Workshop on Insect Pest Management of Blackberries & Blueberries

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Fruit IPM Website: http://comp.uark.edu/~dtjohnso
FRUIT PEST MANAGEMENT:
Current Pest Information
New Articles and PM Talks
Pest and Disease Facts
Management and Spray Guides
Spray Efficacy Tables
Organic Product Information
Grape Viticulture/PM Workshops

RICE PEST MANAGEMENT:
Rice Presentations
Rice Publications

OTHER LINKS:
University of Arkansas
Dale Bumpers College
Entomology Department
Cooperative Extension
AR Ag Experiment Station
Johnson Faculty Web Site
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*Pest Management in 2007 - A Year Without Fruit*

* Managing freeze-injured vineyards
(Handout on 15-17 May 2007) *

Dr. Donn Johnson
Professor - Fruit and Rice Entomology

*** SE Regional Insect Pest Management Award Winner (PDF) ***
Southeastern Branch of the Entomological Society of America (ESA) announced that Dr. Donn T. Johnson will receive the ESA Award for Excellence in Integrated Pest Management (IPM) to be presented at the Southeastern Branch meeting in March 2007 in Knoxville, TN.

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http://comp.uark.edu/~dtjohnso/Current Pest Information.htm

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Print Insect Trap Recording Form 2007 (pdf)

AR Fruit Experts & Emergency Poison Phone number

2007 AR Scouting/PM Decision Making

2007 MO Scouting/PM Decision Making

2007 AR Pest Degree-Days (DD)

2007 MO Pest DD & Rainfall

2007 AR Grape DD Maps & Disease Infection Events
2007 MO Grape DD Maps & Disease Infection Events

ARCHIVES:
2005 & 2006 Archive - AR/MO Pest DD & Scouting
Insecticide Resistance Management

• Use one insecticide against many consecutive generations of a pest results in resistance.

• Delay development of resistance:
  1) Scout pests to justify & improve spray timing
  2) Do not use 1 formulation more than three consecutive generations of a pest
  3) Rotate an insecticide with another of a different mode of action
Insecticide Resistance Action Committee
Resistance Management for Sustainable Agriculture and improved Public Health

Total Global Insecticide/Miticide Sales
2003 of $6.65 billion
• **Class: Organophosphate** = inhibit acetylcholine esterase
  – **Imidan** = phosmet
    • CRFW, CFW & JB **on blueberry**
  – **Malathion**
    • Aphids, chafer, JB, mites & thrips **on blackberry**
    • CRFW, CFW & JB **on blueberry**

• **Class: Carbamate** = acetylcholine esterase inhibitor
  – **Lannate** - methomyl
    • Aphid, CRFW, CFW, sharpnosed leafhopper **on blueberry**
  – **Sevin** - carbaryl
    • Aphid, CRFW, CFW, chafer, cutworms, JB, June beetles, leafrollers, scale, strawberry clipper, tarnished plant bug **on blackberry & blueberry**
Insecticides for Conventional Brambles & Blueberry (handout)

- **Class: Pyrethroid** = sodium channel modulators
  - **Capture 2EC** - bifenthrin
    - Leafrollers, mites & raspberry crown borer (October) on blackberry
- **Class: Insect growth regulators disrupt molting**
  - **Confirm** - tebufenozide (ecdysone agonists)
  - **Esteem** - pyriproxyfen (juvenile hormone mimic)
    - Cranberry (CRFW) & cherry (CFW) fruitworms & scale on blueberry
Insecticides for Organic Brambles & Blueberry

- **Class: Azadirachtin** = ecdysone agonists = disrupts molting
  - **Aza-Direct** (IGR, repellent, antifeedant)
    • Aphids, caterpillars, cutworms, JB, mites, psyllids, scale, stink bugs, weevils & thrips
  - **Neemix** (similar to Aza-Direct)
    • Aphids, caterpillars, CFW, cutworms & leafrollers
- **Class: Pyrethrin** = sodium channel modulators
  - **PyGanic** (pyrethrin + rotenone)
    • Aphids, beetles, caterpillars, E. tent caterpillar, JB, psyllids, rednecked cane borer (RNCB), scale, stink bugs, tarnished plant bug & thrips
  - **Pyrellin** (pyrethrin)
    • Aphids, chafers, JB, mites, RNCB & thrips
Insecticides for Organic Brambles & Blueberry

- **Class: Nicotinic** = acetylcholine receptor agonists
  - Entrust
    - Suppress caterpillars, CRFW, CFR & thrips
- **Surround** - no resistance development expected
  - Kaolin clay white film makes plants less apparent & reduces feeding
    - Chafer, JB, leafrollers, psyllid & thrips
### Bramble Plant Symptoms and Arthropod Identification

**Dr. Donn Johnson and Barbara A. Lewis**  
Department of Entomology, AGRI 319, University of Arkansas, Fayetteville, AR 72701

<table>
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<tr>
<th>Plant Symptoms</th>
<th>When and How to Look</th>
<th>Arthropod Description</th>
<th>Arthropod Common Name</th>
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</thead>
<tbody>
<tr>
<td>Galls on primocanes with longitudinal splits in bark</td>
<td>April - split open galled cane to see larva</td>
<td>Worm, ½ to 3/4”, thin, legless, flattened head</td>
<td>Rednecked cane borer</td>
</tr>
<tr>
<td>Shot holes in primocane leaflets and black frass</td>
<td>Early-May to early-June look on primocanes leaves for RNCB adults</td>
<td>Beetle, 1/4”, thin black body, orange-red neck</td>
<td></td>
</tr>
<tr>
<td>Terminal leaves curled, malformed (worse if pines nearby = overwinter site)</td>
<td>Bud swell, inspect plants for curled leaves in perimeter</td>
<td>Adults, 1/10”, waxy-yellow to brown, clear wings</td>
<td>Blackberry psyllid</td>
</tr>
<tr>
<td>Stem of flower bud girdled, bud dies and falls off</td>
<td>When flower buds first swell, look for symptoms</td>
<td>Weevil, 1/10”, snout, dark-reddish brown body</td>
<td>Strawberry bud weevil or Strawberry clipper</td>
</tr>
<tr>
<td>Poor drupe development &amp; deformed fruit</td>
<td>April to harvest, weekly check 100 fruit for damaged buds or fruit</td>
<td>Worm, 1/8”, yellow, legless; Bug (Adult or nymph), ½-3/4”, brown to green, suck</td>
<td>Blackberry midge &amp; Stink bugs</td>
</tr>
<tr>
<td>Defoliating leaves &amp; ripening fruit</td>
<td>June and July check for damaged leaves and beetles</td>
<td>Beetle, ¾”, brown wing, green neck</td>
<td>Japanese beetle</td>
</tr>
<tr>
<td>Canes are wilted, low vigor or dead from soil with terminal a shepherd’s crook</td>
<td>June or July, look for larva by splitting open root crown of low vigor canes</td>
<td>Beetle, 1”, green wing</td>
<td>Green June beetle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worm, 1”, white, legs, thick body and amber head</td>
<td>Raspberry crown borer</td>
</tr>
</tbody>
</table>
Blackberry Pests

- SC – strawberry clipper
- Gall Midge
- RNCB – rednecked cane borer
- SB – stink bugs
- JB - Japanese beetle
- GJB - Green June beetle
- RCB – raspberry crown borer
## Bramble Pest Biology

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</tr>
</thead>
<tbody>
<tr>
<td>Clipper</td>
<td>Bloom</td>
<td>Fruiting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>New leaves</td>
</tr>
<tr>
<td>RNCB</td>
<td>陪同虫卵</td>
<td>蛹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stink bugs</td>
<td>成虫</td>
<td>幼虫</td>
<td>成虫</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RCB</td>
<td>Larva in crown</td>
<td>蛹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>毛虫</td>
</tr>
<tr>
<td>GJB JB</td>
<td>Larva</td>
<td>蛹</td>
<td>JB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Strawberry Clipper (SC)

• **Identification:**
  – Dark-brown, snout weevil, 1/16” long
  – Legless, white larva

• **Biology:**
  – 1st opened bloom to late May:
    • Weevil lays egg inside flower bud
    • Weevil clips flower bud stem
    • Larva feeds on anthers of flower
    • Pupate in soil
    • Adult emerges and overwinter
Strawberry Clipper

• **Damage:**
  – Clipped buds fall to ground = yield loss

• **Monitor weekly after 1st opened bloom:**
  – 100 fruit clusters checked for clipped bud stems
  – Tap 100 clusters over white paper plate to jar weevils

• **Chemical Control (yield loss):**
  – Spray if detect new clipped buds or weevils
  – **Sevin, Aza-Direct or Neemix** applied as needed
• **Identification:**
  – Fly midge, 0.1” long
  – Legless, yellow larva, 0.1” long

• **Biology:**
  – 1\textsuperscript{st} flower bud to late May:
    • Fly emerges & lays egg inside flower bud
    • Larva feeds on immature drupes
    • Pupate in soil and overwinter

• **Damage** (no economic losses):
  – Cause poor drupe development
  – Deforms fruit
Gall Midge

• Monitor weekly in April & May:
  – 100 fruit clusters for damaged buds

• Chemical Control *(rarely needed)*:
  – *No insecticide currently labeled*
  – Sevin will probably control both clipper & midge simultaneously
Rednecked Cane Borer (RNCB)

• **Identification:**
  – Black beetle, red neck only 3/4 ” long
  – Legless, white larva & wide brown head

• **Biology:**
  – **Late April through May:**
    • Beetle feeds on primocane leaves
    • Lays egg in lower primocane stem
    • Larva girdles stem causing gall
    • Larva overwinter in stem
- Adults emerge = 29 April to 8 June
Rednecked Cane Borer

• **Damage:**
  – Gall results in winter injury
  – Gall reduces nutrient flow & yield

• **Monitor weekly in May:**
  – Walk planting looking for
    • RNCB adults on primocane leaves
    or
    • Small holes in primocane leaves

• **Cultural (if < 5% canes galled):**
  – **March** - remove galled fruiting canes

• **Chemical Control (if > 5% galled):**
  – Pyrellin or PyGanic when adults present
Stink Bugs (SB)

- Brown stink bugs
- Green stink bugs

**Identification:**
- Brown or green bugs
- ½ to 1” long
- Piercing mouthpart
- Wingless nymphs
Stink Bugs

• Biology:
  – April – adults emerge from fence row debris, feed on fruit & mate
  – May – lay egg masses by fruit
  – May to harvest – nymphs & adults on fruit
  – Overwinter in debris as adults

• Damage:
  – May to harvest –
    • Feed on fruit
    • Fruit tastes like SB and
    • Drupes deformed
Stink Bugs

• Monitor weekly for:
  – May - 100 fruit clusters for nymphs
  – Check for SB in yellow pyramid trap baited with SB pheromone

• Chemical Control:
  – PyGanic:
    • Time application against SB nymphs *(only registered insecticide)*
1 June - August

Japanese beetles
(Defoliate 350 plants & eat fruit)

Green June beetles
(Feed on ripe fruit)
Japanese Beetle (JB)  
(New Pest In Arkansas - 2001)

Source: http://ceris.purdue.edu/napis/pests/jb/imap/jbmap.html
Japanese Beetle

- **Identification:**
  - Metallic brown-green beetle ½” long

- **Biology:**
  - **July to May** - larva feed on grass roots & pupate in soil
  - **June & July** - adults emerge from the soil
  - **June & July** - males fly low to the ground over pasture
    - Males find females emitting sex pheromone
    - Mate & lay eggs in turf
    - Feed on leaves & fruit
Japanese Beetle in NW Arkansas 2006

- Elkins
- Fayetteville
- UA Farm
- Hindsville
Japanese Beetle

• **Damage:**
  – Adults attracted to & skeletonize leaves & eat fruit

• **Monitoring for adults:**
  – Dual lure trap captures adults (1st detection)
  – Check foliage & fruit for 1st feeding

• **Chemical Control:**
  – Sevin at 1st feeding
  – Apply to top of plants

• **Mass trap adults**
We Prevent JB Foliar Damage

Unsprayed vines = 23.1%
Surround = 5.2% foliar damage
Admire applied 1 June = 10.3%
Admire applied 14 June = 8.3%
Green June Beetle (GJB)

- **Identification:**
  - Metallic green beetle 1” long
  - Grub moves on back

- **Biology:**
  - **July to June** - larva feed on compost & pupate in soil
  - **Late June & July** - adults emerge from soil after rain
  - **July** - males fly over pasture, locate females by sex pheromone, mate & lay eggs in pasture soil
Green June Beetle

Green June Beetles Trap Catch in 2005

Date

Total/Trap

0
200
400
600
800
1000
12-Jul
13-Jul
15-Jul
20-Jul
26-Jul
1-Aug
4-Aug
9-Aug
12-Aug
18-Aug
25-Aug
1-Sep
9-Sep

8-Jul
12-Jul
13-Jul
15-Jul
20-Jul
26-Jul
1-Aug
4-Aug
9-Aug
12-Aug
18-Aug
25-Aug
1-Sep
9-Sep

Green June Beetles Trap Catch in 2005
Green June Beetle

• Damage:
  – **July-August** - adults attracted to odor of fermenting ripe fruit & feed on fruit as group

• Monitor for adults:
  – Flying in pastures or
  – Feeding on ripe fruit

• Mass trap adults
  – Mix-M baited traps 80’ apart set 100’ outside planting

• Chemical Control:
  – Sevin
    • Apply to fruit at 1st beetle feeding
Raspberry Crown Borer

- **Identification:**
  - Moth mimics yellow jacket wasp, 1” long
  - White larva, 6 legs, brown head, 1-1/2” long

- **Damage:**
  - **March to August** - larva feeds in crown & lower cane
  - Cause vigor and yield loss
Raspberry Crown Borer

1 Year Life Cycle in Arkansas

10 months

Sept.

Oct.
Raspberry Crown Borer

• **Monitor for:**
  – Brown eggs on underside of terminal leaves in mid October

• **Chemical control:**
  – **Capture 2EC**
    • Apply in 50 gal to lower cane & soil as drench in late October or early November

$375 / gal. Capture = $18.75 / 6.4 oz / A treatment
(only 2 sprays / season)
Occasional Blackberry Pests

- **Blackberry psyllid:**
  - Curl terminal leaves (April) (if planting near pines)
- **Thrips** from mid-April to harvest
  - Not sure doing any damage
  - Bother pickers or when washing (on windows)
- **Spider mites**
  - Outbreak caused by applying Sevin or Capture (or any other pyrethroid)
Questions on Brambles?
# Blueberry Pest Symptoms, Scouting, ID (handout)

## Blueberry Plant Symptoms and Arthropod Identification

Dr. Donn Johnson and Barbara A. Lewis  
Department of Entomology, AGRI 319, University of Arkansas, Fayetteville, AR 72701

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<tr>
<td>Holes in buds or missing buds and flowers</td>
<td>Bud swell - inspect buds for symptoms twice weekly</td>
<td>caterpillar, 1-1/4&quot;, brown body, dark brown head</td>
<td>Climbing cutworms</td>
</tr>
<tr>
<td>Webbed-tents in wild cherry trees or missing blueberry leaves &amp; flowers</td>
<td>Pre-bloom on look for &amp; remove tents &amp; larvae in cherry trees &amp; burn</td>
<td>caterpillar, 2&quot;, white line on back, black head, brownish-red &amp; blue body, tan hairs</td>
<td>E. tent caterpillar</td>
</tr>
<tr>
<td>Berry turns purple, cluster of fruit w/ webbing &amp; frass, Single berry - no frass.</td>
<td>Bloom to harvest look for eggs in calyx or damaged berries</td>
<td>caterpillars, 3/5&quot;, yellowish to green ------ 3/8&quot;, reddish</td>
<td>Cranberry fruitworm or Cherry fruitworm</td>
</tr>
<tr>
<td>Leaves rolled or tied together with webs</td>
<td>Petal-fall on look for symptoms</td>
<td>caterpillar, ½&quot;, green, wiggly when leaf unfolded</td>
<td>Leaf rollers (many species)</td>
</tr>
<tr>
<td>Red blistersed or misshapened buds &amp; berries</td>
<td>Bud swell to fruit set look for misshapened buds &amp; berries</td>
<td>mites not visible without microscope -</td>
<td>Blueberry bud mite</td>
</tr>
<tr>
<td>Webbing over tip of branch with caterpillars eating leaves inside web</td>
<td>Mid-June &amp; August look for webbed limbs, remove infested limb &amp; burn</td>
<td>caterpillars, 1&quot;, yellow to brown, hairy, yellowish stripe on sides</td>
<td>Fall web worm</td>
</tr>
<tr>
<td>Leaves cupped under, margin yellowing, &amp; plant stunted (stunt disease)</td>
<td>Petal-fall: check yellow sticky traps for SNLH in May, July &amp; October</td>
<td>leafhopper adult is 3/16&quot;, brown, creamy wings spots pointed head, red eyes</td>
<td>Blueberry sharpnosed leafhopper (SNLH)</td>
</tr>
</tbody>
</table>
Blueberry Pests

- CC – climbing cutworms
- Eastern Tent Caterpillar
- CRFW - Cranberry fruitworm
- CFW - Cherry fruitworm
- Fall webworm
- GJB - Green June beetle
- JB - Japanese beetle
Insecticide Use in Blueberry

• **Bud Swell**  
  – Spray if ≥ 1 cutworm per 100 leaf/flower cluster

• **During bloom**  
  – Presence of honeybees  
  – Only Confirm 2F and *Bt* can be used during bloom  
  – *Bt* works best against early larval instars

• **Post-bloom**  
  – *Cranberry fruitworm*  
    • Spray after removal of honey bees  
    • Apply insecticide 5-10 days after the peak pheromone trap counts  
    • Single well timed spray may be sufficient to control cranberry fruitworm
Climbing Cutworm (CC)
(Several species)

- **Identification:**
  - Light brown body, dark brown head caterpillars
  - 6 thoracic legs & 5 pair legs on abdomen
  - 1 to 1-1/2” long

- **Biology:**
  - Overwinter as larvae in soil
  - Fed on buds in April
  - Pupate
  - Moths emerge in late spring
  - Lay eggs
  - Summer caterpillars feed on weeds
Climbing Cutworm
(Several species)

- **Damage:**
  - *March to mid-April* during bud swell to bloom caterpillar eats holes in buds at night
  - *Cause yield loss*

- **Monitor:**
  - Outbreaks more common in areas of sandy soil

- **Control**
  - Sevin
  - Aza-Direct, Neemix
  - Entrust
Eastern Tent Caterpillar

- **Identification:**
  - Caterpillar, 2 in. long
  - White line on back
  - Tan hairs on brownish-red & blue body
- **Hosts:** cherry, chokeberry, plum, apple & crabapple
- **Biology:**
  - *Overwinter* as egg case on twigs
  - *Late March* caterpillars hatch
  - Form web tent in tree crotch
  - Caterpillars leave tent during the day to feed, but return at night
  - Mature caterpillar move from tree
  - Attack blueberry & pupate
  - Moths emerge in summer & lay eggs
Eastern Tent Caterpillar

• **Damage:**
  – *March to early-April* caterpillar group defoliate fruit tree

• **Monitor:**
  – *Late March*, watch for web tents in tree crotches

• **Mechanical control:**
  – Remove egg masses during the winter
  – Remove tents and caterpillars at night & destroy

• **Control (sprays)**
  – *Bt* (Dipel)
  – Sevin
Cranberry Fruitworm

- **Identification:**
  - Moths, brownish, 5/8
  - Egg, flat white scales
  - Caterpillar, 3/8”, yellow-green to light pink

- **Biology:**
  - **Overwinter** - larva in cocoon of silk & soil particles
  - Moths emerge after bloom
  - Eggs laid on edge of calyx
  - Larva feed inside many berries

- **Damage:**
  - Webbing on cluster of berries
  - Frass
Cranberry Fruitworm

Figure 11. Life cycle of cranberry fruitworm.
Cranberry Fruitworms Hatch After 250 DD

2003 Trevor Nichols Research Complex Pheromone Trapline Data
Fennville, MI

For emergence graphs of other common fruit pests refer to our website at http://www.maes.msu.edu/tnrc/03trapline.htm
Cherry Fruitworm

• **Identification:**
  - Moth, 2/5” wing span, grayish black
  - Eggs - round, flat on calyx
  - Caterpillar, 3/8”, reddish, dark head

• **Biology:**
  - **Overwinter** - larva burrows in a dead blueberry cane & pupate in spring
  - Moths emerge before cranberry FW
  - Egg laying begins after PF
  - Larvae often enter berries in the calyx or on the berry side

• **Damage:**
  - Eat 1 berry, blue & shrunken
  - Berry drops by harvest
  - No webbing or frass
Monitoring for Eggs & Larvae of Cranberry & Cherry Fruitworms

- Monitoring:
  - Petal fall
  - History of infestation
  - Sample near woods
    - Hand lens to see eggs on calyx
    - Larval entry to berry

Figures 3-8. Eggs of CFW (3-5) and CBFW (6-8). Initially opaque (3 & 6), the eggs become pigmented as they mature (4 & 7). Upon maturity, the dark head capsule (arrow) of the developing larva is clearly visible within the egg (5 & 8).

Figure 12. CFW (Left) enter fruit in the calyx, and CBFW (right) enter near stem (arrow).
Cranberry & Cherry Fruitworms

- **Cultural Control:**
  - Eliminate weeds around plants = no overwintering protection

- **Mechanical Control:**
  - Pick off infested webbed or early ripened berries
Cranberry & Cherry Fruitworms

- Control by Insecticides:
  - 1st see larval entry = 1st spray
  - 2nd application 7 to 12 days later
  - Recommend:
    - \textit{Bt} (Dipel)
    - Aza-Direct or PyGanic
    - Confirm or Esteem
    - Imidan
    - Lannate or Malathion
    - Sevin
Fall webworm

• **Identification:**
  – Caterpillars, 1", yellow to brown, hairy, yellowish stripe on sides

• **Biology:**
  – Larva feed as group inside webbed limb in:
    • Late June
    • August
Fall webworm

- **Mechanical control:**
  - Remove webbed nest & larvae and destroy

- **Control by Insecticides:**
  - *Bt* (Dipel), Aza-Direct, PyGanic
  - Confirm & Esteem
  - Imidam
  - Lannate Malathion
  - Sevin
Other Blueberries Pests

- **Japanese beetle** – becoming problem in NW AR
- **Green June beetle** – problem near pastures
- **Bagworms** hatch in June, larvae balloon in from infested juniper/cedar nearby (look for during pruning)
- **Yellow-necked caterpillar** defoliate an occasional plant in July or August
- **Sharpnosed leafhopper** transmit mycoplasm causing blueberry stunt (*stunt not too bad in AR – no need to spray*)
- **Stem borers** attack stressed plants (keep plants healthy)
- **Plum curculio** (rarely attack blueberry in AR)
Questions on Blueberries?