Insecticide Selection and Invasive Insect Update

DIANE ALSTON, ENTOMOLOGIST
UTAH STATE UNIVERSITY
PESTICIDE EDUCATION WORKSHOP
DECEMBER 2014
Integrated Pest Management (IPM)

Sustainable

- Economics and Environment

Integrated Strategies

- Cultural (plant & site management)
- Mechanical (barriers, disruption, traps)
- Biological (natural enemies)
- Chemical (pesticides)

Monitor pest numbers/injury

- Treat only when needed
Utah Pests Online Resources
www.utahpests.usu.edu
Fact Sheets: over 200 fact sheets on pests of ornamentals, turf, fruits, vegetables, field crops, health-related, nuisance, stored products, structural, etc.
Video Fact Sheets

Paper Wasp Traps
Entomologist Dane Alston discusses the difference between native paper wasps and European paper wasps, and how to make your own traps to combat them.

Billbug Identification and Detection in Turf
Entomologist Ricardo Ramirez discusses the identifying characteristics of billbugs in turf, and demonstrates how to detect the damaging larval stage.

Tips for avoiding bed bugs while traveling
Entomologist Ryan Davis discusses safe travel techniques to avoid falling prey to bed bugs, and how to minimize the chances of bringing bed bugs back to the home.

Using a Beating Tray
A beating tray is a large cloth frame that is used to catch insects that fall from a shaken branch. It is helpful for monitoring a large area, such as an orchard, quickly.

Bed Bug Travel Tips
IPM Advisories:
ornamentals, turf, fruits, vegetables
www.utahpests.usu.edu/ipm

Free subscription
Timely info on pest activity
- insects
- mites
- diseases
- nutrient deficiencies
- environmental stress
Lots of images!
IPM recommendations
Effective pesticides

All you need to sign up for the advisories is an email address
IPM Advisories (2014 Examples)

What’s in Bloom
Beech (Fagus sylvatica)
Buddleja davidii
Callicarpa dichotoma
Euphorbia esula
Hydrangea arborescens
Insect/Disease Information
DECIDUOUS TREES
Honeylocust Spider Mite

Honeylocust seed tires can sometimes be a problem especially during stressed times. They feed on the underside of leaves and cause them to roll yellow-brown in color and eventually die. Their populations build rapidly in hot weather and they are starting to be noticeable now. This pest will not kill trees, but repeated infestations can cause growth to slow.

The honeylocust trees are vulnerable to leaf injury when they lose their leaves in the fall, followed by severe leaf injury when the honeylocust leaves begin to emerge in the spring. Honeylocusts are also susceptible to leaf injury when they are stressed due to drought.

Turfgrass Integrated Pest Management
An integrative approach to the management of turfgrass insects, 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.

Turfgrass Integrated Pest Management
Seasonal Turfgrass Pest Prediction, Utah State University Extension, Fall 2014

Billbug: Activity in Turf and a New Insecticide Option
Billbugs (Sphenophorus spp.) are a primary pest of turfs in the Intermountain West. Adult weeds deposit eggs in turf stems. Larvae then emerge from the egg and feed within the stems. Mature larvae feed on roots below ground, and eventually pupate with adults emerging from the soil.

Although adults do feed on turf, their main source of nutrition is soil feeding and is seen as severe discoloration resembling strong stresses seen turf and severe turf decline.

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, where there is a complex of more billbug species that occurs simultaneously including the bluegrass, hunting, and Rocky Mountain billbug. In some locations, the billbug affecting the Turfgrass 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 population in the Intermountain West. For example, first occurrence of billbugs in Logan, UT in 2014 was more than one month earlier (50 degree days, April 12) than what would be predicted by the current Basis 50 degree day (DD) model® used in the east (392 (50DD) Feb 13-31). Recognizing these differences is key to improving the strong and reliable efficacy of management strategies that are available.

Billbug: Activity in Turf and a New Insecticide Option

Waterproofed brown leaves caused by honeylocust

Bellox: Root Lesion Nematode
Bellox: Root Lesion Nematode is a root pest that occurs in Utah and the West. It feeds on the roots of many different plants. The nematode can cause stunted growth and reduced yield.

Billbug: Activity in Turf and a New Insecticide Option

Disease Cycle: The pathogen survives in the soil or plant debris. Roots of infected plants are attacked and the disease is transmitted through crop rotation. Infection can occur at any stage of the life cycle, but infection becomes more severe in the fall when the climate is cooler and the length of the day becomes shorter. The disease is characterized by large, dark, sunken lesions on the roots. Control: Cultural and chemical control are recommended to reduce the severity of the disease.
Pest Diagnostics
Utah Plant Pest Diagnostic Lab
www.utahpests.usu.edu/uppdl

Sample Submission

Submit a Sample
Topics

Considerations for Insecticide Use
- Select an effective chemical
- Prevent resistance in pest populations
- Off-target effects: pollinators, beneficial insects

Insecticide Classes
- Attributes
- Common active ingredients used in landscapes, fruits, and vegetables
- Examples of IPM Strategies

Invasive Insect Update
- Spotted wing drosophila, Brown marmorated stink bug,
  Velvet longhorned beetle, Emerald ash borer
Why do we care about insecticide classification?

Understand the chemical’s mode-of-action (MOA) (how it kills the insect)

Select products that will be effective and appropriate for the situation

Avoid developing resistance in the pest population
  ◦ Chemicals in the same class have the same MOA
  ◦ Risk for resistance is greater for chemicals with same and related MOA
  ◦ Overuse of the same MOA can select for resistant individuals in the population
  ◦ Insects with short generation time, high birth rate, and many generations each year are more prone to resistance

Develop short- and long-range strategies for IPM practices and use of chemicals
Considerations for Insecticide Use

Prevent resistance

Sustain economics and health of environment

Sustain effective insect control

Select least toxic option that is effective

- Protect pollinators
  - Managed bees: honeybee, alfalfa leafcutter bee, alkali bee
  - Wild & native bees: solitary nesters
    - blue orchard bee, squash bee, bumblebees
- Protect beneficial insects, mites, and spiders
  - Predators of pest insects
  - Parasitoids of pest insects
<table>
<thead>
<tr>
<th>Mode of Action</th>
<th>Class</th>
<th>Active Ingredient Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetylcholinesterase inhibitors (nerve synapse)</td>
<td>1A. Carbamates</td>
<td>carbaryl, methomyl, oxamyl</td>
</tr>
<tr>
<td></td>
<td>1B. Organophosphates</td>
<td>acephate, diazinon, malathion</td>
</tr>
<tr>
<td>Sodium channel modulators (nerve membrane)</td>
<td>3A. Pyrethroids</td>
<td>bifenthrin, cyfluthrin, cypermethrin, esfenvalerate</td>
</tr>
<tr>
<td>Nicotinic acetylcholine receptor agonists (nerve synapse)</td>
<td>4A. Neonicotinoids</td>
<td>acetamiprid, dinotefuran, imidacloprid</td>
</tr>
<tr>
<td>Nicotinic acetylcholine receptor allosteric activator (nerve synapse)</td>
<td>5. Spinosyns</td>
<td>spinetoram, spinosad</td>
</tr>
<tr>
<td>Juvenile hormone mimics (growth regulation)</td>
<td>7. Juvenile hormone analogs</td>
<td>hydroprene, kinoprene, methoprene</td>
</tr>
<tr>
<td>Microbial disruptors of insect midgut membranes (selective gut poison)</td>
<td>11. <em>Bacillus thuringiensis</em></td>
<td><em>Bt israelensis, Bt kurstaki, Bt tenebrionis</em>, transgenic cry proteins</td>
</tr>
<tr>
<td>Ryanodine receptor modulators (nerve &amp; muscle action)</td>
<td>28. Diamides</td>
<td>chlorantraniliprole, cyantraniliprole</td>
</tr>
</tbody>
</table>

*Insecticide Resistance Action Committee*
## Insecticide Attributes

<table>
<thead>
<tr>
<th>Class</th>
<th>Product examples</th>
<th>Persistence*</th>
<th>Plant penetration</th>
<th>Rainfastness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbamates</td>
<td>Carbaryl, Sevin, Vydate</td>
<td>Short - Medium</td>
<td>Cuticle penetration</td>
<td>Moderate</td>
</tr>
<tr>
<td>Organophosphates</td>
<td>Imidan, Malathion, Orthene</td>
<td>Medium - Long</td>
<td>Surface</td>
<td>Low</td>
</tr>
<tr>
<td>Pyrethroids</td>
<td>Asana, Brigade, Mustang, Permethrin</td>
<td>Short - Medium</td>
<td>Cuticle penetration</td>
<td>Moderate - High</td>
</tr>
<tr>
<td>Neonicotinoids</td>
<td>Admire Pro, Assail, Merit, Safari</td>
<td>Medium</td>
<td>Translaminar &amp; Acropetal (up &amp; out)</td>
<td>Moderate</td>
</tr>
<tr>
<td>Spinosyns</td>
<td>Entrust, Radiant, Success</td>
<td>Short - Medium</td>
<td>Translaminar</td>
<td>Moderate - High</td>
</tr>
<tr>
<td>Insect Growth Regulators</td>
<td>Distance</td>
<td>Medium - Long</td>
<td>Translaminar</td>
<td>Moderate</td>
</tr>
<tr>
<td><em>Bacillus thuringiensis</em></td>
<td>Deliver, Dipel, Javelin</td>
<td>Short</td>
<td>Surface</td>
<td>Low</td>
</tr>
<tr>
<td>Diamides</td>
<td>Altacor, Belt, Exirel</td>
<td>Medium - Long</td>
<td>Translaminar</td>
<td>Moderate - High</td>
</tr>
</tbody>
</table>

*Short = 2-5 days; Medium = ~1 week; Long = 1.5-3 weeks
Insecticides with Physical Modes of Action

**Horticultural Oils**
- Dormant or in-season
- Suffocation, clogs the spiracles (openings for air/respiration)

**Insecticidal Soaps**
- Breaking down wax layers on insect cuticle

**Kaolin Clay**
- Hydrophobic - desiccation
- Repellent

**Diatomaceous Earth & Boric Acid**
- Abrasive
- Form cuts in insect cuticle - desiccation

Apply horticultural oil to suffocate scale insects
# Common Insecticides

## Landscape Ornamentals

<table>
<thead>
<tr>
<th>Insect pest</th>
<th>Class</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphids</td>
<td>Carbamate, Pyrethroid, Neonicotinoid</td>
<td>Orthene, Talstar, Merit</td>
</tr>
<tr>
<td>Caterpillars</td>
<td>IGR, Microbial, Spinosyn</td>
<td>Azatrol (neem), Bt, Conserve</td>
</tr>
<tr>
<td>Leaf miners</td>
<td>Carbamate, Pyrethroid</td>
<td>Sevin, Defense, Talstar</td>
</tr>
<tr>
<td>Thrips</td>
<td>Spinosyn, Pyrethroid</td>
<td>Conserve, Battle, Scimitar</td>
</tr>
<tr>
<td>Spider mites</td>
<td>Physical</td>
<td>Oils, soaps</td>
</tr>
</tbody>
</table>

## Turfgrass

<table>
<thead>
<tr>
<th>Insect pest</th>
<th>Class</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Billbugs</td>
<td>Carbamate, Pyrethroid, Neonicotinoid, Diamide</td>
<td>carbaryl, deltamethrin, imidacloprid, Acelepryn</td>
</tr>
<tr>
<td>Sod webworm</td>
<td>Pyrethroid, Spinosyn</td>
<td>Talstar, spinosad</td>
</tr>
<tr>
<td>White grubs</td>
<td>Diamide, Neonicotinoid</td>
<td>chlorantraniliprole, imidacloprid</td>
</tr>
</tbody>
</table>
Woody Plants: Scale Insects

European Elm Scale

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)
- Feeding spots (halo) & scale on fruit
Scale Mechanical Control & Monitoring

Prune out infested limbs in winter/spring pruning

Place sticky bands on tree limbs to trap the young “crawler” stage

- Primarily a monitoring tool

Tangletrap™ sticky band & crawlers

Black pineleaf scale crawlers

San Jose scale crawlers
Timing for Scale Insecticides

➡️ Delayed dormant oil

Dormant Oil Spray (2-4%)
- Spring – at bud break – smothers overwintering scales
- Combine with a compatible insecticide

➡️ Systemic post-bloom

Systemic soil drench or injection
- Spring (Post-bloom)
  - Soft Scales – imidaclorpid (Merit, Bayer Advanced, others)
  - Armored Scales – dinofuran (Safari) – ornamentals only

➡️ Late spring to early summer when “crawlers” are active

IPM Advisories provide timing info

Target Crawlers
- June to July (varies with species; sticky bands to monitor)
  - horticultural oil, insecticidal soap, carbaryl (Sevin), dinofuran (Safari),
  - pyriproxyfen (Distance), buprofezin (Talus), azadirachtin (Azatin, Neem oil),
  - synthetic pyrethroids (Tempo, Talstar, others), malathion
# Common Insecticides

## Fruits

<table>
<thead>
<tr>
<th>Insect pest</th>
<th>Class</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codling moth</td>
<td>Diamide</td>
<td>Altacor</td>
</tr>
<tr>
<td></td>
<td>Neonicotinoid</td>
<td>Assail</td>
</tr>
<tr>
<td></td>
<td>IGR</td>
<td>Intrepid</td>
</tr>
<tr>
<td>Aphids</td>
<td>Neonicotinoid</td>
<td>Admire Pro</td>
</tr>
<tr>
<td></td>
<td>Tetranic acid</td>
<td>Ultor</td>
</tr>
<tr>
<td></td>
<td>Physical</td>
<td>Oils, soaps</td>
</tr>
<tr>
<td>Scale</td>
<td>Organophosphate</td>
<td>Lorsban</td>
</tr>
<tr>
<td></td>
<td>IGR</td>
<td>Esteem</td>
</tr>
<tr>
<td>Stink bugs</td>
<td>Pyrethroid</td>
<td>Asana</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Warrior</td>
</tr>
</tbody>
</table>

## Vegetables

<table>
<thead>
<tr>
<th>Insect pest</th>
<th>Class</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomato russet mite</td>
<td>Carbamate</td>
<td>Vydate</td>
</tr>
<tr>
<td></td>
<td>Organophosphate</td>
<td>Malathion</td>
</tr>
<tr>
<td>Corn earworm</td>
<td>Carbamate</td>
<td>Sevin</td>
</tr>
<tr>
<td></td>
<td>Pyrethroid</td>
<td>Warrior</td>
</tr>
<tr>
<td>Earwig</td>
<td>Spinosyn</td>
<td>Success</td>
</tr>
</tbody>
</table>
Aphids: Common!!

Symptoms:
- Curled leaves & shoots
- Sticky honeydew
- Black sooty mold
- Tending ants

Woolly ash aphid
- Small, soft-bodied
- Live in groups (colonies)
- Suck phloem sap
- “Tail pipes” (cornicles)

Rose aphid

Linden aphid
Aphid Life Cycle Variations

Species with broad or specific host ranges

During the growing season:
- crowding & food availability determine if adults are winged or wingless
  - most aphids are females
  - give birth to live young without mating

Temperate regions = Utah:
- most aphids lay overwintering eggs on woody host
  - autumn: winged adults fly to deciduous tree/shrub host, mate, lay eggs
  - spring: generation(s) on woody host, winged adults fly to vegetative hosts (weeds, vegetables, ornamentals)
- conifer aphids are usually host specific
Aphid Insecticides

dormant (2-4%) and horticultural oils (1%) (many brands)

insecticidal soap (many brands)

imidacloprid (Merit, Bayer Advanced, generics)
  ◦ systemic, post-bloom only
  ◦ new bee protection labels

pyrethroids (many brands)
  ◦ bifenthrin (Talstar), cyfluthrin (Tempo), lambda-cyhalothrin (Scimitar, Battle), pyrethrin

pymetrozine (Endeavor) – antifeedant

acephate (Orthene) – locally systemic

acetamiprid (Assail, Tristar)

malathion (many brands)
Aphid Biological Control

Convergent Lady Beetle

Hover or Syrphid Fly

Green Lacewing
Aphid Mechanical Control

Stiff spray of water applied to plants every 2-3 days until aphid numbers decline

Works best if initiated before leaves are curled

(also good for spider mites)
Aphid Cultural Control

Avoid excess nitrogen applications
- balance annual growth
- avoid excessive, lush growth
Invasive Insect Pests

RESIDENT IN UTAH AND NOT HERE YET

Spotted wing drosophila and brown marmorated stink bug slides courtesy of Lori Spears, USU CAPS Coordinator
Spotted Wing Drosophila

- Native to southeast Asia

- Most *Drosophila* spp. attack rotting fruit

- *Drosophila suzukii* (SWD) preferentially infests ripe and ripening fruit
SWD Activity in Davis County
2010-2013

<table>
<thead>
<tr>
<th>Year</th>
<th>Total # of SWD</th>
<th>Date of 1st trap capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>73</td>
<td>Aug 18</td>
</tr>
<tr>
<td>2011</td>
<td>61</td>
<td>Sep 8</td>
</tr>
<tr>
<td>2012</td>
<td>16</td>
<td>Sep 17</td>
</tr>
<tr>
<td>2013</td>
<td>23</td>
<td>Sep 25</td>
</tr>
</tbody>
</table>
SWD Activity in Northern Utah

2014

1st trap capture: June 2
- A single male was found in a wild habitat in Davis County that included river hawthorn and other feral fruits

5 new county detections:
- Rich
- Cache
- Box Elder
- Weber
- Utah

SWD abundances sharply increased in 2014
## SWD Activity in Northern Utah

### 2010-2014

### ALL YEARS

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</tr>
<tr>
<td>2013</td>
<td>23</td>
<td>Sep 25</td>
</tr>
<tr>
<td>2014</td>
<td>3586*</td>
<td>June 2 / August 12</td>
</tr>
</tbody>
</table>

### 2014

<table>
<thead>
<tr>
<th>County</th>
<th>Total # of SWD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rich</td>
<td>204</td>
</tr>
<tr>
<td>Cache</td>
<td>2252</td>
</tr>
<tr>
<td>Box Elder</td>
<td>397</td>
</tr>
<tr>
<td>Weber</td>
<td>260</td>
</tr>
<tr>
<td>Davis</td>
<td>455</td>
</tr>
<tr>
<td>Utah</td>
<td>18</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3586*</td>
</tr>
</tbody>
</table>

* The Utah CAPS team will continue to monitor for SWD during the winter of 2014-2015
Heat Tolerance of SWD

- *D. suzukii* is most active when temperatures are between 17-28°C (63-82°F). Male sterility is induced at 30°C (86°F).
Brown Marmorated Stink Bug

Invades homes/buildings in the fall/winter – major nuisance pest

Extremely broad host range: field crops, fruits, vegetables, fruiting ornamentals

Can cause substantial economic crop loss

Difficult to control with insecticides

Trapped in Salt Lake and Utah Cos. 2012-2014

Look alike:
Rough stink bug (native to Utah)
Brown Marmorated Stink Bug

- Native to eastern Asia
- First detected in the U.S. in Pennsylvania in late 1990s
- Feeds on a broad range of plants
  - crops, ornamentals
- Can be a major nuisance pest
Velvet Longhorned Beetle

(former name: Chinese Longhorned Beetle)

Native: Asia & Eastern Europe

Adults lay eggs on bark, larvae tunnel into the wood to feed, potentially killing the tree

Trapped in multiple locations along the Wasatch Front (introduced on wood packing material)

Attacks orchard trees & wide range of forest and landscape trees: cherry, apple, cottonwood, willow, mullberry

Potentially a pest of live trees and dry wood (structures)

Over 250 adults were trapped in a sweet cherry orchard in Pleasant Grove in 2014
Emerald Ash Borer: Invasive – not in Utah, yet...

Emerald Ash Borer is on our doorstep

Native to Asia

Flatheaded beetle

Larvae feed on inner bark disrupting water & nutrient transport

First found in the U.S. in MI in 2002

Killed millions of ash trees in SE MI alone

Attacks mature trees (olive family, Oleaceae)

- Ash: all species of North American ash
- White fringetree (*Chioanthus virginicus* L.)
USU Extension Pest Management Team: Utah Pests

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
Find this slideshow and others at www.utahpests.usu.edu