PEACH INSECT MANAGEMENT UPDATES & RECOMMENDATIONS ON PHEROMONE TRAPS AND DEGREE-DAY MODELS FOR TIMING INSECTICIDE APPLICATIONS

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Updates …

• … on brown marmorated stink bug and spotted wing Drosophila, with revised recommendations on monitoring and control
• … on management recommendations for other major insect pests
Brown marmorated stink bug

- *Halyomorpha halys*
- Introduced (NOT intentionally) from Asia, first detected in Allentown, PA, in 1998
- Damaging populations as far west as OH, KY, and IN in 2014, some crop damage in IL in 2015
- Overwinters as an adult, aggregates in large numbers in homes and other shelters
- Expect 2 generations per year in IL
BMSB confirmed occurrence in IL, through 2015

- Confirmed in 19 counties (+1 from 2014)
- Highest near Chicago & St Louis
- Some fruit growers seeing bugs in buildings near orchards
- Damage in orchards?

Occurrence is probably more widespread than confirmed reports indicate.

### Brown Marmorated Stink Bug Confirmations

<table>
<thead>
<tr>
<th>County</th>
<th>Year Confirmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cook</td>
<td>2010</td>
</tr>
<tr>
<td>Kane</td>
<td>2011</td>
</tr>
<tr>
<td>McLean</td>
<td>2011</td>
</tr>
<tr>
<td>Champaign</td>
<td>2011</td>
</tr>
<tr>
<td>Du Page</td>
<td>2012</td>
</tr>
<tr>
<td>Vermilion</td>
<td>2012</td>
</tr>
<tr>
<td>Whiteside</td>
<td>2012</td>
</tr>
<tr>
<td>Madison</td>
<td>2012</td>
</tr>
<tr>
<td>Morgan</td>
<td>2012</td>
</tr>
<tr>
<td>St. Clair</td>
<td>2013</td>
</tr>
<tr>
<td>Tazewell</td>
<td>2013</td>
</tr>
<tr>
<td>LaSalle</td>
<td>2013</td>
</tr>
<tr>
<td>Piatt</td>
<td>2013</td>
</tr>
<tr>
<td>Jefferson</td>
<td>2013</td>
</tr>
<tr>
<td>Will</td>
<td>2013</td>
</tr>
<tr>
<td>Kankakee*</td>
<td>2013</td>
</tr>
<tr>
<td>Lake</td>
<td>2014</td>
</tr>
<tr>
<td>Knox</td>
<td>2014</td>
</tr>
<tr>
<td>Peoria</td>
<td>2014</td>
</tr>
<tr>
<td>Rock Island</td>
<td>2014</td>
</tr>
<tr>
<td>Sangamon</td>
<td>2015</td>
</tr>
</tbody>
</table>

* suspected, but unconfirmed
White bands on legs and antennae are diagnostic
Not brown marmorated stink bug
Send in suspected specimens

- Kill by freezing 3-5 days or placing in rubbing alcohol
- Send in a crush-proof container
- Mail to:
  - Rick Weinzierl
  - Univ. of Illinois Department of Crop Sciences
  - 1102 South Goodwin Avenue
  - Urbana, IL 61801
  - If this changes after my retirement, I will provide an update via the IL Fruit and Vegetable News
Brown marmorated stink bug

- Feeds on a variety of host plants
  - Ornamental shrubs (butterfly bush, viburnum, rose)
  - Ornamental trees (crabapple, walnut, maple, redbud)
  - Vegetables (sweet corn, tomato, green bean, asparagus, pepper)
  - Fruits (pear, apple, cherry, grape, raspberry)
  - Agronomic crops (soybean, corn)
- Highly mobile and easily switches hosts
- Like other stink bugs, BMSB sucks plant juices with its beak, causing plant injury
  - Severe damage to apples, peaches, tomatoes, sweet corn, many other crops
  - Many noncrop hosts serve as reservoirs for population buildup
  - Very difficult to control … insecticide efficacy summarized later
References on BMSB management

Emergence of Brown Marmorated Stink Bug, Halyomorpha halys (Stål), as a Serious Pest of Agriculture

Tracy C. Leskey
USDA-ARS
Appalachian Fruit Research Station
Kearneysville, WV 25430  USA


Toxicity of various insecticides against adults of brown marmorated stink bug, Halyomorpha halys (Stål), (Hemiptera: Pentatomidae)

Results of BMSB adults direct contact laboratory bioassays conducted until April 14, 2011

Greg Krawczyk, Travis R. Enyeart and Margaret E. Reid

Pennsylvania State University, Department of Entomology
Fruit Research and Extension Center
Biglerville, PA 17307
gke13@psu.edu

April 14, 2011

Project supported by grants from Pennsylvania Department of Agriculture and United States Department of Agriculture

http://extension.psu.edu/fruit-production/files/bmsb-slide-presentation
From Anne Nielsen, Rutgers ...

- Activity begins mid-April to early May ... maybe earlier.
- Threshold = 1 in orchard ... visual and beat samples
  - Most active at tops of trees, may be easier to sample on cloudy days
  - Nymphs most active at night
BMSB Trapping

- Trap is ~4 ft. tall, pyramid shape with catch chamber
- Aggregation pheromone ("USDA # 10) plus MDT
- If BMSB are attracted to the traps, damage on surrounding plants will be greater

For 2016, I do not recommend reliance on these traps in IL. Frequent sampling with a beating tray is recommended. If you do use traps, be sure to look closely at surrounding vegetation to see if BMSB is present.
BMSB commercial trap and lures suppliers

http://www.agbio-inc.com/

http://www.greatlakesipm.com

http://www.rescue.com/
* Also available from Walmart, Home Depot, Lowe’s etc. ...
Most effective insecticides against BMSB

(based on combined data from T. Leskey, T. Kuchar and G. Krawczyk)

**PYRETHROID**
IRAC Group 3A
- bifenthrin (Brigade)
- fenpropathrin (Danitol)
- cyfluthrin (Baythroid)
- λ-cyhalothrin (Warrior)

**NEONICOTINOID**
IRAC Group 4A
- dinofuran (Venom, Scorpion)
- thiametoxam (Actara)
- clothianidin (Belay)
- imidacloprid (Provado, Admire Pro)
- acetamiprid (Assail)

**OTHER**
(IRAC Groups 1A, 1B, 2A)
- methomyl (carbamate) (Lannate LV and SP)
- endosulfan (organosulfone) (Amistar, Thionex)
- acephate (organophosphate) (Acephate)
Venom, Scorpion, Actara, Belay, Admire, and Provado are VERY HIGHLY toxic to bees.
## Selected BMSB insecticides by crop

Use Actara or Belay ONLY AFTER bloom and where blooming weeds are NOT present (they attract foraging bees).

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Preharvest Interval (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apples</td>
</tr>
<tr>
<td>Actara (thiamethoxam)</td>
<td>14</td>
</tr>
<tr>
<td>Baythroid XL (beta-cyfluthrin)</td>
<td>7</td>
</tr>
<tr>
<td>Belay (clothianidin)</td>
<td>7</td>
</tr>
<tr>
<td>Brigade (bifenthrin)</td>
<td>not registered</td>
</tr>
<tr>
<td>Danitol (fenpropathrin)</td>
<td>14</td>
</tr>
<tr>
<td>Lannate (methomyl)</td>
<td>14</td>
</tr>
<tr>
<td>Mustang Maxx (zeta-cypermethrin)</td>
<td>14</td>
</tr>
</tbody>
</table>

References

• Tracey Leskey. Season-Long Patterns of Attraction of Brown Marmorated Stink Bug to Pheromone Lures and Light Traps in Orchard Agroecosystems.

• Greg Kraczyk. Revisiting IPM in the World with BMSB.
  • http://extension.psu.edu/plants/tree-fruit/presentations/2014-winter-fruit-meetings/brown-marmorated-stink-bug-and-orchard-ipm

• Rutgers BMSB Spray Schedule Table.
Spotted wing Drosophila

- Native to East Asia, where it is a pest on fruit.
- Now widespread in IL … damage to blueberries, raspberries, blackberries, peaches, mulberries, elderberries, black currants, Japanese honeysuckle, pokeweed … and more
Relative host susceptibility

Host Potential Index*

We did rear SWD from ripe peaches from the University of Illinois Fruit Research Farm at Urbana in 2015.
2014 national rankings of insecticide efficacy
8 states, 15 state by crop combinations
MI, CA, OR, WA, ME, NY, NJ, GA

Excellent 4
Good 3
Fair 2
Weak 1
No activity 0

Agri-Mek  Altacor  Apta  Actara  Asana  Assail  Bifenture  Brigade  Danitol  Delegate  Diazinon  Endigo  Entrust  Exirel  Fyfanon  Hero  Imidan  Lannate  Leverage 360  Malathion  Movento  Mustang Max  Provado  Pyganic
Insecticides for SWD control

Very effective:
  Asana, Brigade/Bifenture, Imidan, Lannate, Mustang Maxx, Danitol, Delegate

Effective:
  Malathion, Hero

Shorter residual:
  Entrust, Assail, Pyganic

Promising:
  Grandevo and Venerate (Marrone); Exirel (DuPont); cyclaniliprole (ISK)
SWD Insecticides

- Brambles
  - Brigade (3), Danitol (3), Delegate (1), Entrust (1), Hero (3), Malathion (1), Mustang Max (1)
- Strawberries
  - Brigade (0), Danitol (2), Entrust (1), Malathion (3), Radiant (1)
- Blueberries
  - Asana (14), Brigade (1), Danitol (3), Delegate (3), Entrust (3), Hero (1), Imidan (3), Lannate (3), Malathion (1), Mustang Max (1)
- Peaches
  - Asana (14), Assail (7), Baythroid (7), **Danitol (3)**, Delegate (14), Entrust (14), Imidan (14), Lannate (4), Malathion (7), Mustang Max (14), Pounce (14), Warrior (14)

Numbers in parentheses indicate required preharvest interval. See the 2016 Midwest Fruit Pest Management Guide and product labels for more information.
Monitoring SWD

- Plastic cup with side holes, use SWD Dual lures from Scentry (vinegar or a yeast + sugar water mix are alternatives)
- Add a small yellow sticky trap to capture flies. Or, use only the bait with a drop of unscented soap.
- Hang in fruit canopy near fruit and in the shade.
- Change bait weekly, and dispose away from trap.
- Best detection potential expected as fruit ripens.
- Check at least twice weekly, and record catches.

See: [http://ipm.illinois.edu/ifvn/contents.php?id=44](http://ipm.illinois.edu/ifvn/contents.php?id=44)
IPM for SWD

• If SWD was present in 2015, start management with first signs of fruit coloring in susceptible crops in 2016 … do not wait to catch SWD adults in traps.

• Use traps baited with Scentry 2-part lures. Use yellow sticky cards and soapy water to capture flies. Available from Great Lakes IPM.

• Place some traps in adjacent woods for early detection.

• Assess fruit infestation by immersing fruit in sugar water (1 cup granulated white sugar in 1 quart water) … larvae will float to the surface. (Can also use 1 cup salt per gallon of water.)

• Exclusion by netting can reduce losses … be aware of temperature elevations if air flow is impeded.

• Remove over-ripe/infested fruit to minimize development sites. Harvest frequently to reduce presence of over-ripe fruit.

• Use insecticides if needed on 2- to 5-day intervals (7 days in peaches):
  – Protect from beginning of fruit ripening through final picking … and beyond.
  – Excellent coverage is necessary.
  – Rotate chemical classes. Early morning and late evening sprays also seem to be most effective.
  – Spray when bees are not active.
  – Beware of PHIs, REIs.
  – (Entrust is the most effective organic insecticide.)

• Use post-harvest chilling to limit larval development.

See: http://ipm.illinois.edu/ifvn/contents.php?id=57#fruit
Controlling “the usual suspects” ...

- Other stink bugs and plant bugs
- Plum curculio
- Oriental fruit moth
- Peachtree & lesser peachtree borer
- San Jose scale
- Japanese beetle
• Stink bugs in general
  – BMSB products (Actara, Belay, Brigade, Danitol, and Lannate per crop labels); other pyrethroids
• Plum curculio
  – Imidan, Assail, Avaunt or pyrethroids (or Surround + Pyganic) at petal fall and first cover
• Oriental fruit moth
  – Pyrethroid resistance in some areas; use IsoMate OFM Rosso or twin tubes for mating disruption or rotate among Altacor/Belt (or Exirel if priced competitively), Assail, Delegate, and Rimon. Imidan also is effective. Base timing on moth counts in pheromone traps and degree-days.
• Peachtree & lesser peachtree borers
  – Trunk sprays of Lorsban or a pyrethroid or IsoMate LPTB Dual for mating disruption
• San Jose scale
  – Immature stages overwinter under covering. Males fly to females and mate around bloom; females give birth to live nymphs under the protective cover of the scale. Crawlers become active a few weeks later. Superior oil prebloom, with or without Lorsban or Esteem. Centaur, Esteem, Movento, Diazinon, or Assail against crawlers (~3rd cover after petal fall)

• Japanese beetle
  – Sevin XLR Plus, pyrethroids, others (Pyganic plus Surround or Neem) ... retreat as needed
Refining the timing of management practices by …

• … understanding life histories of specific pests
• … using weather data (in the form of degree-days) to track and predict development
  • Where to get the data and the models
• … monitoring populations
  • To refine degree-day models
  • To assess pest densities
Life histories … what stage overwinters? How many generations per year?

<table>
<thead>
<tr>
<th>Insect or Mite</th>
<th>Overwintering Stage</th>
<th>Generations per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>European red mite</td>
<td>Eggs on limbs</td>
<td>8 or more</td>
</tr>
<tr>
<td>San Jose Scale</td>
<td>Immatures under scales on limbs</td>
<td>2</td>
</tr>
<tr>
<td>Stink bugs / Plant bugs</td>
<td>Adults in ground cover, woods</td>
<td>2 or more</td>
</tr>
<tr>
<td>Lesser peachtree borer</td>
<td>Larvae beneath bark</td>
<td>2</td>
</tr>
<tr>
<td>Greater peachtree borer</td>
<td>Larvae beneath bark</td>
<td>1</td>
</tr>
<tr>
<td>Plum curculio</td>
<td>Adults in ground cover, woods</td>
<td>1 (2 in southern states)</td>
</tr>
<tr>
<td>Oriental Fruit Moth</td>
<td>Mature larvae in cocoons on trees</td>
<td>3-5</td>
</tr>
<tr>
<td>Japanese beetle</td>
<td>Larvae in soil</td>
<td>1</td>
</tr>
</tbody>
</table>
# Life histories ... when do infestations occur?

<table>
<thead>
<tr>
<th>Insect or Mite</th>
<th>Timing of infestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>European red mite</td>
<td>Egg hatch begins around pink; numbers build over generations; thrive in hot, dry weather</td>
</tr>
<tr>
<td>San Jose Scale</td>
<td>Mating occurs around bloom; crawlers start new infestations a few weeks later, around third cover</td>
</tr>
<tr>
<td>Stink bugs / Plant bugs</td>
<td>Adults become active as temps exceed 60 F</td>
</tr>
<tr>
<td>Lesser peachtree borer</td>
<td>Moth flight begins in early May in southern IL; a second flight occurs in late summer</td>
</tr>
<tr>
<td>Greater peachtree borer</td>
<td>Moth flight begins in mid-June and spans several weeks</td>
</tr>
<tr>
<td>Plum curculio</td>
<td>Adults become active around bloom; lay eggs into fruit shortly after petal fall</td>
</tr>
<tr>
<td>Oriental Fruit Moth</td>
<td>Moth flight begins shortly before bloom; subsequent generations tunnel into fruit or shoots through fall</td>
</tr>
<tr>
<td>Japanese beetle</td>
<td>Adults emerge June through August and persist through fall</td>
</tr>
</tbody>
</table>
Insects develop more rapidly at higher temperatures (up to a point). Laboratory studies can determine the rate of development for a given stage or range of stages of each species over a range of temperatures, and results are analyzed to determine the threshold or base for degree-day (phenology) models and the total number of degree-days required to complete development.

Total DD = \( d (T - Th_L) \)
Total DD = 20 \((25-10) = 300\) (that is, 300 Celsius degree-days above a 10°C threshold)
Max = 65, Min = 45, Base = 50

### Minimum Temperature Calculation

\[
\left( \frac{\text{Maximum} + \text{Minimum temperature}}{2} \right) - \text{Minimum threshold}
\]

* If minimum temperature < minimum threshold, set minimum temperature = minimum threshold.

* If maximum temperature > maximum threshold, set maximum temperature = maximum threshold.
### Revisiting time of occurrence … by degree-days

<table>
<thead>
<tr>
<th>Insect or Mite</th>
<th>Base (°F)</th>
<th>Timing of infestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>European red mite</td>
<td>50</td>
<td>Egg hatch begins at 150-175 DD after January 1 (pink); 350-400 DD/generation</td>
</tr>
<tr>
<td>San Jose Scale</td>
<td>51</td>
<td>Peak flight 250-300 DD after January 1; 900-1,050 DD/generation</td>
</tr>
<tr>
<td>Brown marmorated stink bug</td>
<td>50</td>
<td>BMSB adults become active 360 DD after January 1; 686 DD per generation</td>
</tr>
<tr>
<td>Lesser peachtree borer</td>
<td>50</td>
<td>Flight begins 350-375 DD after January 1</td>
</tr>
<tr>
<td>Greater peachtree borer</td>
<td>50</td>
<td>Flight begins ~ 1440 DD after January 1</td>
</tr>
<tr>
<td>Plum curculio</td>
<td>50</td>
<td>Egg-laying into fruit ENDS 308 DD after petal fall</td>
</tr>
<tr>
<td>Oriental Fruit Moth</td>
<td>45</td>
<td>First flight begins ~230 DD after January 1. ~965 DD/generation</td>
</tr>
<tr>
<td>Japanese beetle</td>
<td>50</td>
<td>Adults emerge from soil from 950 -2150 DD after January 1</td>
</tr>
</tbody>
</table>
Traps for monitoring peach insects

• Use large delta traps with removable sticky liners.
• Key species to monitor with traps … oriental fruit moth, lesser peachtree borer, and greater peachtree borer. Also learn biofix date for codling moth.
• At least 3 traps per species per farm. After that, 1 per 5 acres. No more than 10-12 per species per farm.
• Separate traps for different species by at least 50 feet
• Check traps twice weekly and record the counts for each trap.
• Supplier = Great Lakes IPM
  • http://www.greatlakesipm.com/
Degree-day (phenology) models

- Thresholds differ for different species
- Starting points for counting degree-days differ for different insects
  - By calendar date (often January 1)
    - (probably less accurate)
  - By “biofix” … usually first capture of the species in a pheromone trap or other trap
- Key events in life cycles are linked to degree-day accumulations … but they are not the same for different species
Where to get data

• Weather stations in your orchard
  • Spectrum Technologies
    • [www.specmeters.com](http://www.specmeters.com)
  • Hobo weather stations
    • [http://www.onsetcomp.com/](http://www.onsetcomp.com/)

• Sky-bit, NEWA, or other sites
  • [http://www.skybit.com/](http://www.skybit.com/)
  • [http://newa.cornell.edu/](http://newa.cornell.edu/)

• Illinois Degree-Day Calculator
So an example ...

- Google “Illinois degree-day calculator”
  - [https://ipm.illinois.edu/degreedays/](https://ipm.illinois.edu/degreedays/)

Insect Growth and Development

Insect growth is affected by two major factors, time and temperature. Insects are unable to maintain a constant body temperature. Because they are cold-blooded, their body temperature varies with the temperature of their surrounding environment. Insects require a certain amount of heat to develop from one stage in their life cycle to another (eggs to larvae to pupae to adults). Insect growth only occurs within a certain range of temperatures, the upper and lower developmental thresholds. The temperature below which no growth occurs is the minimum or lower developmental threshold. The temperature must be at or above the minimum developmental threshold in order for insect growth to occur. Growth increases with higher temperatures up to a maximum temperature known as the upper or maximum developmental threshold. Once the upper threshold is surpassed, no additional growth occurs. Developmental thresholds are different for all insect species.

The amount of heat required by an organism to complete its development is known as physiological time. Physiological time is usually expressed in units called degree-days. Degree-days measure insect growth and development in response to daily temperatures. Degree-days are the accumulation of heat units above some temperature (the lower threshold) for a 24-hour time period. One degree day results when the average temperature for a day is one degree over the minimum threshold. The accumulation of degree-days can be added over a period of time and used to estimate growth and predict insect development. The accumulation of degree-days usually begins with either an arbitrary starting point such as a calendar date (many insect pests use January 1 or March 1) or a [here](https://ipm.illinois.edu/degreedays/). Click here to learn more about degree-day calculations.

Using Phenology Models in an Integrated Pest Management Program

Phenology models help predict the timing of events in an organism's development using degree-days. Degree-days allow us to predict when significant biological events such as the appearance of insect pests may occur. Determining when an insect pest will appear is often a difficult task. Depending on the variation in
So an example …

- Then …

And again.
Now at...

http://www.sws.uiuc.edu/warm/pestdata/sqlchoose1.asp?plc=

Choose a pest, choose a location, and click calculate
Insert a date for the “biofix” … use local biofix date for codling moth if you do not trap for SJS males.
Illinois Climate Network: Accumulated Degree Days, Results

Choose Another Pest

Accumulated degree-days for San Jose scales at Champaign, from 01/01/2016 through 01/24/2016.

Actual total: 1
Average (11 year): 4

Projected Totals (based on site climate normals)
   One-Week: 1
   Two-Week: 2

To determine the relationship between accumulated degree-days and San Jose scale development, click here.
<table>
<thead>
<tr>
<th>San Jose Scale</th>
<th>Base = 50°F</th>
<th>Biofix = First male capture or start with biofix of codling moth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accum Deg Days</td>
<td>Generation</td>
<td>% Males</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>100</td>
<td>1</td>
<td>89</td>
</tr>
<tr>
<td>200</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>300</td>
<td>1</td>
<td>100</td>
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<td>400</td>
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<td>700</td>
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</tr>
<tr>
<td>800</td>
<td>2/1</td>
<td>1</td>
</tr>
<tr>
<td>900</td>
<td>2/1</td>
<td>8</td>
</tr>
<tr>
<td>1000</td>
<td>2/1</td>
<td>29</td>
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<td>1100</td>
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<td>1200</td>
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<td>1300</td>
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<td>1400</td>
<td>2</td>
<td>98</td>
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<tr>
<td>1500</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>1600</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

San Jose scale

- Immature stages overwinter under the hard covering. Males fly to females and mate around bloom; females give birth to live nymphs under the protective cover of the scale. Crawlers become active a few weeks later. Use superior oil prebloom, with or without Lorsban or Esteem. Use Centaur, Esteem, Movento, Diazinon, or Assail against crawlers (~3rd cover after petal fall)
Prebloom in peaches... Oils at green tip to pink suffocate insect stages that are coated with spray

- Dormant oil / superior oil at 2 percent by volume early, decreasing to 0.5 to 1 percent by volume at pink
- Controls San Jose scale and European red mite eggs
- Successive applications of oil in this period improve control
- Not harmful to beneficials at this time. No cross-resistance or resistance management issues
- May add Lorsban to improve scale control, but oil alone is very effective
- May add Esteem for increased scale control, but later application against crawlers is also effective
- Timing by DDs ... before 250 DD (base 51F) starting January 1 (before adults are mature and males leave the scales to mate with females) ... you will do that anyway if the sprays are applied before bloom
Timing control of San Jose scale crawlers

These DD accumulations start with “biofix” (= capture of males in traps). That occurs at roughly the same time as codling moth biofix, so …

<table>
<thead>
<tr>
<th>DD Target</th>
<th>Action taken when target reached</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>Place a piece of black tape, with sticky side out on an infested scaffold limb. Begin examining tape at least twice weekly for minute scale crawlers.</td>
</tr>
<tr>
<td>380-400</td>
<td>Crawler emergence should begin.</td>
</tr>
<tr>
<td>600-700</td>
<td>Maximum crawler movement. This is the best time for an insecticide spray.</td>
</tr>
</tbody>
</table>

When the traps begin to catch males consistently, start accumulating degree-days using a 51°F lower threshold and a 90°F upper threshold. If it is needed, apply a treatment for crawlers around 400-450 DD after you catch the first SJS males (OR around 400-450 DD after the local codling moth biofix date OR ~650-700 DD starting January 1). Be aware that SJS traps may fail to catch any adults if weather is cold, rainy, or windy. **Total generation time for San Jose scale is 900 - 1050 DD.**
## Controlling San Jose scale crawlers in peaches

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Effectiveness</th>
<th>PHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admire Pro</td>
<td>F</td>
<td>7</td>
</tr>
<tr>
<td>Assail</td>
<td>F</td>
<td>7</td>
</tr>
<tr>
<td>Belay</td>
<td>G</td>
<td>7</td>
</tr>
<tr>
<td>Calypso</td>
<td>F</td>
<td>30</td>
</tr>
<tr>
<td>Centaur</td>
<td>E</td>
<td>14</td>
</tr>
<tr>
<td>Diazinon</td>
<td>F</td>
<td>21</td>
</tr>
<tr>
<td>Esteem</td>
<td>E</td>
<td>45</td>
</tr>
<tr>
<td>Movento</td>
<td>G</td>
<td>7</td>
</tr>
</tbody>
</table>
Plum curculio

Assail, Avaunt, and Imidan are products of choice for PC control at petal fall (and sometimes first cover) but not very effective against stink bugs and plant bugs; pyrethroids are effective against plum curculio, plant bugs, and stink bugs.
Degree-days and plum curculio?

- You made a petal fall and maybe a shuck-split spray for curculio control
  - It has only been a few days since that spray, and 1.5 inches of rain falls
    - You have to reapply an insecticide if there is insect pressure (oriental fruit moth or stink bugs)
- Does your next application still have to control plum curculio, or has its egg-laying period ended?
  - By 308 degree-days after petal fall in apples (75%) of blossoms have dropped), plum curculio egg-laying has ended.
OFM Damage to Peaches
Degree-days and OFM

First-generation moth flight (from overwintered larvae) begins about 230 DD (base 45) after January 1. First consistent capture of moths in pheromone traps provides a biofix. Development by degree-days (based on Croft et al. and Rice et al.):

<table>
<thead>
<tr>
<th>Life stage or interval</th>
<th>Degree-days, base 45F</th>
</tr>
</thead>
<tbody>
<tr>
<td>From moth flight to egg hatch</td>
<td>193-200</td>
</tr>
<tr>
<td>Larval development</td>
<td>387</td>
</tr>
<tr>
<td>Pupal development</td>
<td>378-383</td>
</tr>
<tr>
<td>Generation time (adult to adult)</td>
<td>963-965</td>
</tr>
</tbody>
</table>
OFM monitoring and control

- Hang pheromone traps in the upper half of the tree canopy beginning at green tip
  - At least 2 per block
- **Threshold** = 6 to 8 moths per trap per week
- Begin counting degree days at first sustained catch (biofix)
  - **Threshold (base)** = 45° F
OFM monitoring and control

- **Spray timing …**
  - First generation (if needed): first application at 175 DD after biofix; second application in ~14 days or at 350 DD after biofix
  - Subsequent generations: **Threshold** = 6 to 8 moths per trap per week; apply sprays at 175 DD after moth counts that exceed this threshold and again in ~ 14 days
    - **OR**
    - Key timing can be based on the first generation biofix. Generation time = 950 - 965 DD (base 45°F)

<table>
<thead>
<tr>
<th>Generation</th>
<th>Timing of 2 most important sprays</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd</td>
<td>1,150 and 1,450 DD after 1st gen biofix</td>
</tr>
<tr>
<td>3rd</td>
<td>2,100 and 2,450 DD after 1st gen biofix</td>
</tr>
<tr>
<td>4th and 5th</td>
<td>Base on traps catching more than 5-15 moths per trap per week</td>
</tr>
</tbody>
</table>

Reminder: OFM degree-days use a 45°F base
First-generation oriental fruit moth flight begins about 230 DD (base 45F) after January 1.
• **Oriental fruit moth**

  • Pyrethroid resistance confirmed in Calhoun County
    • Survival at diagnostic dose that should kill 99%, 2009-2010:
      • Lab colony 1.3%
      • Urbana susceptible 0.7%
      • Calhoun 1 9.3%
      • Calhoun 2 >81%
    • Because pyrethroids are still used in these orchards for stink bug control, resistance levels will not decline

  • Alternatives
    • Mating disruption – problems in mixed blocks
    • Altacor or Belt, Assail (not Calypso), Delegate, Rimon, Exirel
    • Imidan
Mating Disruption for OFM Control

- OFM Rosso (120 days)
- OFM Twin Tube (180 days)
For spray timing, use pheromone traps (LPTB and GPTB lures in different traps). Hang LPTB traps by late April or May 1. Hang GPTB traps by June 1. Spray for LPTB 7-10 days after traps start catching moths. For GPTB, spray after harvest is complete.

- (Greater) **Peachtree borer and lesser peachtree borer**
  - Trunk sprays still effective
    - Lorsban 4EC ... not to contact fruit
    - Timing generally early May for LPTB.
    - Asana or Warrior postharvest for LPTB and PTB if Lorsban applied in spring
  - Consider transplant dips/drenches for new trees
    - Lorsban 75WG or 4EC
  - Mating disruption
    - Isomate PTB Dual is very effective ... apply by May 1 in southern IL
Degree-days and BMSB … models are still “preliminary”

- Activity begins mid-April to early May … maybe earlier.
- DD model: Base 50F, starting date January 1
  - 85 DD: Adults begin reproductive maturation
  - 360 DD: First active spring adults
  - 566 DD: First egg-laying
- In-season: 538 DD to develop from egg to adult; an additional 148 DD required for female maturation before egg-laying (686 DD egg-to-egg generation time … so second-generation egg-laying occurs around 1252 DD after January 1.
- Third generation? Probably; depends on what triggers diapause

See
http://uspest.org/cgi-bin/ddmodel.us?spp=bms&uco=1&shd=0&mkg=0
and
http://www.stopbmsb.org/stink-bug-basics/life-stages/#_ftnref2
“Warty protuberances” on Redhaven and Contender at the University of Illinois Fruit Research Farm at Urbana.
- NOT peach wart virus
- Possibly related to plant bug feeding
## Results of 2015 Peach Insecticide Trial, Urbana

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% Marketable Fruit</th>
<th>% Catfaced Fruits</th>
<th>Tunnels with Frass / 100 Fruits</th>
<th>Larvae / 100 Fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1- Untreated</strong></td>
<td>24.8a</td>
<td>72.8a</td>
<td>13.5a</td>
<td>1.8a</td>
</tr>
<tr>
<td><strong>2- Assail, Altacor, and Altacor + Warrior</strong></td>
<td>88.8 c</td>
<td>11.3 b</td>
<td>0.0 c</td>
<td>0.0 b</td>
</tr>
<tr>
<td><strong>3- Cyclaniliprole 50 SL, 16.4 fl oz/A</strong></td>
<td>50.3 b</td>
<td>49.8a</td>
<td>2.3 b</td>
<td>0.0 b</td>
</tr>
<tr>
<td><strong>4- Cyclaniliprole 50 SL, 22 fl oz/A</strong></td>
<td>39.8 b</td>
<td>59.8a</td>
<td>0.8 bc</td>
<td>0.0 b</td>
</tr>
</tbody>
</table>
References, resources

• 2016 Midwest Fruit Pest Management Guide

• Illinois Fruit and Vegetable News
  • http://ipm.illinois.edu/ifvn/

• Purdue’s Facts for Fancy Fruit
  • http://www.hort.purdue.edu/fff/fff.shtml

• Great Lakes IPM
  • http://www.greatlakesipm.com/