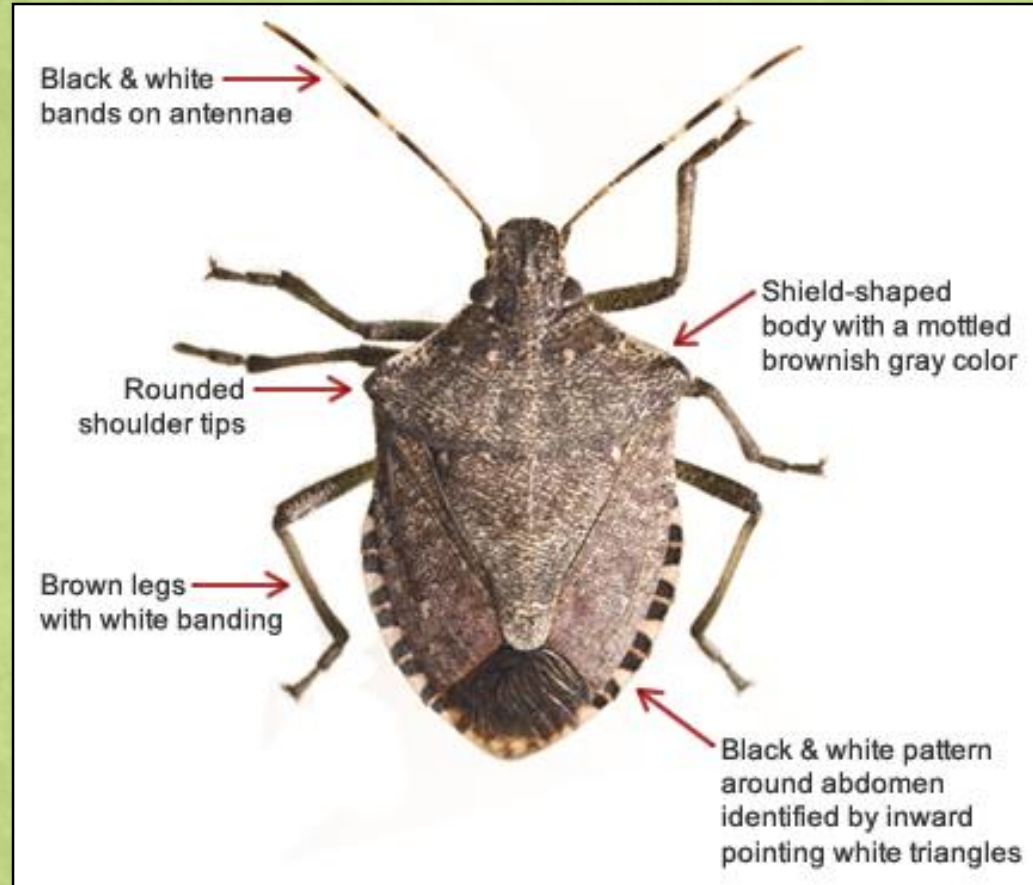


Photo: Steve Jacobs

Identification of BMSB



Photos: David R Lance



BMSB Lookalikes



Photo: Steven Valley

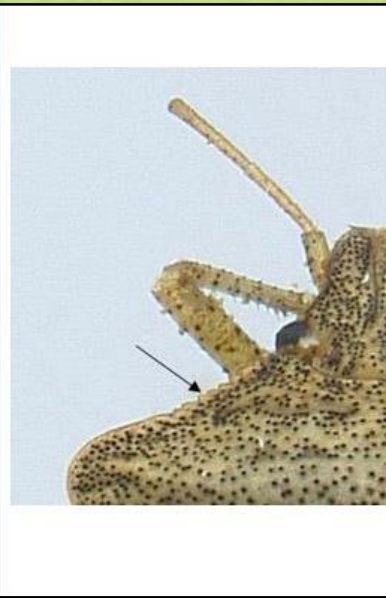
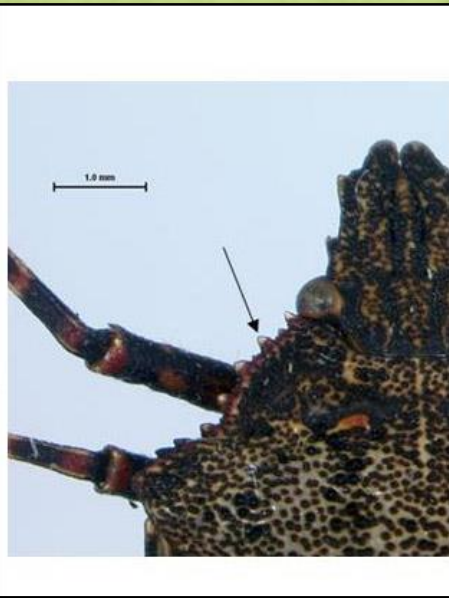


Photo: Antonia Guidotti



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

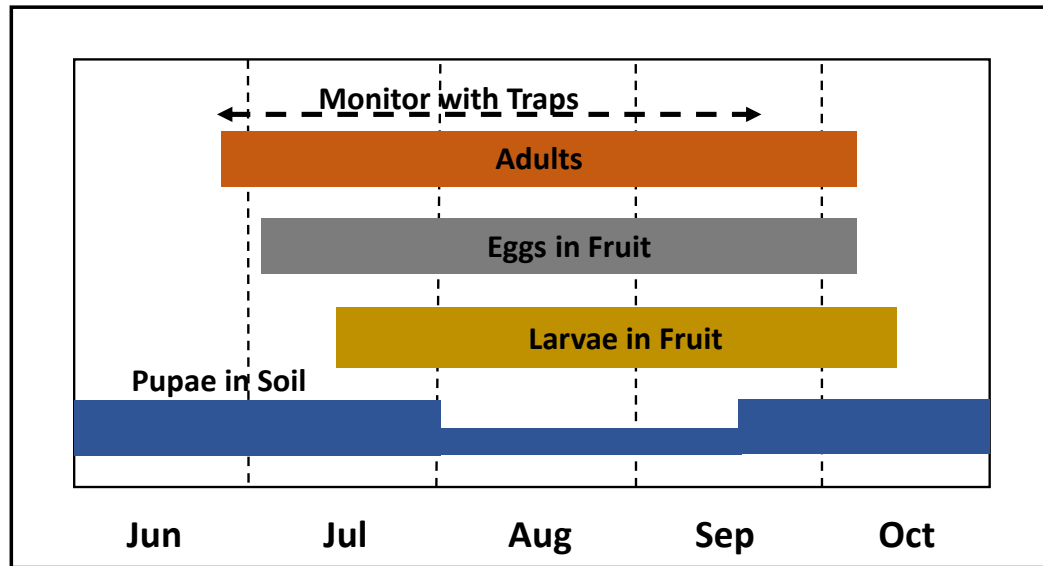


Breakdown of plum flesh
from AM feeding



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*)



Native hawthorn shrub: River hawthorn

New Fact Sheet

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

**UTAH**
PESTS fact sheet

EXTENSION
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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