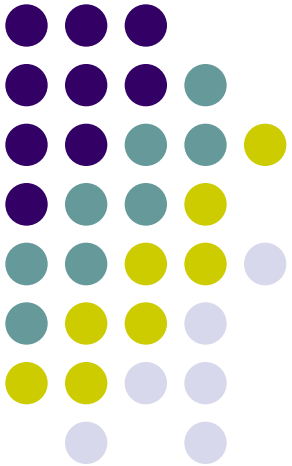
New Issues in Insect Management in Apples and Peaches

Rick Weinzierl
University of Illinois

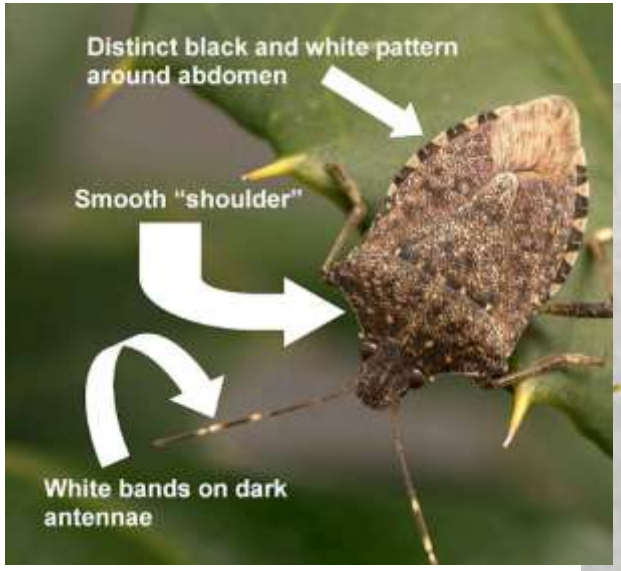
weinzier@illinois.edu

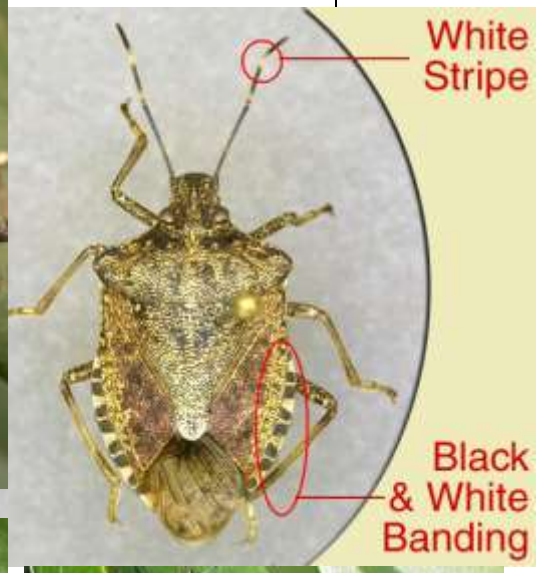


UNIVERSITY OF ILLINOIS
EXTENSION

Brown marmorated stink bug

- *Halyomorpha halys*
- Introduced (NOT intentionally) from Asia, first detected in Allentown, PA, in 1998
- Now established as far west as OH, KY, and IN?
- Overwinters as an adult, aggregates in large numbers in homes and other shelters
- Expect one to two generations per year





Brown marmorated stink bug

- Severe damage to apples, peaches, tomatoes, sweet corn, many other crops
- Many noncrop hosts serve as reservoirs for population buildup
- Very difficult to control … pyrethroids kill nymphs and adults present at the time of application



http://ento.psu.edu/extension/factsheets/brown-marmorated-stink-bug
http://ohioline.osu.edu/hyg-fact/pdf/FS_3824_08.pdf

Spotted Wing Drosophila

A new invasive pest of Michigan fruit crops

Rufus Isaacs

Department of Entomology, Michigan State University

maes research

Project GREEEN

USDA

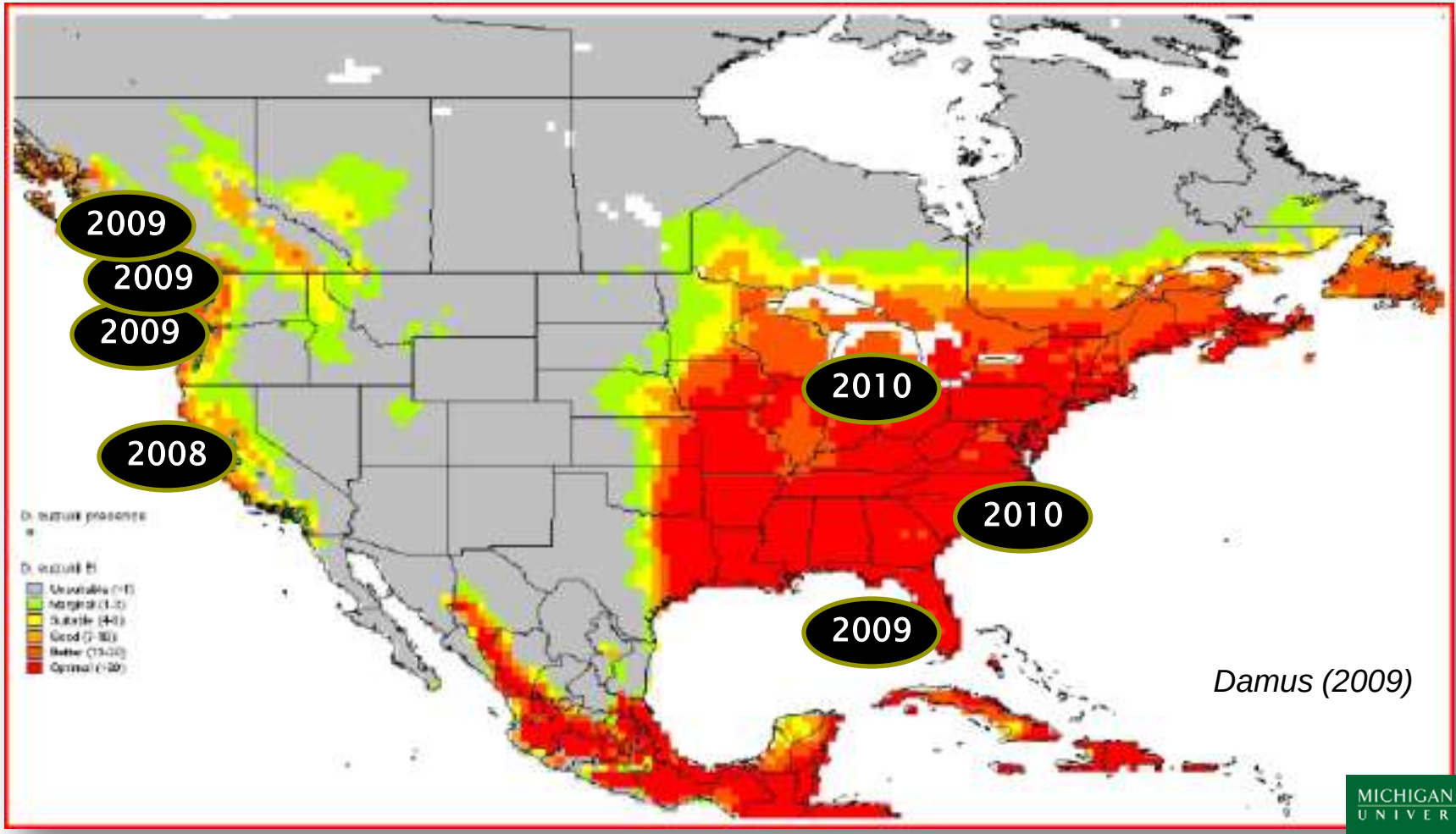
MICHIGAN STATE UNIVERSITY EXTENSION

Spotted wing Drosophila

- Native to East Asia, where it is a pest on fruit.
- Information on climate in Asia used to **predict** distribution in the Americas.
- Detected in CA in 2008, OR, WA, BC, FL in 2009, UT, SC, NC, MI, WI in 2010

Where has SWD been detected?

- Detected in CA in 2008, OR, WA, BC, FL in 2009, UT, SC, NC, MI, WI in 2010



MICHIGAN STATE UNIVERSITY

2010 Monitoring for SWD in Michigan

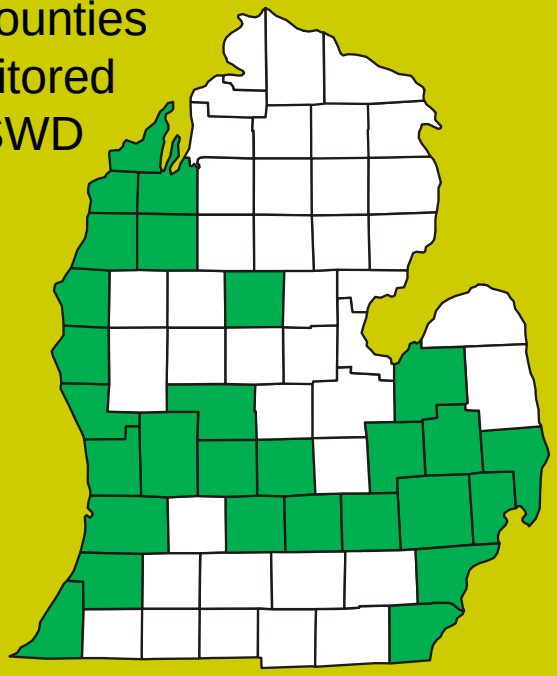
Over 300 traps deployed in spring, more in late September

Detections in blueberry, raspberry, grape, cherry, rest areas, backyards.

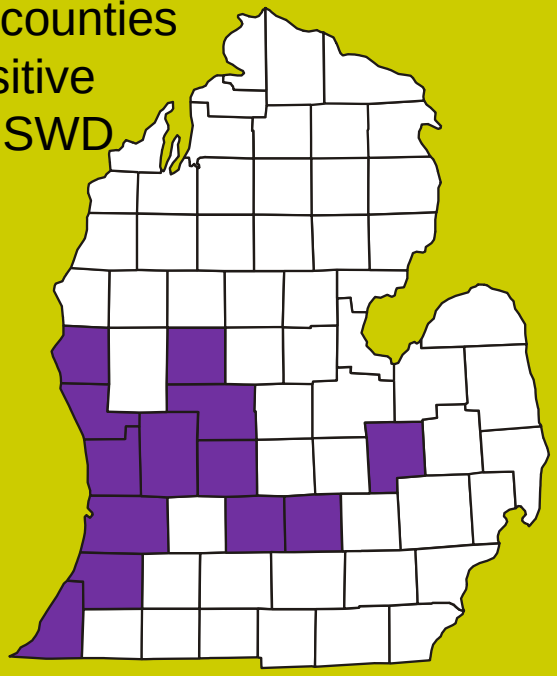
Highest activity of SWD was late-season, well into November.

13 counties positive for SWD as of Nov 20, 2010.

27 counties monitored for SWD



13 counties positive for SWD



MICHIGAN STATE UNIVERSITY

Fruit affected by SWD

Highest risk

Strawberries
Raspberries
Cherries
Nectarines
Blueberries
Blackberries

Moderate risk

Peaches
Grapes
Pears
Apples
Tomato

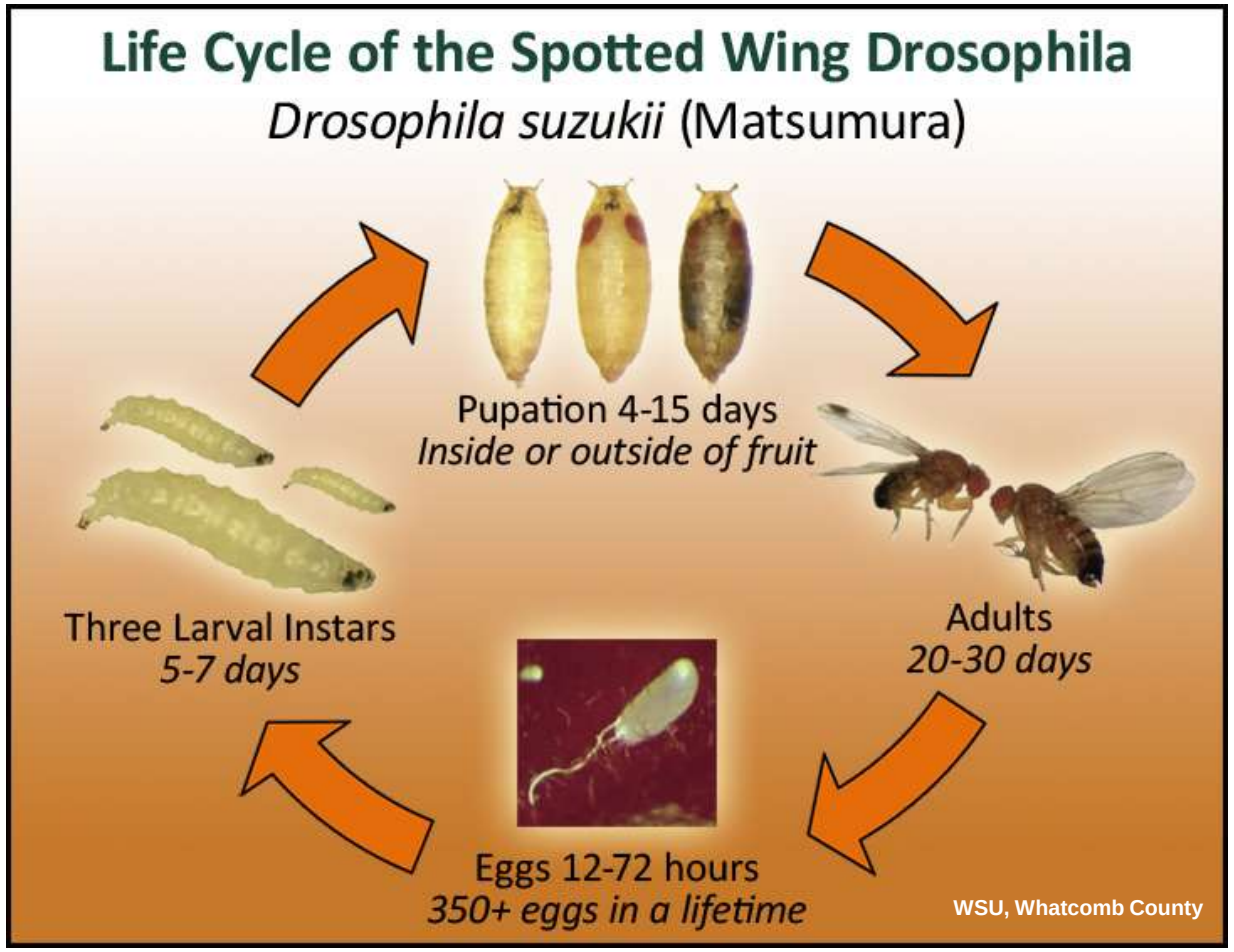
Alternate hosts

Wild plants with berries, such as…

Snowberry
Elderberry
Pokeweed
Dogwood




Biology of SWD



- Optimal development is at 65-70°F, **~12 day** generation time.
- Adult flies live for 3-6 weeks, and females can lay over 300 eggs.
- Limited by high heat in summer and by winter cold. But, SWD populations are found in cold regions of Japan.

MICHIGAN STATE UNIVERSITY

Strawberry, raspberry, and blackberry are hosts for SWD

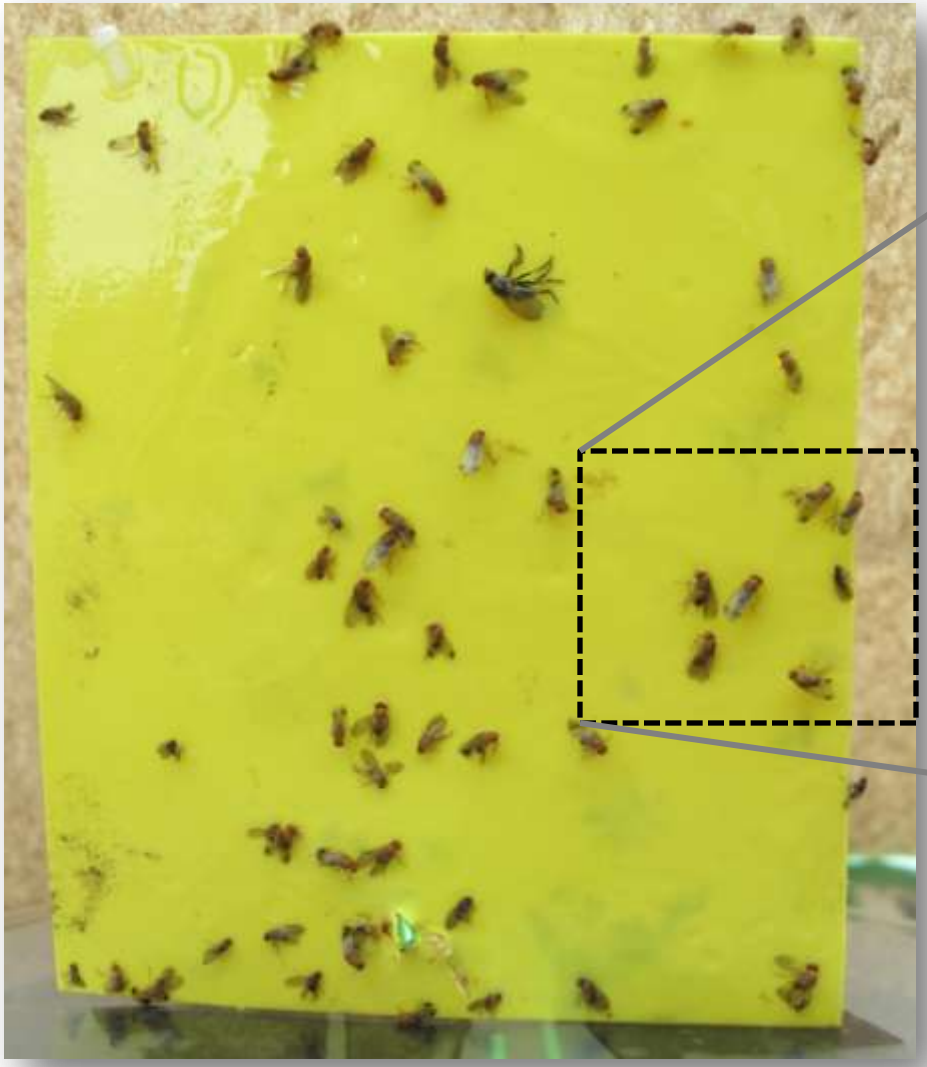
Monitoring SWD

Approx. $1/trap for materials and construction.

- Plastic cup with side holes, apple cider vinegar bait.
- Use small yellow sticky trap to capture flies. Or, use only vinegar with a drop of unscented soap.
- Hang in fruit canopy near fruit and in the shade.
- Change vinegar weekly, and dispose away from trap.
- Best detection potential expected as fruit ripens.
- Check weekly, and record catches.

MICHIGAN STATE UNIVERSITY

Spotting SWD males on traps



MICHIGAN STATE UNIVERSITY

SWD identification

MALE

M. Hauser, UC

dark spot on each wing

two dark bands on each foreleg

FEMALE

two rows of serrations on ovipositor

no dark spots on wings

M. Hauser, UC

Click HERE for a detailed key for identifying SWD

MICHIGAN STATE UNIVERSITY

Checking fruit for SWD

To see eggs on berry surface

Look for pits in fruit surface or egg tubes

Use a 30x hand lens, also available with LED light for better viewing

To check berries for SWD larvae

Start as fruit begins coloring

Sample 1-2 lbs, ripest suspect fruit

Place in a shallow pan

Pour solution over: 1 Tbsp salt in 1 cup water

Look for mature larvae

Eggs and smallest larvae difficult to detect

MICHIGAN STATE UNIVERSITY

IPM for SWD

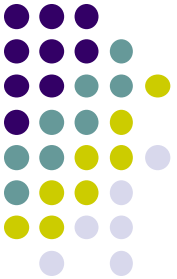
- Midwest growers should be prepared to monitor and manage SWD in 2011.
- If SWD is present, protection is needed from fruit coloring to harvest.
- Remove over-ripe/infested fruit to minimize breeding sites.

IPM for SWD

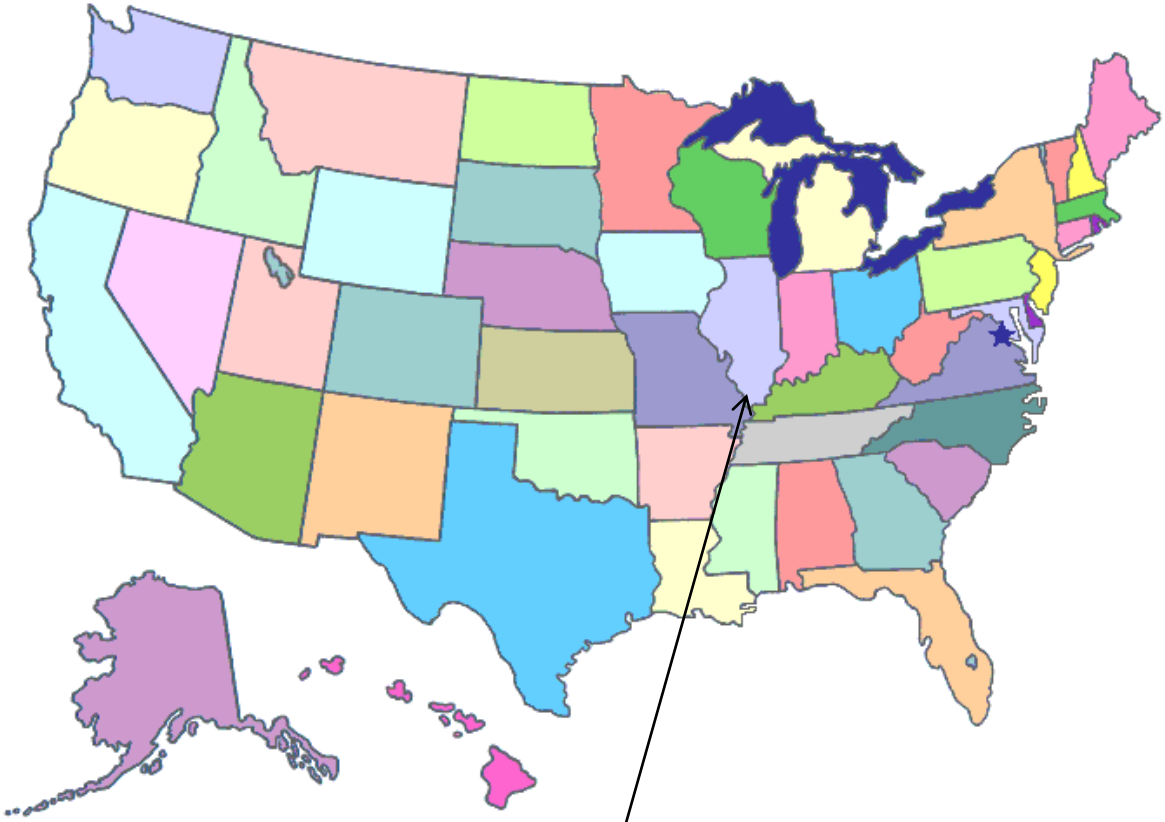
- If flies are detected, SWD is sensitive to OP (e.g. Malathion) and pyrethroid (e.g. Brigade) insecticides.
- Beware of PHIs, REIs, safety issues.
- Current IPM programs might require adjustment if SWD is detected.
- Entrust and Pyganic are the most effective organic insecticides. Shorten interval (5 days) to maintain control.
- Stay informed through workshops, newsletters, websites.

Comstock Mealybug on Peaches

Date and location:



- Reported on August 7; first detected by grower around July 15
- Insecticides applied before I was contacted; grower identified problem as woolly apple aphid on peaches
  - Diazinon
  - Movento
- Egg masses common on fruit, limbs, and bases of new shoots
- Adults and living immatures rare from August through September



Near Murphsyboro, IL

Identification

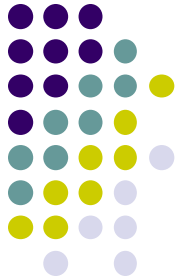
- Submitted through the Cooperative Agricultural Pest Survey (CAPS) because of concerns about pink hibiscus mealybug
- Identified by Dr. Gregory Evans, USDA APHIS PPQ Systematic Entomology Laboratory
- Comstock mealybug, *Pseudococcus comstocki* (Kuwana) (Hemiptera [Homoptera]: Pseudococcidae)
- Although the published range of Comstock mealybug includes the Ohio River Valley and the lower Mississippi River Valley, this is the first observation of Comstock mealybug on peaches in IL and the only time I have seen mealybugs on peaches or apples in Illinois in over 20 years of field extension work.

Contributing factors?

- No organophosphate insecticides
- Extremely hot, dry summer
- Proximity to natural area (park)
- ??

- Photos at http://ipm.illinois.edu/mealybugs/

Common pests of apples



- Direct pests (arthropods) include:
  - Plum curculio
  - Codling moth
  - Oriental fruit moth
  - Apple maggot
  - Stink bugs and plant bugs
  - Leafrollers (obliquebanded, red-banded, and tufted apple bud moth)
  - Asian multicolored lady beetle
- Indirect pests (arthropods) include:
  - San Jose scale
  - Spotted tentiform leafminer
  - White apple leafhopper, potato leafhopper
  - Rosy apple aphid, “green” aphids, and woolly apple aphid)
  - European red mite
  - Dogwood borer
  - Japanese beetle

For codling moth in 2011 …

- Four alternative and reduced-risk chemistries are available:
  - Assail and similar neonics. Assail: Limit of 4 applications, 7-day PHI; excellent against CM, OFM, aphids, leafhoppers, leafminers; fair to good against plum curculio, apple maggot, San Jose scale, plant bugs, and Japanese beetle. (See labels for Calypso and Clutch.)
  - Rimon. Limit of 4 applications, 14-day PHI; excellent against CM, leafrollers, leafminers and OFM; some activity against Japanese beetle, and a little suppression of leafhoppers and plant bugs, but primarily a Lep killer
  - Altacor (and Belt). Limit of 3 applications (at recommended rate), 5-day PHI in apples, 7- to 10-day PHI in peaches. Altacor is excellent against CM, OFM, and other Leps. Belt label does not list OFM.
  - Delegate. Limit of 4 applications, 7-day PHI (14 for peaches). Use against CM, OFM, other Leps … not effective against other pests

Pheromones for mating disruption

- "Twist-tie" type dispensers
  - Isomate C-Plus, NoMate-CM, CheckMate-CM
  - "Twin-tubes" available
- Sprayable pheromones
  - CheckMate CM from Suterra, Certis markets 3-M's sprayable pheromones
- Last Call
  - Pheromone plus permethrin, dispensed in small droplets (IPM Tech)
- Others

All codling moth pheromone products are effective against only the target species, in this case, the codling moth. Specific products also are available to disrupt mating of oriental fruit moth, dogwood borer, and the peachtree borers.

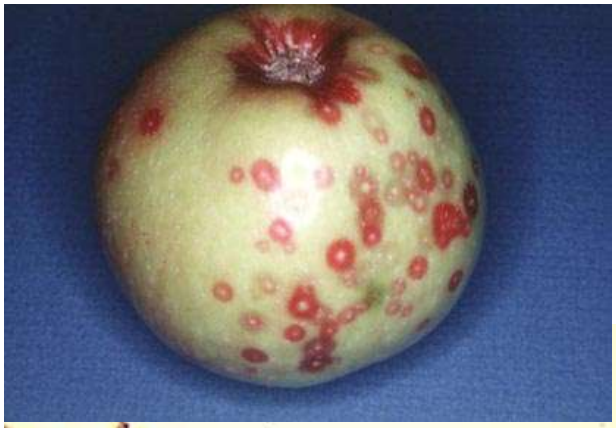
Other insecticide updates

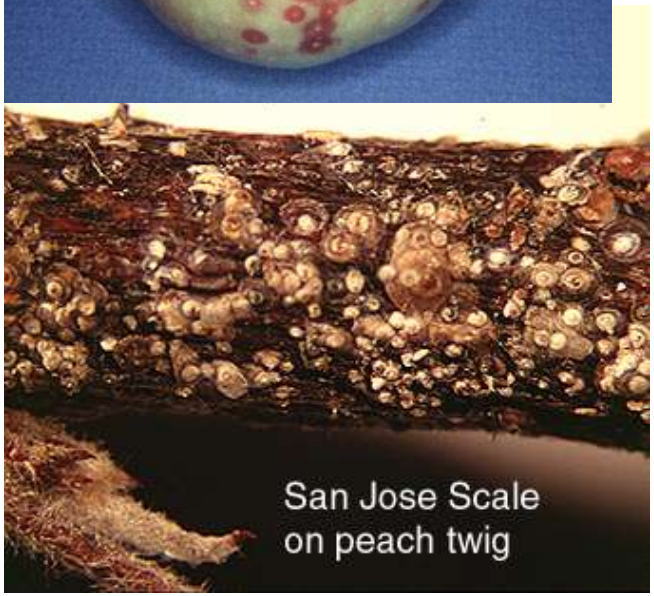
- Guthion 50W
  - LIMIT OF 1 APPLICATION PER SEASON IN 2011 … see product label
- Movento … reregistered
  - Labeled for apples and grapes
  - Targets: San Jose scale and woolly apple aphid in apples, grape phylloxera in grapes

Organics

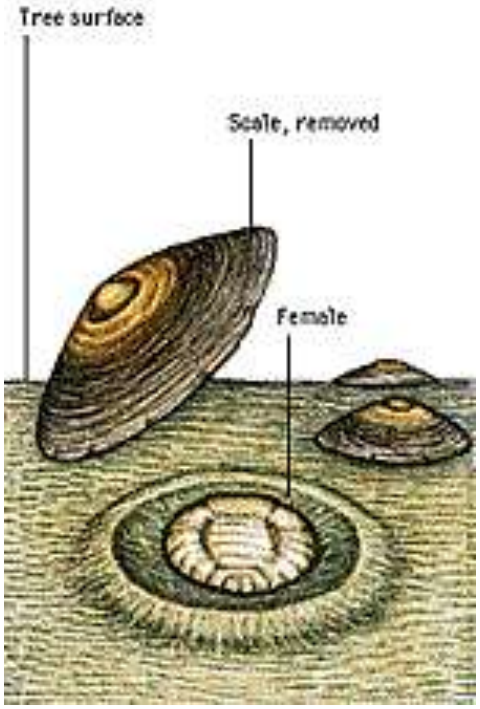
- Mating disruption against codling moth (Isomate C-Plus ties)
- Codling moth virus against codling moth
- Entrust against codling moth (fair at 7- to 10-day intervals), apple maggot, STLM, leafrollers
- GF-120 (same ingredient as in Entrust) as a bait for apple maggot control
- BT (Dipel and others) against leafrollers
- Oils against San Jose scale, mites, and aphids
- Neemix and pyrethrins against Japanese beetle

San Jose scale



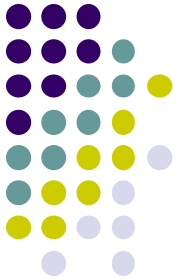


- Increasing problems in several orchards in recent years (even in managed orchards)
- Why?
  - Long-term population density cycle on other hosts?
  - No post-bloom use of Lorsban or Penncap-M to kill crawlers

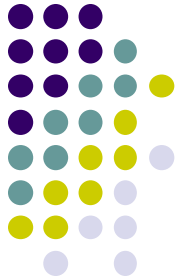


Immature males and females overwinter under scales, and males emerge and fly to females around bloom. Females give birth to live nymphs under the protective cover of the scale. Crawlers become active a few weeks later.

Prebloom … Oils at green tip to pink suffocate insect stages that are coated with the 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, rosy apple aphid eggs, and 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, Supracide, or Diazinon to improve scale and aphid control, but oil alone is very effective
- May add Esteem for increased scale control, but later application against crawlers is also effective.
- Early timing (green tip) is best for scale control; later timing (half-inch green to pink) is better against European red mite and rosy apple aphid

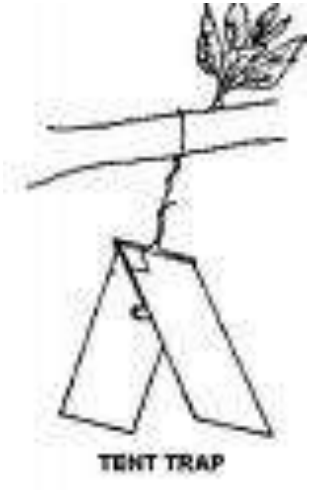


Against mites

- Oil at green tip to pink
- Apollo, Savey, or Agri-Mek at petal fall
- Nexter, Zeal, Acramite, Fujimite, Kanemite, Envidor in summer cover sprays
- Summer oils at ½ to 1 percent; consider fungicide compatibility

Against San Jose scale

- Oil at green tip to pink
- Lorsban at green tip to pink (with oil)
- Esteem at green tip to pink (with oil) or against crawlers (~ 3rd cover)
- Centaur, Esteem, or Assail against crawlers (~3rd cover after petal fall)



DD Target	Action taken when target reached
300	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.
380-400	Crawler emergence should begin.
600-700	Maximum crawler movement. This is the best time for an insecticide spray.

Hang baited pheromone traps by early bloom. 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 600 to 700 DD after you catch the first males. Be aware that the traps may fail to catch any adults if weather is cold, rainy, or windy. Total generation time for San Jose scale is 1050 DD.

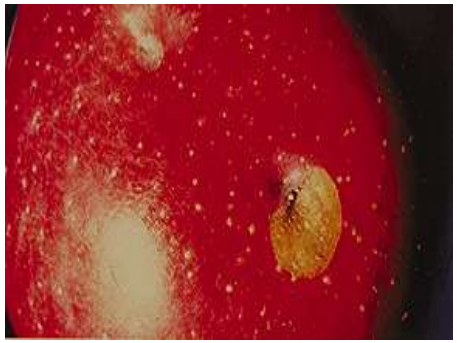
Later control of San Jose scale

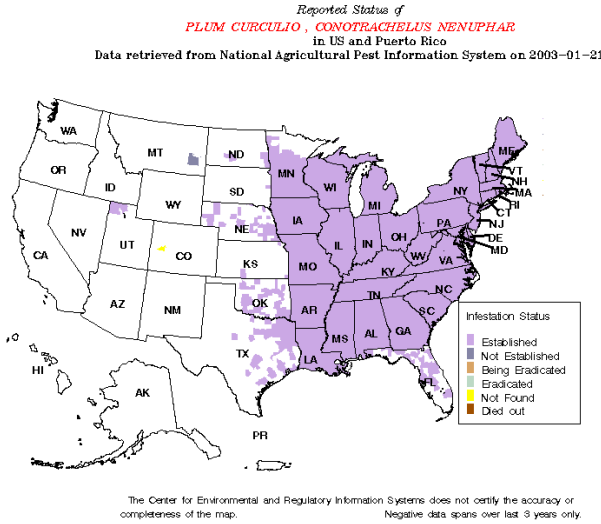
- Crawler activity begins around 4-6 weeks after bloom; monitor with black sticky tape where infestations were apparent the previous year
- Insecticides include
  - Movento (Group 23)
  - Esteem (Group 7)
  - Assail (Group 4A)
  - Centaur (Group 16)
  - Diazinon (Group 1B)

Bloom

- Hang codling moth pheromone traps
  - Order from Great Lakes IPM, Suterra, or Gempler's
  - Use at least 3; then 1 per 5 acres up to 10 – 12 traps per farm
- Hang codling moth mating disruption dispensers (Isomate C-Plus) or begin applications of sprayable pheromone or Last Call if mating disruption is to be used against codling moth
  - Use additional 10x lures in traps to measure success of mating disruption

Plum curculio





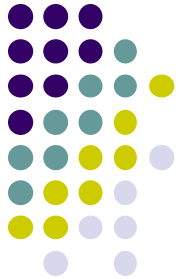
Guthion, Imidan, and Avaunt are products of choice for PC control at petal fall (and sometimes first cover)

Apple maggot

- Hang traps by June 1; minimum of 3 per block, outside of border rows facing woods
- Threshold = 1 AM fly per unbaited trap; 5 per baited trap (or more conservative, but not zero)
- Treat when threshold is reached; begin monitoring traps again in 14 days or after rains that remove residues
- Effective: Guthion, Imidan, Assail, Calypso, Diazinon, Pyrethroids
  - Not as good: Avaunt and SpinTor/Entrust
  - Rimon, Delegate, and Altacor are not effective against apple maggot
- Sprays not needed after mid-August ???

Possible maximum cover spray program for apples, 2011

(assumes a risk of OP-resistant CM)



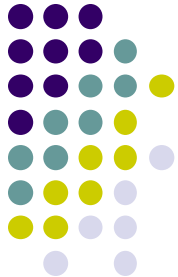
- Biofix
- Petal Fall
  - Avaunt OR Imidan OR [Rimon+Imidan]
- 1st cover … still probably <240 dd since biofix
  - Avaunt OR [Rimon + Imidan]
- 2nd cover (CM hatch now much greater, apple maggot egg laying may be underway)
  - Assail (5.3 ounces/acre for CM, up to 7 ounces/A against AM) or Calypso

Sprays at petal fall target plum curculio & leafrollers. Codling moth egg-laying is underway, so Rimon can be used for early CM control, but it will not control PC.

Either of these choices will finish off PC control if needed and provide adequate early control of CM as egg hatch begins before the next spray.

Of the reduced-risk products for CM control, Assail is most effective against AM and somewhat useful against WAA and SJS.

Possible maximum cover spray program for apples, 2011

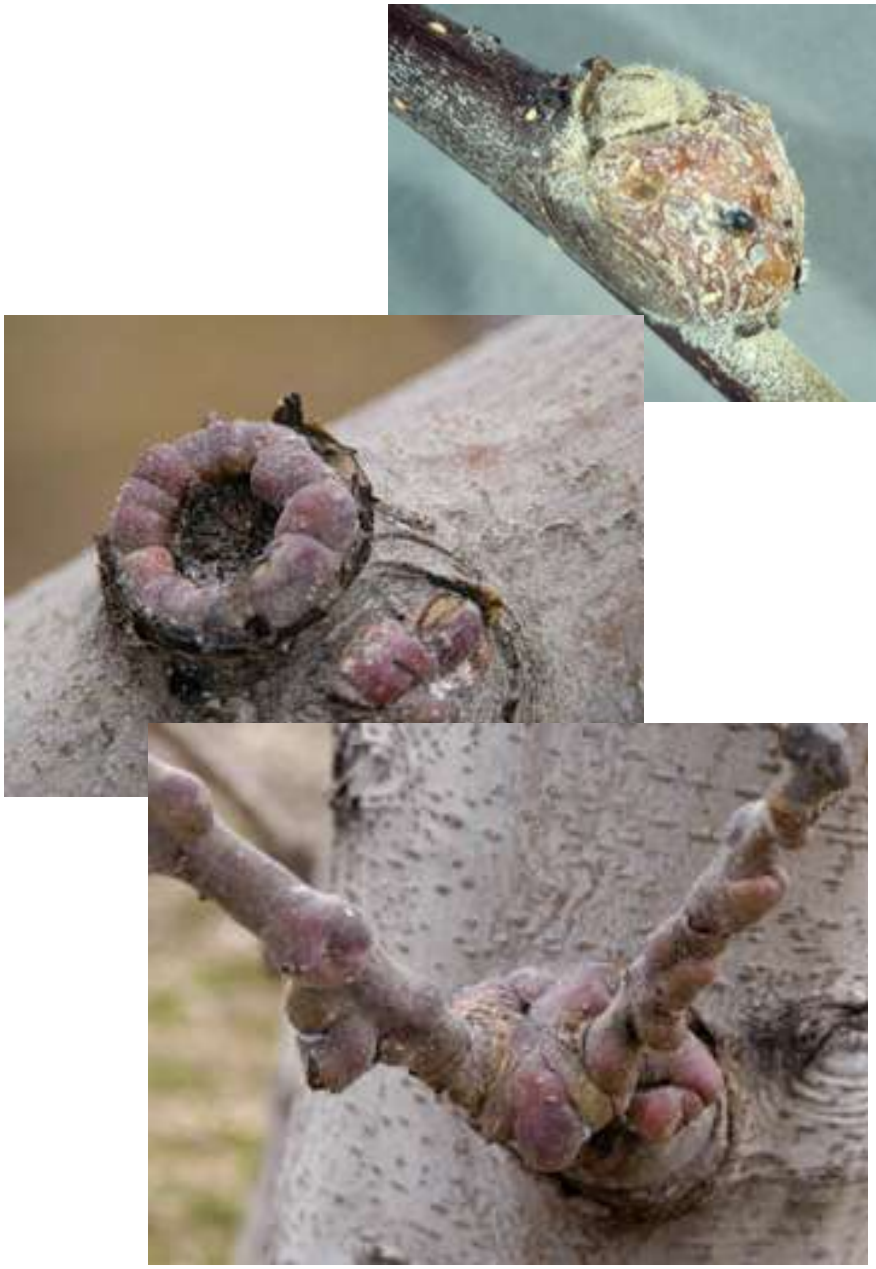


- 3rd cover
  - Assail (5.3 ounces/acre for CM, up to 7 ounces/A against AM) or Calypso
- 4th cover
  - Assail (5.3 ounces/acre for CM, up to 7 ounces/A against AM) or Calypso
- 5th cover
- 6th cover
- 7th cover
- 8th cover

These two sprays carry to the end of 1st gen CM hatch and nearly all of AM egg-laying. Continue to check AM traps to determine need for further control.

These sprays all depend on need … indicated by counts of CM males in pheromone traps and AM flies on red sphere traps. Either Altacor or Delegate will control CM during this period.

Woolly apple aphid colonies on shoots.



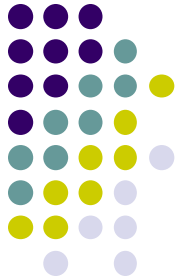
Twig galls caused by
woolly apple aphid.

Woolly apple aphid colony and galls on apple roots.

Woolly apple aphid life history

- All WAA on apples are female; when mature they give birth to live young without mating.
- Nymphs overwinter below ground on roots; movement to and from shoots occurs throughout the growing season.
- Production of males, mating, and egg-laying occurs only on American elm. Parthenogenic reproduction on apples sustains populations.
- Feeding causes galling on roots and shoots; heavy infestations on roots can kill young trees.

Woolly apple aphid management



- Resistant rootstocks
  - Reduce WAA numbers and movement up to foliage
  - Suffer less galling
- Insecticides
  - Soil drenches of new transplants – Admire
  - Foliar applications
    - Previously recommended: Diazinon, Endosulfan, and Provado
    - Recently registered: Movento

Mixtures

- Assume a half-rate of A provides 70 percent control of the target pest and a half-rate of B also provides 70 percent control. How much control will the mixture provide?
  - If the action of the two ingredients is independent (two completely different modes of action and detoxification routes) …
  - A controls 70 of 100 insects … 30 remain alive.
  - B controls 70 percent of those 30 … 21 dead and 9 remain alive
- If the target pest population already contains a portion that is resistant to A or B, control provided by that ingredient will be less than 70 percent

Mixtures

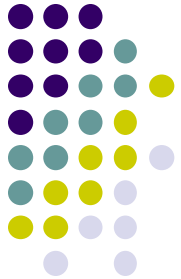
- Where resistance is already an issue for several pests, mixtures may be valuable to control multiple pests (one ingredient against some, the second against others), but mixtures are not well suited for preventing resistance development.
- Rates of each ingredient have to be high enough to provide control for the necessary treatment interval.

Mixtures

- Appropriate mixtures in apples or peaches might include
  - Apples: Altacor or Delegate or Rimon to control OP-resistant codling moths plus Imidan for apple maggot control or plum curculio control
  - Peaches: Altacor or Delegate or Assail (or mating disruption) to control pyrethroid-resistant oriental fruit moths plus Permethrin to control stink bugs and plant bugs

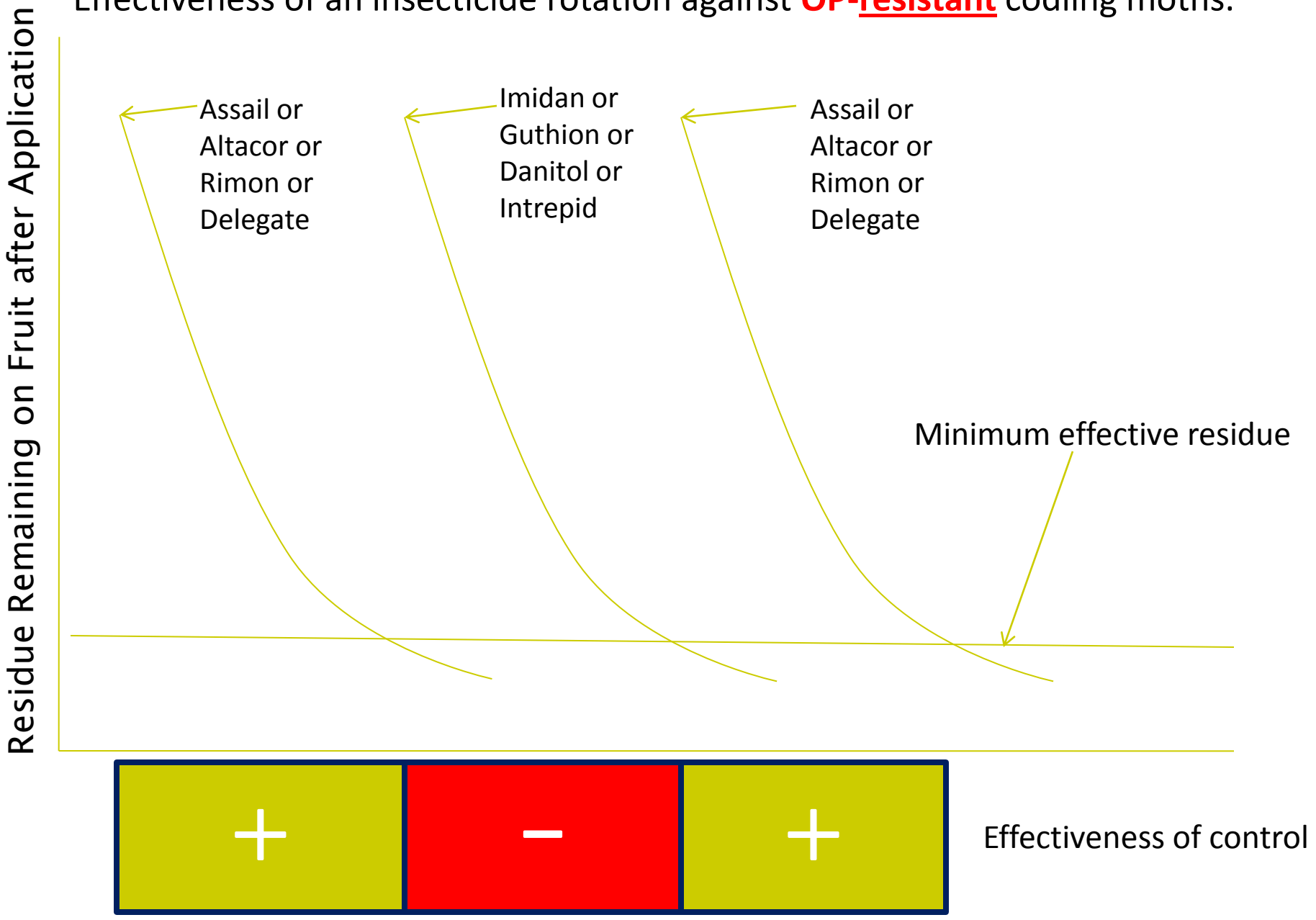
These mixtures are not intended to delay resistance development but to manage a pest complex in which resistance is already an issue for one or more species.

Rotations (to delay resistance development)



- Insecticide A for a period, then insecticide B, (then insecticide C), then back to A
- Goal is to not use the same insecticide against successive generations of the same pest
- Any increase in resistance gene frequency (and prevalence of resistant insects) may decline again in the absence of treatment (selection). (This decline may or may not happen, but there is no negative cost to effective rotations.)

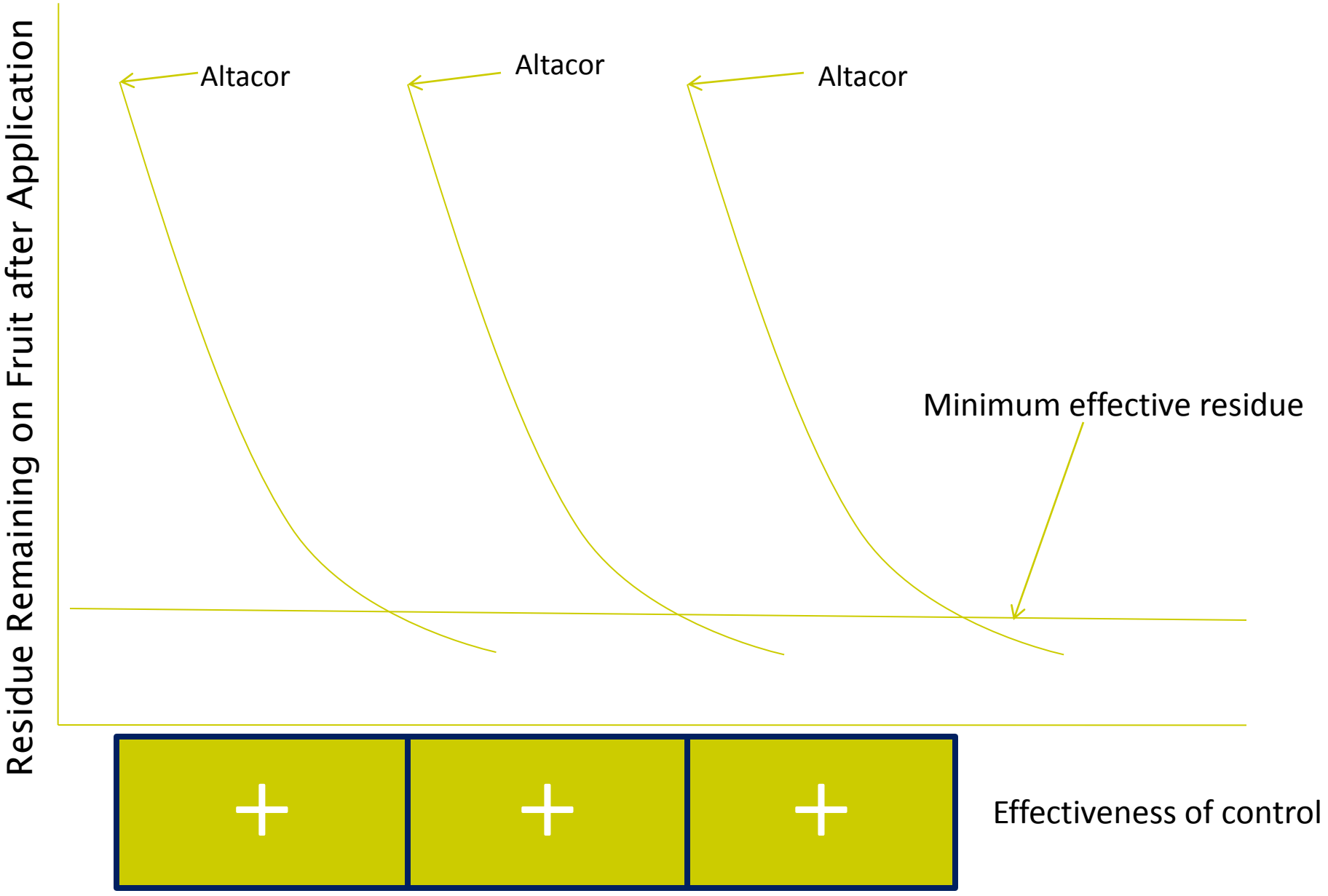
Effectiveness of an insecticide rotation against **OP-resistant** codling moths.



Making rotations work

- If resistance to a given insecticide already exists, it cannot be part of a rotation scheme against that pest (especially for internal pests, because they cannot be controlled after they enter fruit).
- The best approach to using rotations against key resistant pests in apples and peaches (codling moth and oriental fruit moth) is to rotate from generation to generation.
- Mixtures that include insecticides to control other pests may be necessary.

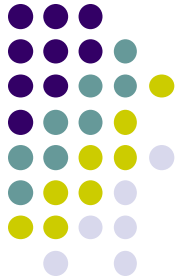
First generation insecticide applications against **OP-resistant** codling moths.



Other options

- Codling moth granulosis virus
  - Cyd-X, Virosoft CP4, Carpovirusine
  - Use low rates repeatedly in first generation sprays or throughout the season
- Mating disruption
  - Multiple products are available, but the "standards" are still
    - Isomate C-Plus for codling moth; full rate is 400 dispensers per acre
    - Isomate M-100, Isomate OFM Rosso, and Isomate OFM Twin Tubes for oriental fruit moth

Specialty suppliers



- Great Lakes IPM (lures, traps, mating disruption products)
  - 989-268-5693; http://www.greatlakesipm.com/
- Gempler's (lures, traps, mating disruption products)
  - 800-382-8473; http://www.gemplers.com/
- Suterra (lures, traps, sprayable pheromones)
  - 541-317-2231; http://www.suterra.com
- Pacific Biocontrol (Isomate pheromone ties)
  - 360-574-9726; http://www.pacificbiocontrol.com
- IPM Tech (Last Call)
  - 888-476-8727; http://www.ipmtech.com/
- Certis (3M's sprayable pheromones)
  - 800-847-5620; http://www.certisusa.com/

References

- 2011 Midwest Commercial Tree Fruit Spray Guide
  - http://www.extension.iastate.edu/Publications/PM1282.pdf
- Midwest Tree Fruit Pest Management Handbook
  - http://www.ca.uky.edu/agc/pubs/id/id93/id93.htm
- Illinois Fruit and Vegetable News
  - http://www.ipm.uiuc.edu/ifvn/index.html