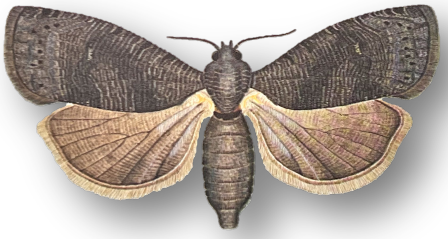
Insect Pest Management of Stone Fruit in the Hudson Valley of NYS



Oriental Fruit Moth
Grapholitha molesta
Invasive: China 1913

Plum Curculio
Conotrachelus nenuphar
Native

Codling Moth
Cydia pomonella
Invasive: Asia-Europe 1700's ?

Brown Marmorated Stink Bug
Cydia pomonella
Invasive: Asia-Europe 1700's ?

Peter J. Jentsch
Poma Tech Inc.

2022 New England Vegetable and Fruit Conference
DoubleTree Hotel in Manchester, New Hampshire
December 13-15

Tuesday, December 13th @ 2:30 PM

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Insect Pests of Stone Fruit

- *American plum borer*
- Cherry fruit fly (Native & European)
- Fruitworms and Leafrollers (GFW, OBLR…)
- *Green Peach Aphid*
- *European red mite*, *two spotted spider mite*
- *Spotted Lanternfly* (Hudson Valley)

- ***Oriental fruit moth****
- ***Peachtree borer* & Lesser peachtree borer***
- ***Plum curculio****
- ***Stink bugs****
- ***Tarnished plantbug****
- ***Spotted Wing Drosophila****

Occasional pests:

Japanese beetle, *Lecanium scale*, rose chafer, *San Jose scale*
White (Prunicola) Scale, *Western Flower Thrips*.

Insect Pests of Stone Fruit

Peach & Nectarine

- *American plum borer*
- Fruitworms and Leafrollers
- *Green Peach Aphid*
- *Lesser peachtree borer*
- *European red mite, two spotted spider mite*
- *Spotted Lanternfly*

- ***Oriental fruit moth****
- ***Peachtree borer***
- ***Plum curculio****
- ***Stink bugs****
- ***Tarnished plantbug****


Mark Dreiling, Bugwood.org

Occasional pests:

Japanese beetle, *Lecanium scale*, rose chafer, *San Jose scale*
White (Prunicola) Scale, *Western Flower Thrips*, *Spotted Wing Drosophila*

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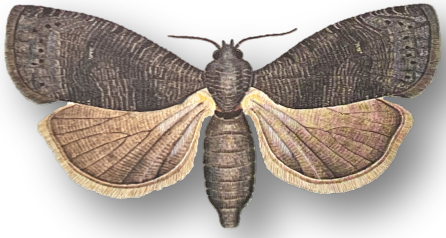
Oriental Fruit Moth *Grapholita molesta*

- Primary Insect Pest in Peach



- Native to China; introduced about 1913
- Hosts include peach, plum, cherry, apricot, nectarine, apple, pear,
- OW stage as pupa in silk cocoon, often within the orchard
- Eggs laid on the surface of leaves
- The 1st gen. larva tunnel into newly growing shoots, killing the terminal bud
- Larvae undergo 4-5 instars stages
- The adult is small, mottled dark primary winged moth ¼" length
- 2nd – 3rd Gen. cause fruit infestation (Gummosis & Frass)

Cornell University NEWA forecasting site: http://www.newa.cornell.edu/.

Oriental Fruit Moth, *Grapholita molesta*

Primary insect pest in stone fruit

1st Gen. Flagging shoot Infestation

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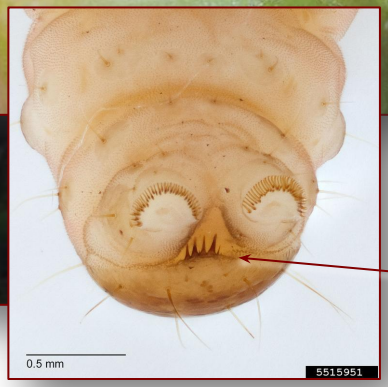
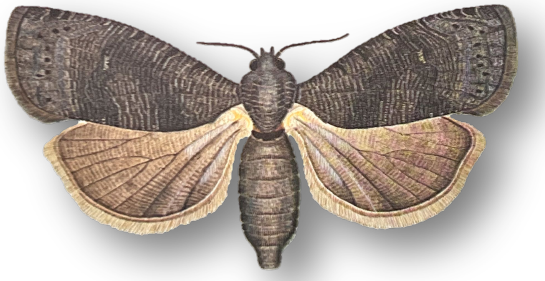
Oriental Fruit Moth

2nd Gen. fruit Infestation



Comb present

Oriental Fruit Moth
Monitoring



OFM

- Wing-Trap

- OFM Pheromone

- Grid patterned liner
- 1 **trap per** 10 **acres** for 30- to 80-**acre** orchards
- 1 **trap per** 20 **acres** for orchards larger than 80 **acres**.

Threshold: 10 OFM /trap/week

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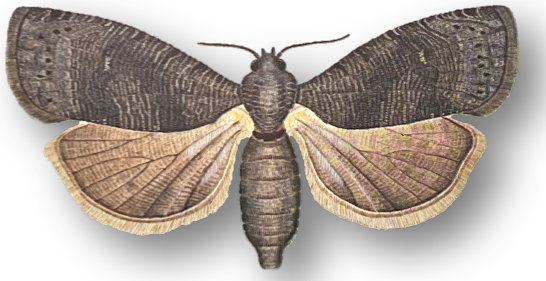
Oriental Fruit Moth
Predictive Modeling



OFM
Trap data to establish
Biofix

NEWA

a partnership of IPM & Cornell University

Dashboard | Weather Tools | Crop & IPM Tools

Integrated Pest Management Tools for Crop Production

Apples | Berries | Field Crops | Grapes | Ornamentals | Vegetables | Other resources | Other decision systems

Apples

Diseases | Insects | Thinning and irrigation | Top of page

Apple Insect Pests

Apple Maggot. This degree day model tracks base 50° F BE degree days to time red sphere trap deployment to manage apple maggot (*Rhagoletis pomonella*).

Codling Moth. This tool predicts codling moth (*Cydia pomonella*) life stages with base 50° F BE degree days to identify treatment windows with management guidelines.

Obliquebanded Leafroller. Using base 43° F BE degree days, this tool delineates obliquebanded leafroller (*Choristoneura rosaceana*) development, sampling strategies, and management guidelines.

Oriental Fruit Moth. This degree day tool (base 45° F BE) tracks oriental fruit moth (*Grapholita molesta*) development across three generations, identifies treatment windows, and provides management information.

Plum Curculio. This tool uses base 50° F BE degree days to estimate the emigration of plum curculio (*Conotrachelus nenuphar*) into the apple orchard following petal fall, the need for treatment and when treatment can cease.

San Jose Scale. Follow San Jose scale (*Comstockaspis perniciosus*) development using base 50° F BE degree days to identify treatment windows along with management guidelines.

1. Log-in
2. Crop IPM Tools
3. Apples
4. Insects
5. Pest: Oriental Fruit Moth
6. Degree Day Accumulation Calculator

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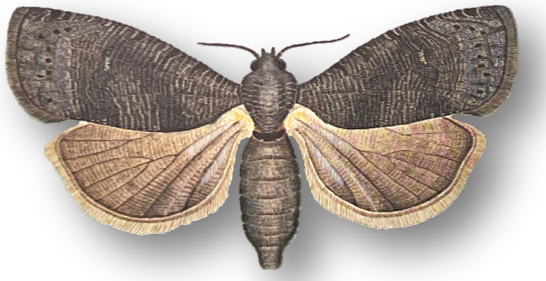
Oriental Fruit Moth



OFM

NEWA

a partnership of IPM & Cornell University

Dashboard | Weather Tools | Crop & IPM Tools

NEWA

WATCH TUTORIAL

First Trap Catch of the 1st Generation

** First Trap Catch of the 1st Generation

04/24/2019 clear

Favorite Stations

Highland HVL, NY

First Trap Catch date above is estimated based on degree day accumulations or user input. Enter the actual date for blocks of interest and the model will calculate the protection period after first trap catch more accurately.

* Date of Interest

May 2019
2019

Su	Mo	Tu	We	Th	Fr	Sa
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

Accumulated degree days (base 45°F BE) first generation first trap catch through 5/10/2019: **169**

* ‘Todays’ date

** Biofix – Date of Sustained catch (Often weather dependent)

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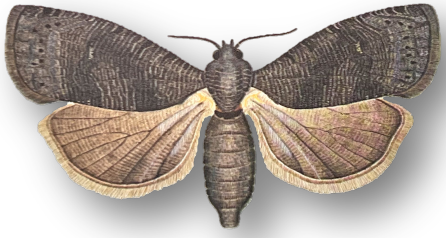
Oriental Fruit Moth *Grapholita molesta*

- Life Cycle



***OFM mature faster in peach** than on apple
Approximately 20-60 degree-days earlier emergence then on apple

1st Generation OFM management begins for
Peach @ (170-200 DD $_{45BE}$)
Apple @ (200-220 DD $_{45BE}$)

*May 2007. Journal of Economic Entomology 100(2):421-30.
C.T. Myers, L.A.Hull, G. Krawczyk

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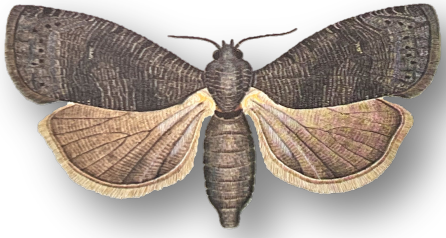
Oriental Fruit Moth *Grapholita molesta*

- Life Cycle



Biofix

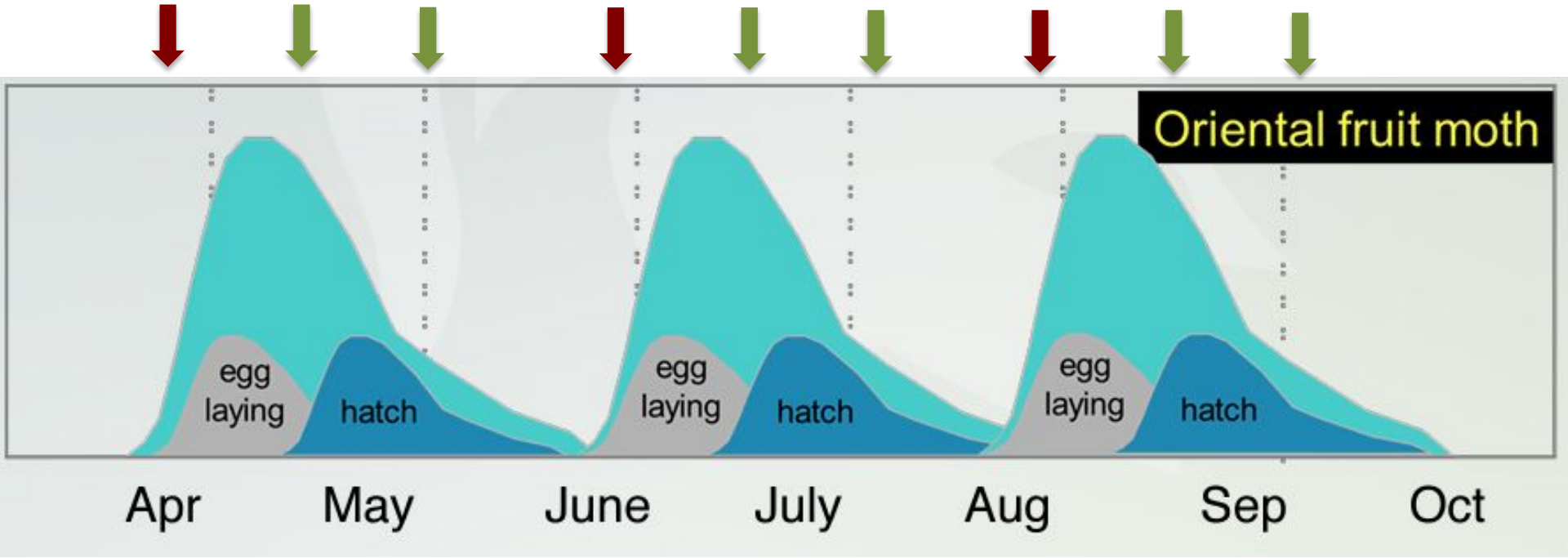
First sustained adult flight

Begin DD Accumulations

***OFM mature faster in peach** approximately 20-60 degree-days earlier emergence on peach than on apple (200-220 DD $_{45BE}$)

Management at egg hatch (Peach)

10% hatch @ **170-200 DD** $_{45BE}$



3 overlapping generations / yr. in Hudson Valley

*May 2007. Journal of Economic Entomology 100(2):421-30.
C.T. Myers, L.A.Hull, G. Krawczyk

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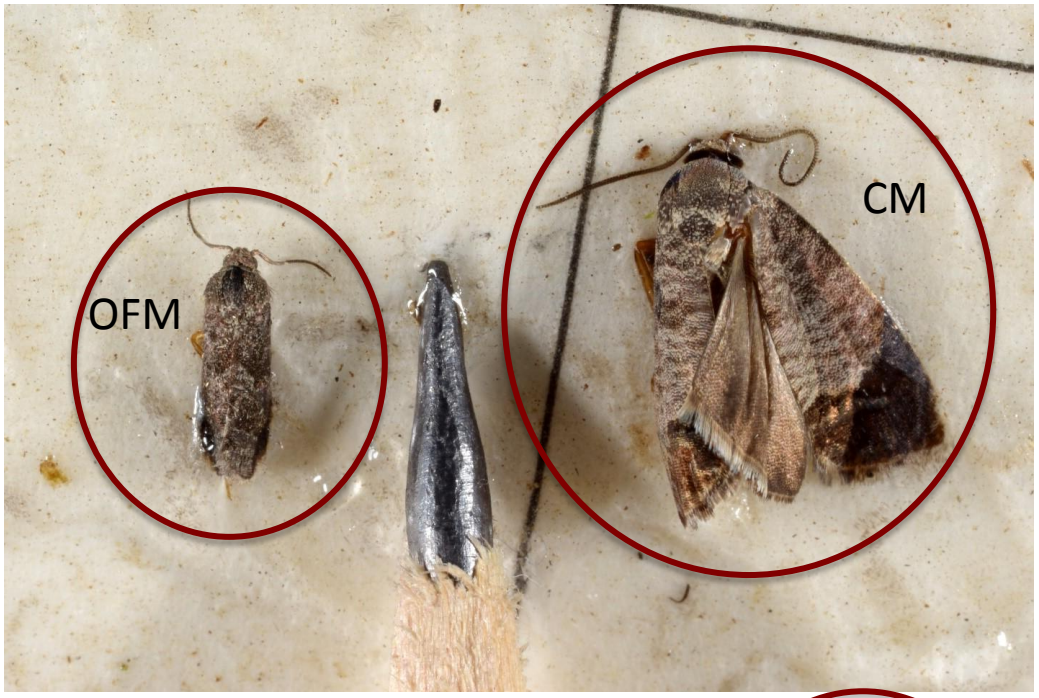
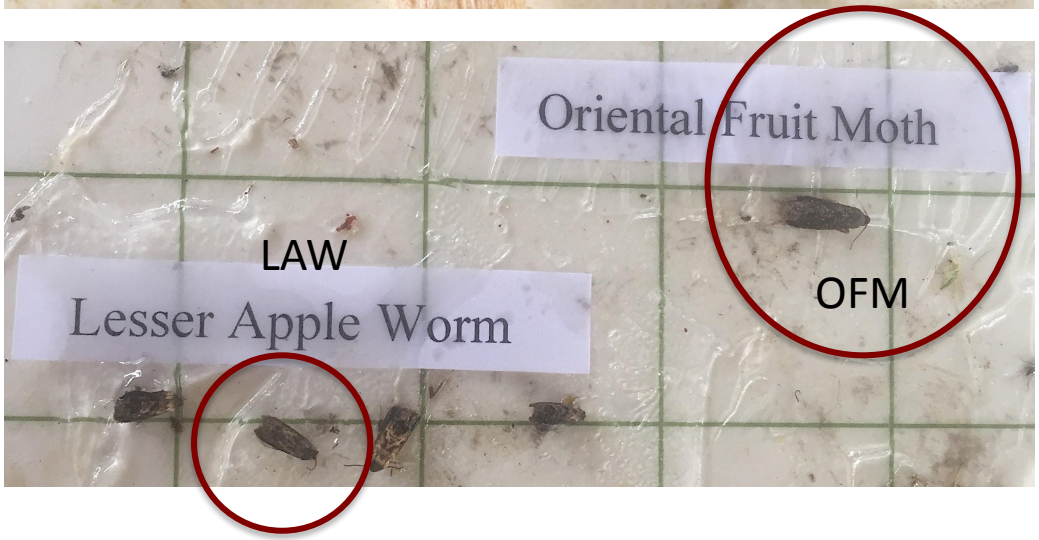
Oriental Fruit Moth

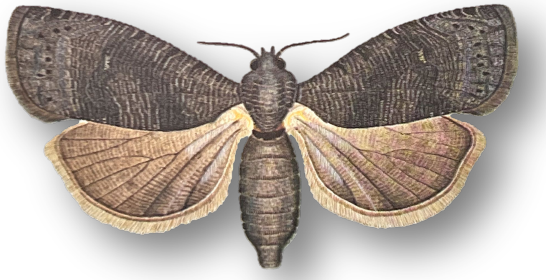
Pheromone Trap Monitoring

Pheromone Monitoring
Genus: Tortricidae
June 5th





CM



OFM

LAW

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Oriental Fruit Moth Management

Pesticide Labels

READ THE LABEL

The labels provides direction for individual product. Using a pesticide in a manner inconsistent with its labeling is a violation of federal law. The label provides information on:

- **Mixing pesticides**
  - **Mixing pesticides together in the same tank. Incorrect tank mixes can…**
    - Result in physical or chemical incompatibilities.
    - It can increase or *decrease* the efficacy of each or all ingredients.
    - Become toxic to the plants.

  - Sprayer Calibration is critical to optimize product efficacy and application costs

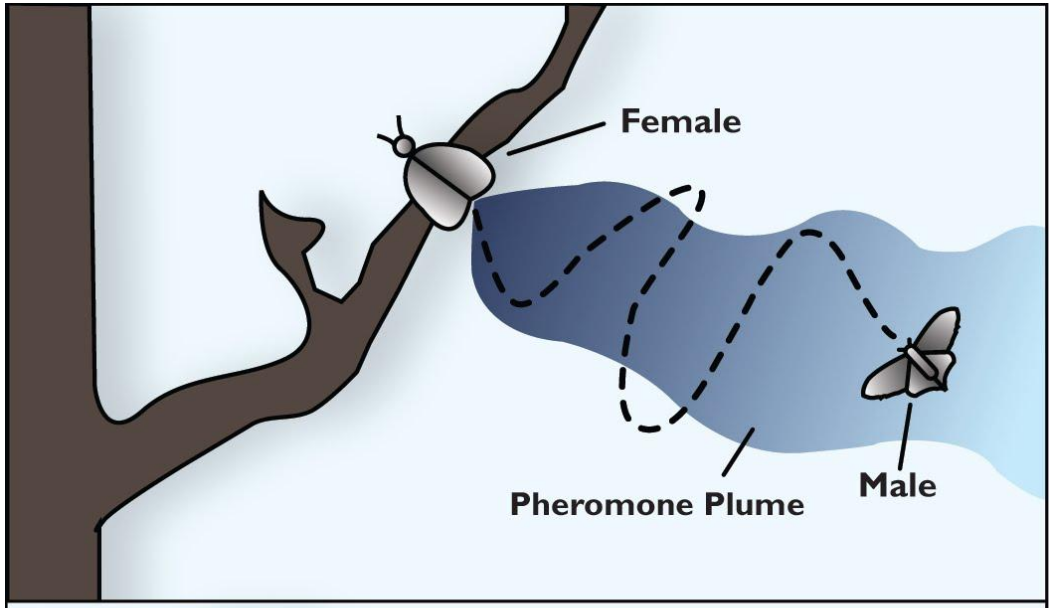
Sequence of materials:

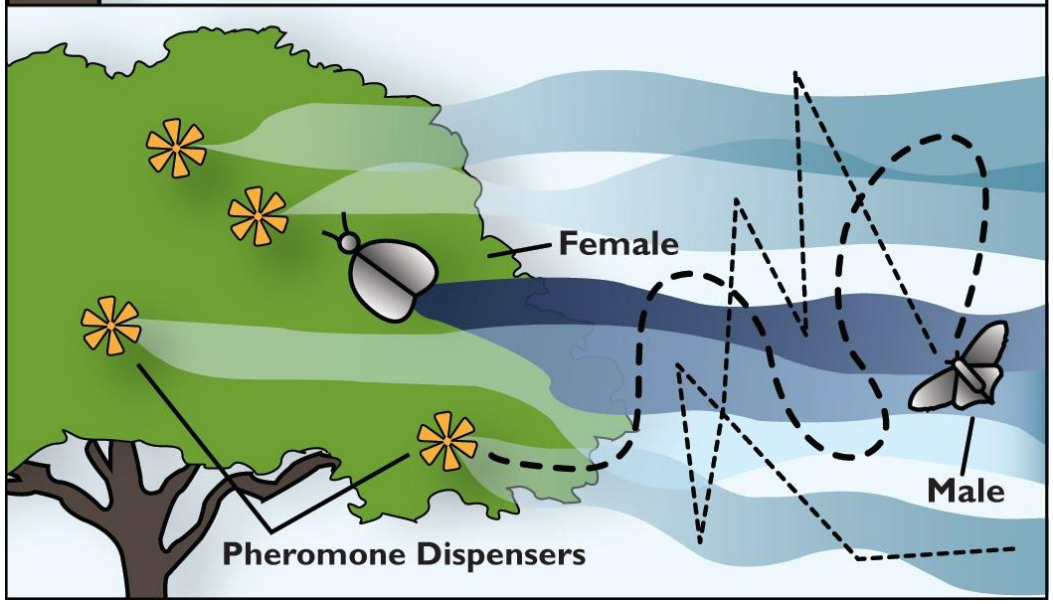
1. Wettable powder (WP) and dry flowables (DF) or water dispersing granule WDG
2. Flowable and microencapsulated products.
3. Emulsifiable concentrates
4. Soluble powder products
5. Crop oils or surfactants should be added last. (Increases penetration into plant tissue (Captan)

- **Application, Storage, Disposal ….**

Oriental Fruit Moth Management

Mating Disruption





Advantages

- **Insecticide Resistance Management**
  - Reduce population density & chemistry selection pressure
- Season long activity
  - Synthetic pheromone OFM & CM
  - 'Confuse' the male cannot find females
- No mating, no fertile eggs
- Results in low larval presence in the orchard
- **Additional insecticides for OFM or CM (using duel MD components) may be needed due to:**
  - High endemic pressure
  - Migration from non-MD orchards

* Monitor MD blocks w/ phero. traps

Oriental Fruit Moth Management

Mating Disruption

Late MD from Pink to Bloom: (Can be placed while hanging DWB pheromone)

- **Set pheromone traps to monitor OFM**

- **Pheromone Mating Disruption**
  - **5-10 acres minimum MD block size**
  - **<u>Isomate twin ties</u> (CM / OFM TT combo) 200 Ties/A**

- **Example**. In an orchard 12’ x 3’ tree spacing = 1210 trees per acre.
  (1210 Trees & 200 ties / A placed every 6th tree)

Oriental Fruit Moth Management

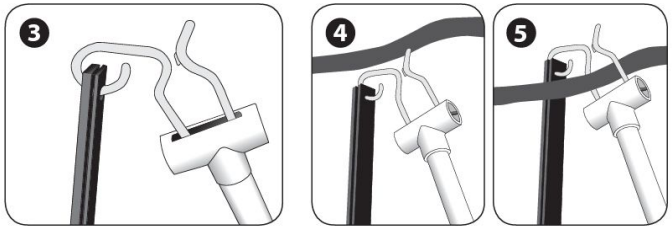
Mating Disruption

Late Pink to Bloom:

- **Set pheromone traps**

- **Pheromone Mating Disruption**
  - **5-10 acres minimum MD block size**
  - **Isomate twin ties (CM / OFM TT combo) 200 Ties/A**
  - **CideTrak (Meso dispenser) 18-36/A. Less time in upper canopy deployment**

Use of a duel MESO PVC clip holder and ‘bamboo’ pole to place MD in upper canopy of tree.



Oriental Fruit Moth Management

Mating Disruption

Late Pink to Bloom:

- **Set pheromone traps**

- **Pheromone Mating Disruption: Automated Dispensers**

Suterra

CheckMate® Puffer® CM-OFM Pro

- Puffer @ 1-2/A in min. of 15-20+A
- Minimum 2 traps per block
- Check pheromone traps weekly
- 2-month replacement cartridge

Pacific Biocontrol

Isomate CM/OFM Mist

- Activate during evening mating flights
  On/Off 5:00PM-12AM
- Mister @ 1-2/A in min. of 15-20+A in grid pattern
- Minimum 2 traps per block
- Check traps weekly
  - 2-month replacement cartridge

Oriental Fruit Moth Management

Mating Disruption

Late Pink to Bloom:

- **Set pheromone traps**

- **Pheromone Mating Disruption**

  - **Sprayable OFM pheromone (Flowable)**

Application

- Onset of application made prior to 1st OFM generation flight.
- Mixed and applied immediately
- Rates @ 1.32 – 2.93 fl. oz./ A (Max. 22.0 oz./A)
- 7-16 Apps/season; **2.0 oz./A = 11 Apps/season to cover 2-3 generations**

Monitoring

- Place a minimum 2 traps per block to determine efficacy of MD.
- Check traps weekly, replacing lures every other month

Oriental Fruit Moth Management

Insecticide Management

Group	IRAC	Insecticide	Rate		$PHI_{(D)}$	$REI_{(Hrs)}$	Efficacy
Diamides	(28)	Altacor 35WDG	3-4.5	oz./A	10	4	High
		Exirel	10-20.5	fl.oz./A	3	12	High
		Cyclaniliprole 50SL	10.9-22.0	fl.oz./A	7	4	High
		Verdepryn 100SL	5.5-11.0	fl.oz./A	7	4	High
Spinosads	(5)	Delegate 25WG	6-7	oz./A	1	4	High
		Entrust 2SC	4-8	fl.oz./A	1	4	Moderate
Pyrethroids	(3A)	Mustang MAXX	1.28-4.0	fl.oz./A	14	12	Moderate
		Warrior II 2.08CS	1.28-2.56	fl.oz./A	14	24	Moderate
		Baythroid XL 1EC	2.0-2.4	fl.oz./A	7	12	Moderate
		Danitol 2.4EC	10.7-21.3	fl.oz./A	3	24	Moderate
Neonicotinoids	(4A)	Assail 30SG	5.3-8	oz./A	7	12	High
Carbamates	(1A)	Sevin XLR Plus	2-3	qt./A	3	12	Moderate

Oriental Fruit Moth Management

Insecticide Management

Pre-Mix

Group	IRAC	Insecticide	Rate	PHI$_{(D)}$	REI$_{(Hrs)}$	Efficacy
Diamide Pyrethroid	(28/3A)	Besiege	6-12 fl oz./A	14	24	High
Neonicotinoid Pyrethroid	(4A/3A)	Leverage 360	2.4-2.8 fl oz./A	7	12	High
Diamide Neonicotinoid	(28/4A)	Voliam Flexi WDG	4-7 oz./A	14	24	High
Diamide Mectins	(28/6)	Minecto Pro	8.0-12.0 fl.oz./A	21	12	High

Insecticide Rotation

Use the <u>same (IRAC) active ingredient during each generation</u>

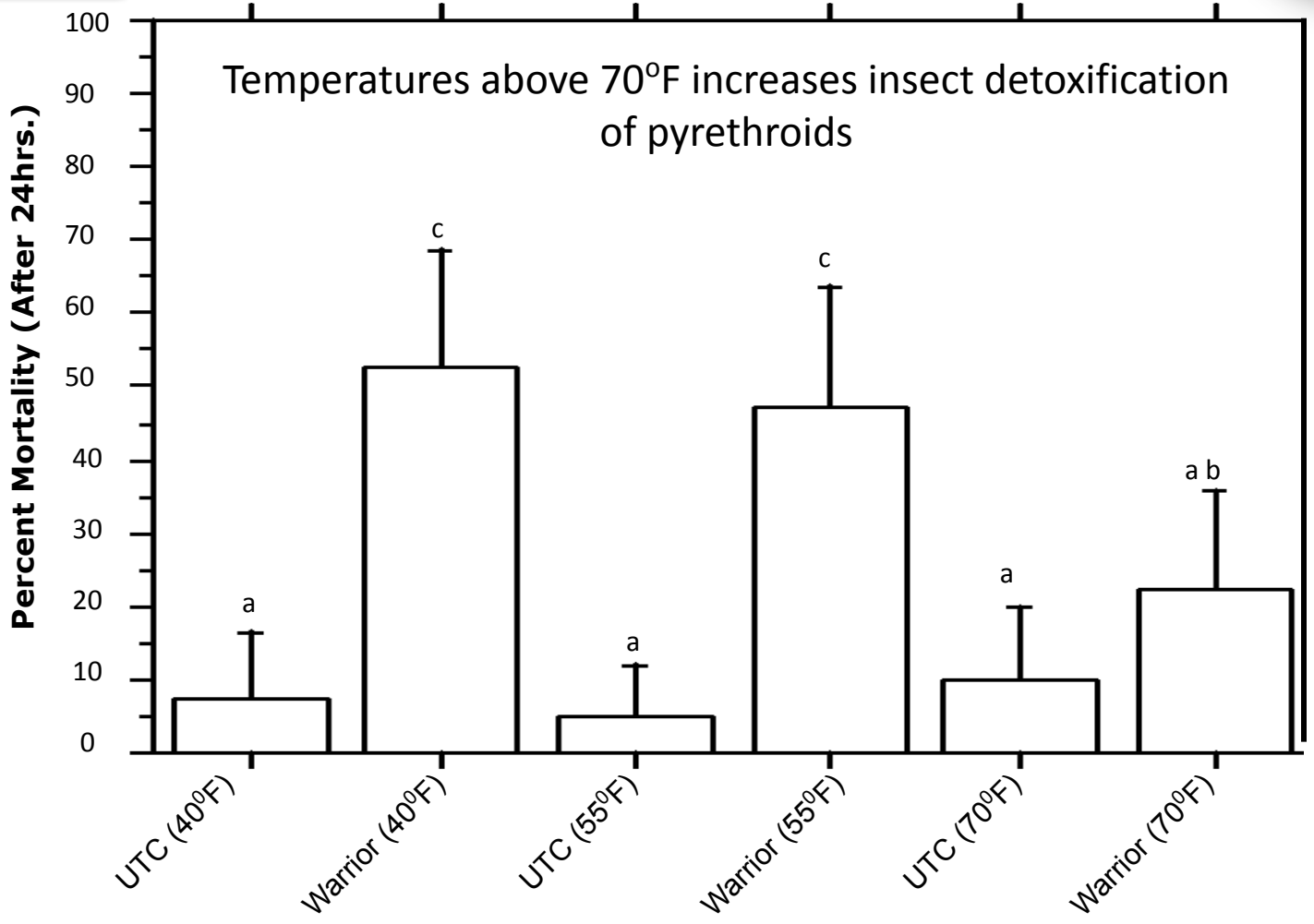
Example: During the 1st Generation, make 1-2 applications of Altacor 35WDG (IRAC 28)

Alternate the active ingredient ie <u>different active ingredient class (IRAC) during each generation</u>

During the 2nd Generation, make 1-2 applications of Delegate 25WG (IRAC 5)

Codling Moth Larvae Bioassay (susceptible 'Benzon' Colony)
NYSAES, Highland NY 2009[1]

Warrior @ 0.16 fl. oz. /A



[1] Bioassay conducted on 1st instar codling moth larva topically treated with 1µL droplet of lamda-cyhalothrin at 0.0005 µg A.I./ 1000 mL or 0.0005 ppm [**3% of the labeled field rate**] placed in temperature controlled chambers over 24 hours.
(df = 3, F-value = 8.648, P-value = 0.0001).

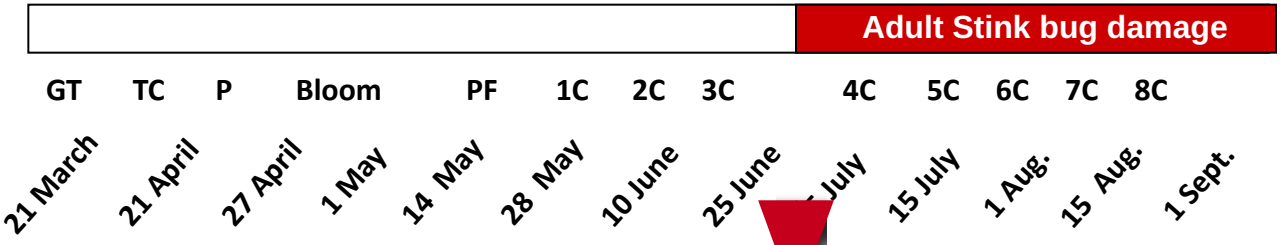
Stink Bug Complex - Peach

- Overwinter
  - Woodland - tree bark
  - Rock outcroppings
  - Man-made structures
- Mouthparts
  - Piercing-sucking
  - Siphon plant juices

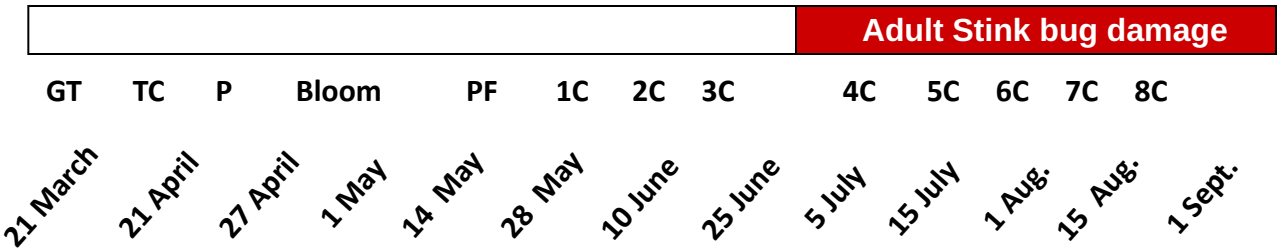
Image: Tim Haye/CABI

Hudson Valley Stink Bug Complex
Species of economic importance

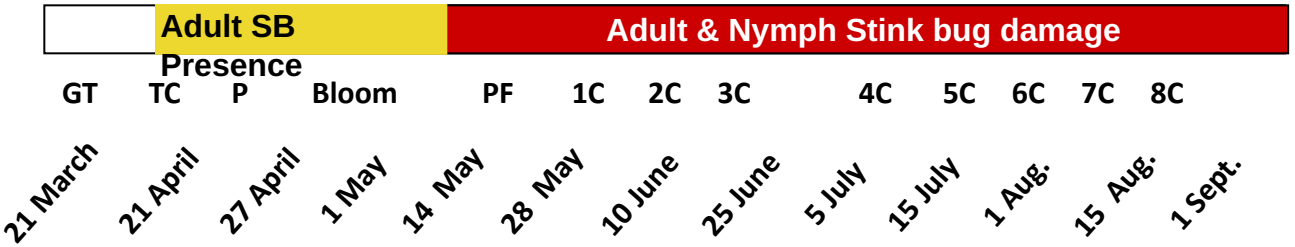
Brown Stink Bug, *Euschistus servus* (Say)



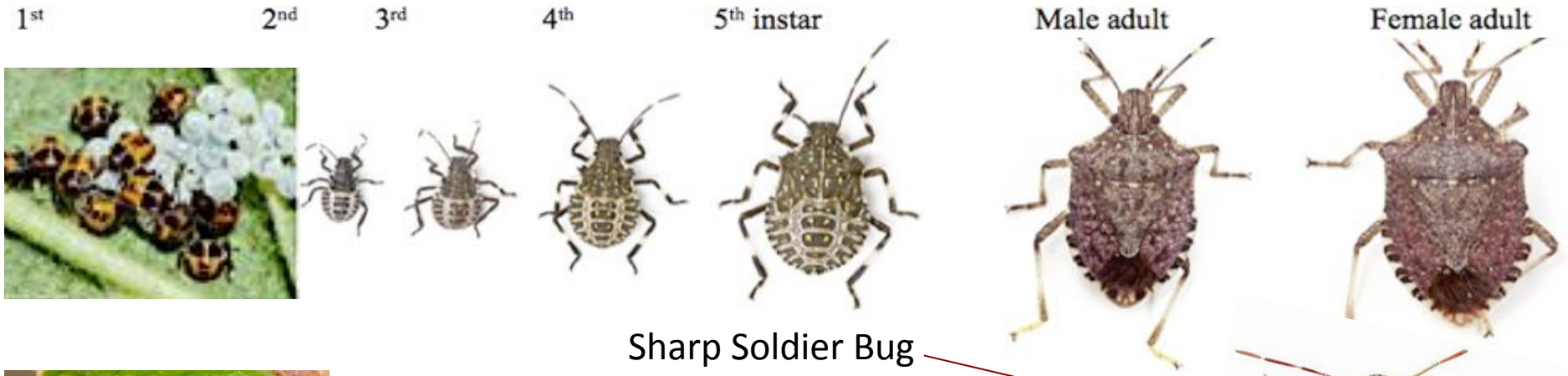
Green Stink Bug, *Acrosternum hilare* (Say).



Brown marmorated stink bug, *Halyomorpha halys* (Stål)



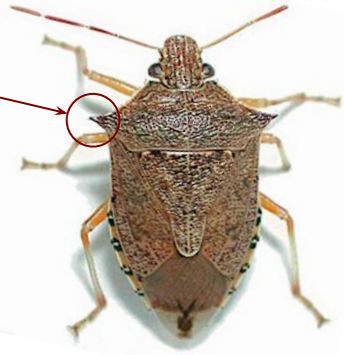
BMSB: Identification



Sharp Soldier Bug







Green Stink Bug




BMSB: Body Mass

High A.I. Rates Required for Mortality Relative to Plum Curculio

Plum Curculio

Brown Marmorated Stink Bug

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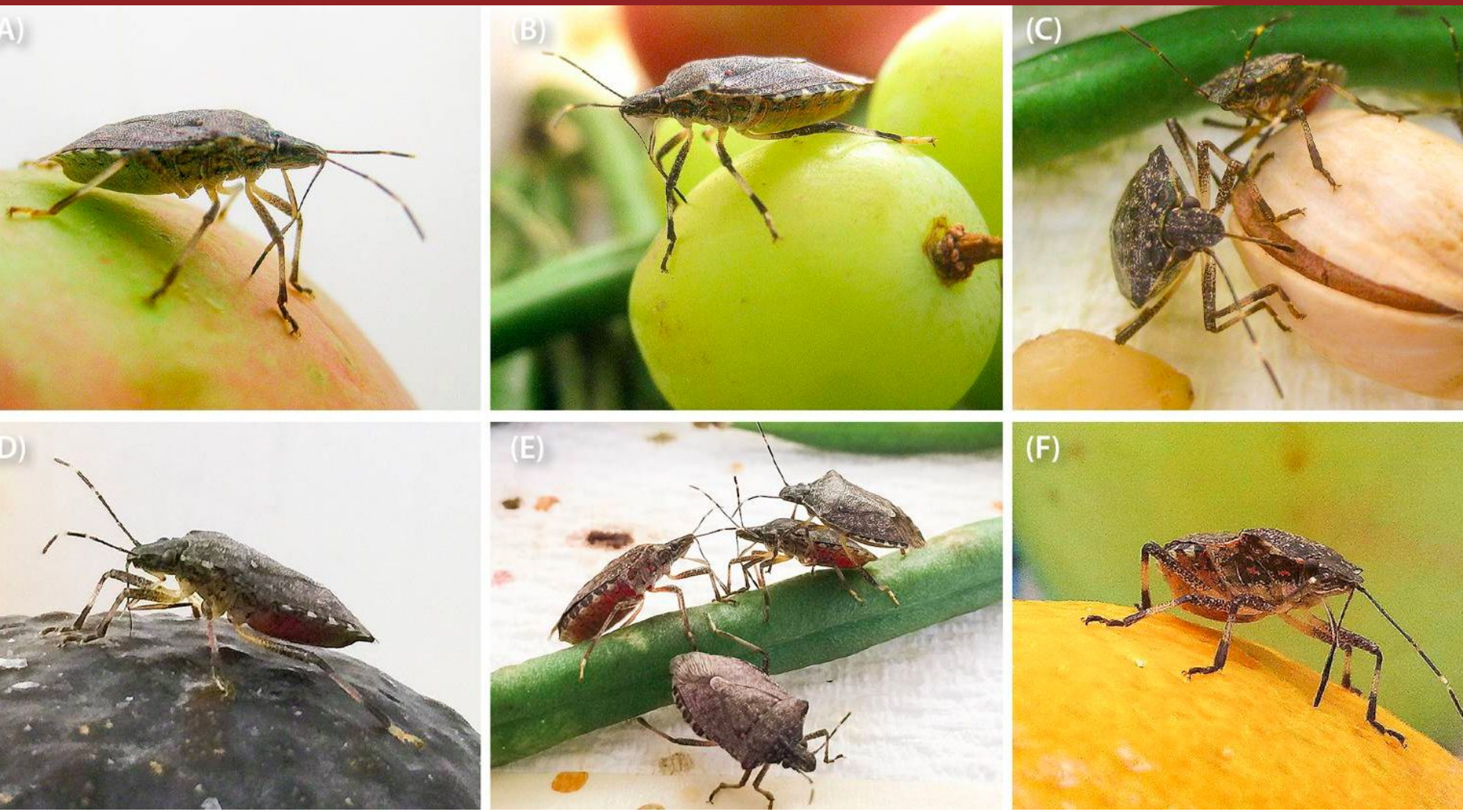
BMSB: Residual Efficacy

Large Body Mass, Feeding Sheath & Limited Abdominal Contact with Fruit



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BMSB: Residual Efficacy

Large Body Mass, Feeding Sheath & Limited Abdominal Contact with Fruit

August 12th 2014 ← 10 Days → August 25th 2014

Management: Insecticide Options

Product	Active ingredient	Rate / A	REI Hrs.	PHI Days	Efficacy (USDA)	Max. per crop / season	App. Interval
Actara 25WDG	Thiamethoxam	2.0-5.5 oz/A	12	35	+++	16.5 oz./A (0.258 lb. a.i./A)	10d
Asana XL 0.66EC	Esfenvalerate	4.8-14.5 fl oz/A	12	21	++	101 fl oz/A (0.525 lb AI/A).	NA
Baythroid XL 1EC	Beta-Cyfluthrin	1.4-2.8 fl oz/A	12	7	++	2.8 fl oz/A (0.022 lb AI/A).	14d
Bifenture EC	Bifenthrin	5.2-12.8 fl oz/A	12	14	++++	32 fl ozs (0.50 lbs ai)	30d
Bifenture 10DF	Bifenthrin	12.8-32.0 oz/A	12	14	++++	80 ozs (0.50 lbs ai)	30d
Brigade WSB	Bifenthrin	12.8-32.0 oz/A	12	14	++++	80 ozs (0.50 lbs ai)	30d
Closer SC***	Sulfoxaflor	2.75 – 5.75 fl oz/A	12	7	+	17.0 fl ozs (0.266 lbs ai)	7d
Danitol 2.4EC	Fenpropathrin	10.66-21.33 fl oz/A	24	14	+++	42.56 fl ozs (0.80 lbs ai)	10d
Endigo ZC	Thiamethoxam / Lambda-cyhalothrin	5-6 fl oz/A	24	35	++++	19 fl oz./A (0.172 lb ai) NY	10d
Gladiator	Zeta-Cypermethrin / Avermectrin B1	19.0 fl oz/A	24	28	++++	19 fl oz./A (0.172 lb ai) NY	21d
Lannate 2.4LV*	Methomyl	2.25 pt/A	72	14	++++	240 ozs (0.50 lbs ai)	7d
Lannate 90SP*	Methomyl	8-16 oz/A	72	14	++++	5.0 lbs	7d
Leverage 360	Beta-Cyfluthrin / Imidacloprid	2.4-2.8 fl oz/A	12	7	+++	2.8 fl oz/A	14d
Surround 95WP	Kaolin	25-50 lb/A	4	0	+	NA	0d
Voliam Xpress EC	Chlorantraniliprole / Lambda-cyhalothrin	6-12 fl oz/A	24	21	+++	31.0 fl oz/A	10d
Vydate 2L*	Oxamyl	4-8 pt/A	48	14	++	281 fl oz/A (128 oz AI/A).	7d
Warrior 1CS	Lambda-cyhalothrin	2.56-5.12 fl oz/A	24	21	++	20.48 fl. oz. (0.28 lb. a.i.)**	5d
Warrior II 2.08CS	Lambda-cyhalothrin	1.28-2.56 fl oz/A	24	21	++	10.24 fl. oz. (0.28 lb. a.i.)**	5d

* Although these materials have excellent topical ratings in lab bioassay studies, field efficacy studies have shown economic fruit injury from BMSB feeding, suggesting low residual levels.

** Post bloom applications

*** Feeding inhibition up to 72hr. post application

(+) low to (++++) high efficacy

*** Venerate XC: Bioinsecticide

2EE 0 DTH

In 2019 HVRL Field studies provided strong anti-feeding response of pome fruit

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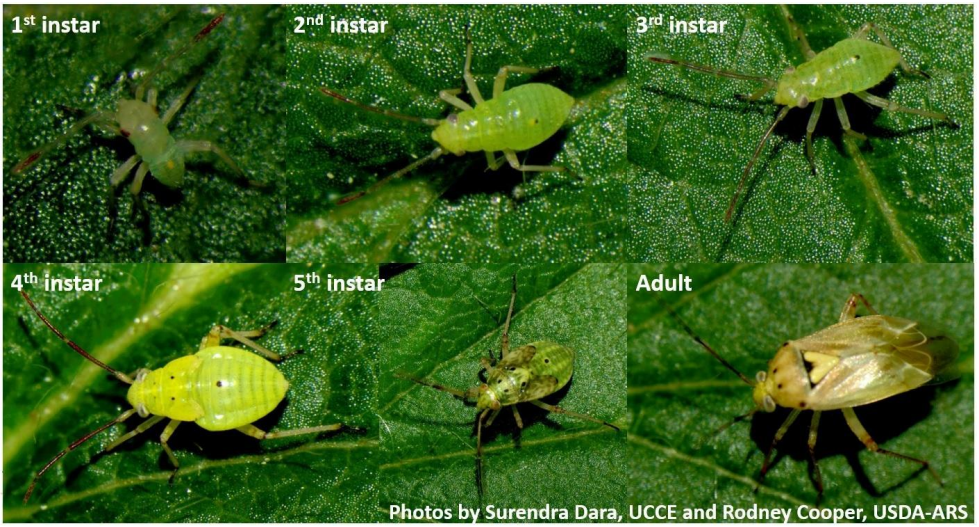
Tarnished Plant Bug, TPB *Lygus lineolaris* (Miridae)
Biology

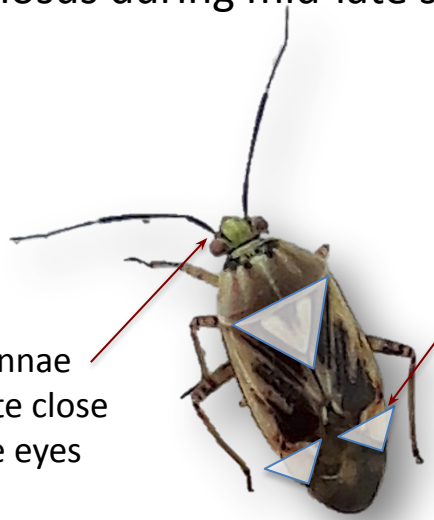
Mirid 'Plant' bugs:

- 5 instar stages
- Two gen./ year

- Piercing-sucking
  - Active at 70°F in broad leaf plants
  - Feed on young, rapidly growing tissue
  - <u>All stages inject toxins while feeding</u>

Toxin discolors, distorts, kills plant tissue
Gummosus during mid-late season feeding





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TPB Peach Injury: Gummosis
Image: Utah State University Extension

TPB Peach Injury: Catfacing, Gummosis, Invagination

Tarnished Plant Bug

Monitoring

Control weeds: in orchards to reduce TPB egg laying and overwintering sites.

Survey: Mid-April to early May, examine plants for bleeding wounds, brown discolored tissues, and other malformations, adult TPB on fruits, flowers, and foliage of susceptible crops.

Monitor: using non-UV-reflecting white sticky boards for adults in spring.

Image: UNH Extension

<u>TPB Economic thresholds</u>

2.4 TPB / trap by tight cluster

4.1 TPB / trap by late pink.

Monitoring in peaches and nectarines is critical at petal fall to shuck fall.

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Tarnished Plant Bug

Insecticide Management

Group	IRAC	Insecticide	Rate		PHI$_{(D)}$	REI$_{(Hrs)}$	Efficacy
Pyrethroids	(3A)	Ambush 25WP	6.4-19.2	oz./A	14	12	High
		Asana XL 0.66EC	4.8-14.5	fl.oz./A	14	12	High
		Baythroid XL 1EC	2.0-2.4	fl.oz./A	7	12	High
		Danitol 2.4EC	10.7-21.3	fl.oz./A	3	24	High
		Mustang MAXX	1.28-4.0	fl.oz./A	14	12	High
		Pounce 25 WP	6.4-16.0	fl.oz./A	14	12	High
		Warrior II 2.08CS	1.28-2.56	fl.oz./A	14	24	High
Diamide Pyrethroid	(28/3A)	Besiege	6-12 fl	oz./A	14	24	High
Neonicotinoids	(4A)	Assail 30SG	5.3-8	oz./A	7	12	Moderate
		Actara 25WDG	4.5-5.5	oz/acre	14	12	High
Neonicotinoid Pyrethroid	(4A/3A)	Leverage 360	2.4-2.8	fl.oz./A	7	12	High
		Endigo ZC	5-5.5	fl.oz./A	14	24	High
Diamide Neonicotinoid	(28/4A)	Besiege	6-12	fl.oz./A	14	24	High
		Voliam Flexi WDG	4-7	oz./A	14	12	High

Plum Curculio *Conotrachelus nenuphar*

Apricot, Plum, Prune, Peach, Cherry

Feeding

Oviposition / Egg Laying

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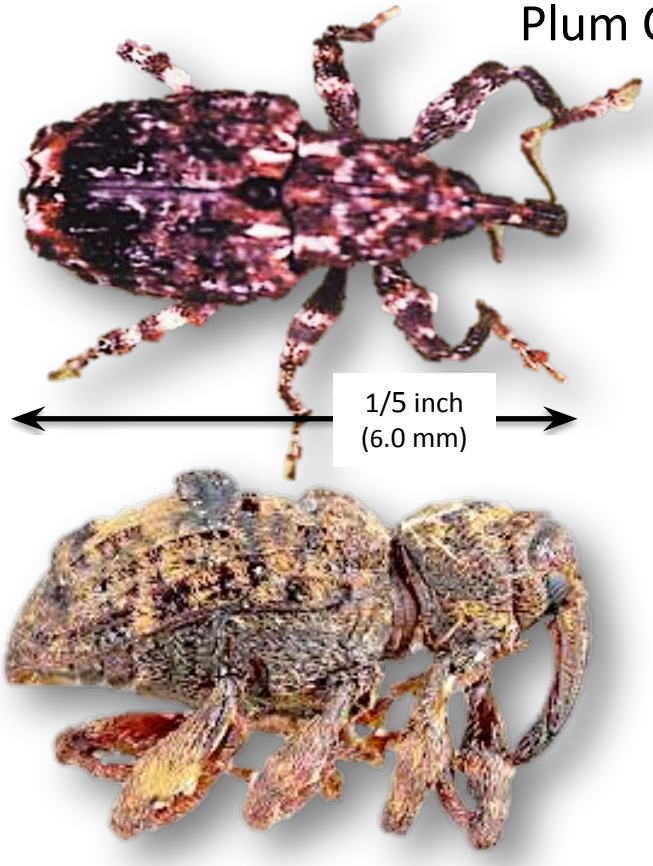
Plum Curculio (PC) *Conotrachelus nenuphar*



Primary pest of stone fruit in NYS & New England.

- True Weevil (Family: Curculionidae) curved Rostrum
- Hosts include apricot, plum, peach, nectarine, cherry
- Most prevalent in orchards with **hedgerows & woodlands**.
- **Egg-laying** in fruit create a crescent scar, resulting in misshapen fruit and internal feeding from developing larva.
- **Feeding** leaves a small fresh / callused hole (expands)

***<u>Apricot and plum</u> fruits are more damaged than apple and peach** by Plum Curculio in West Virginia. Apricot had the highest percentage of injury followed by Japanese plum, European plum, apple, peach, sweet cherry, sour cherry and pear.

Journal Of Entomological Sciences. April 1, 2005
Brown, M.W. 2005. Host Utilization And Phenology Of Injury By Plum Curculio (Coleoptera: Curculionidae) In West Virginia. Journal Of Entomological Sciences. J. Entomol. Sci. 40(2): 149-157 (2005).

Plum Curculio (PC)

Life History:

- The adults **overwinter** along wooded edges, fence rows, brush piles, rock walls in protected orchard locations.
- Adults become active in spring as mean temperature exceeds 60° F. or maximum temperatures exceed 75° F. as tree fruit come into bloom.
- Emerge from overwintering quarters to feed on buds, blossoms and newly set fruit.
- The beetles attack the fruits as it reaches **5mm**
- **Feeding injury** into 1/8 inch into the pulp.
- **Oviposition damage:** Female cuts the skin with her mouth part
- Deposits a single egg in the opening that she pushes to the bottom of the cavity with her snout.
- In front of the egg cavity she cuts a **crescent-shaped slit** that extends obliquely under the egg to leave it in a flap of flesh.


Feeding


Oviposition / Egg Laying

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Plum Curculio (PC)

Life History:

- Each female is capable of depositing from 100 to 500 eggs.
- The **larvae are legless, C-shaped, develop in the fruit** where they feed for several weeks before reaching maturity.

- **Infested fruits may drop from the tree early. Mature larvae leave the fruit and crawl into the soil** to a depth of several inches where they construct earthen pupal cells.
- During **July and August**, the new brood of adults begins to emerge to feed on developing fruits
- Low fall temperatures force them into hibernation.
- One generation of PC in New York State each year.

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Plum Curculio (Peach & Nectarine)

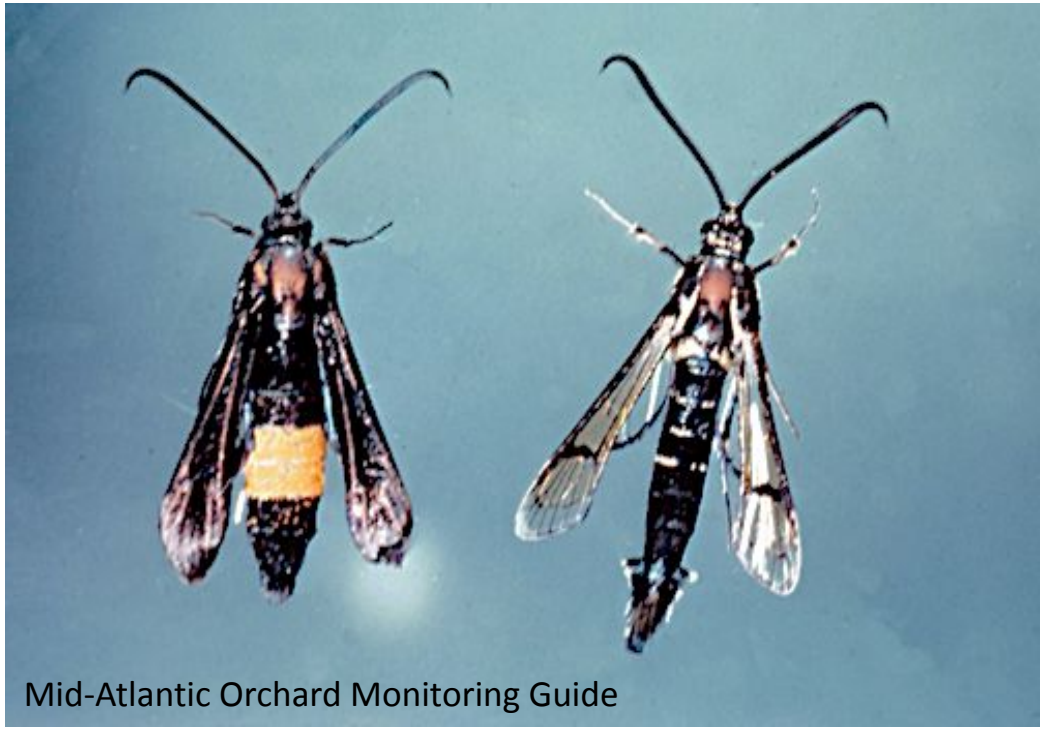
Insecticide Management

Group	IRAC	Insecticide	Rate	PHI (D)	REI (Hrs)	Efficacy
Pyrethroids	(3A)	Ambush 25WP	6.4-19.2	oz./A	14	12 Moderate
		Asana XL 0.66EC	4.8-14.5	fl.oz./A	14	12 Moderate
		Baythroid XL 1EC	2.0-2.4	fl.oz./A	7	12 Moderate
		Danitol 2.4EC	10.7-21.3	fl.oz./A	3	24 Moderate
		Pounce 25 WP	6.4-16.0	fl.oz./A	14	12 Moderate
		Warrior II 2.08CS	1.28-2.56	fl.oz./A	14	24 Moderate
Pyrethroid Diamide	(3A/28)	Besiege	6-12 fl	oz./A	14	24 High
Neonicotinoid	(4A)	Actara 25WDG	4.5-5.5	oz./A	14	12 High
Neonicotinoid Pyrethroid	(4A/3A)	Leverage 360	2.4-2.8	fl.oz./A	7	12 High
		Endigo ZC	5-5.5	fl.oz./A	14	24 Moderate
Mectin Diamide	(6/28)	Minecto Pro	6-12	fl.oz./A	14	24 High
Mectin Pyrethroid	(6/3A)	Mustang MAXX	1.28-4.0	fl.oz./A	14	12 High
Neonicotinoid Diamide	(4A/28)	Voliam Flexi				

Plum Curculio (Cherry)

Group	IRAC	Insecticide	Rate		PHI (D)	REI (Hrs)	Efficacy
Pyrethroids	(3A)	Ambush 25WP	6.4-19.2	oz./A	14	12	Moderate
		Asana XL 0.66EC	4.8-14.5	fl.oz./A	14	12	Moderate
		Baythroid XL 1EC	2.4-2.8	fl.oz./A	7	12	Moderate
		Mustang MAXX	1.28-4.0	fl.oz./A	14	12	High
		Pounce 25 WP	6.4-12.8	fl.oz./A	14	12	Moderate
		Warrior II 2.08CS	1.28-2.56	fl.oz./A	14	24	Moderate
Diamide Pyrethroid	(28/3A)	Besiege	6-12 fl	oz./A	14	24	High
Neonicotinoids	(4A)	Actara 25WDG	4.5-5.5	oz/acre	14	12	High
Neonicotinoid Pyrethroid	(4A/3A)	Leverage 360 Endigo ZC	2.4-2.8 5-5.5	fl.oz./A fl.oz./A	7 14	12 24	High Moderate
Diamide Neonicotinoid	(28/4A)	Minecto Pro Voliam Flexi WDG	6-12 4-7	fl.oz./A oz./A	14 14	24 12	High High
Diamide Pyrethroid	(28/3A)	Gladiator EC Besiege	19.0 6-12 fl	fl.oz./A oz./A	21 14	12 24	High High
Oxadiazine	(22)	Avaunt 30WDG	5-6	oz./A	14	12	High

Peach Tree Borer, *Synanthedon sp.* (Lepidoptera: Sesiidae)
Peach (all stone fruit)


Mid-Atlantic Orchard Monitoring Guide

Clear-winged moths (wasp-like)
1 Generation/yr.

- **Peach tree borer**

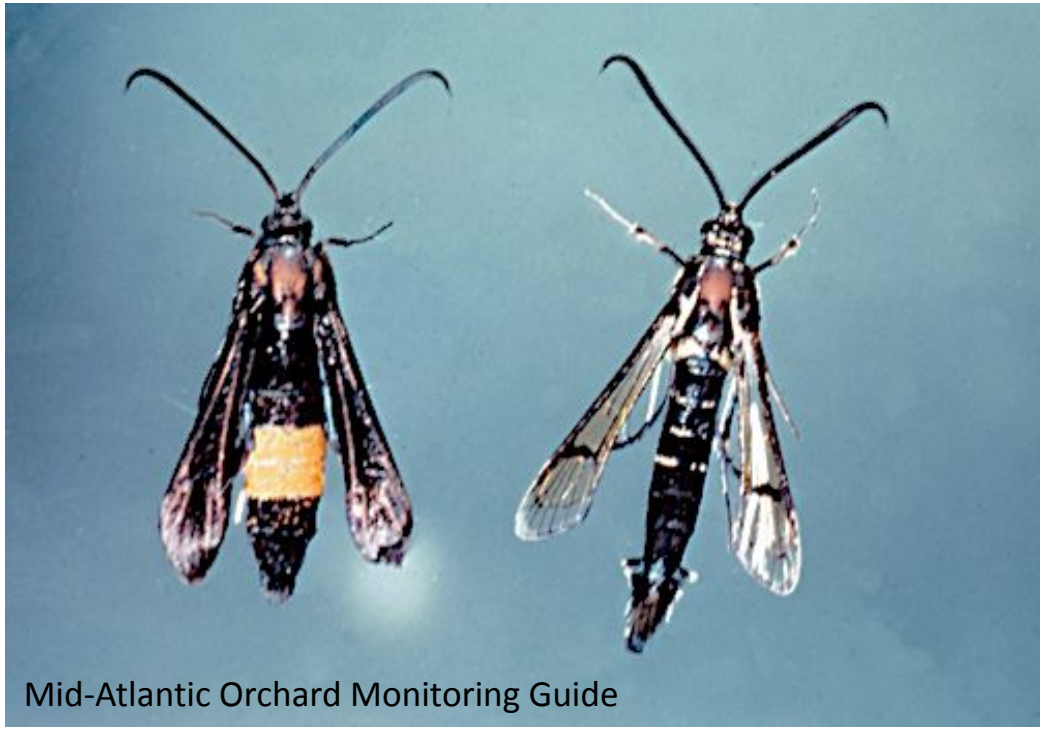
Synanthedon exitiosa, feeds in the trunk at or just below soil level.

- **Lesser peach tree borer**

Synanthedon pictipes, feeds primarily in the branches and limbs, injury cracks.

Overwinter within the tree as larvae.

Peach Tree Borer, *Synanthedon sp.* (Lepidoptera: Sesiidae)
Peach (all stone fruit)


Mid-Atlantic Orchard Monitoring Guide

Clear-winged moths (wasp-like)
1 Generation/yr.

- **Peach tree borer** (PTB)

Synanthedon exitiosa, feeds in the trunk at or just below soil level.

- **Lesser peach tree borer** (LPTB)

Synanthedon pictipes, feeds primarily in the branches and limbs, injury cracks.

- Adults LPTB emerges first, emerging from pupa in mid-late May, PTB in June.
- Females produce 400-800 eggs, hatch beginning mid-July


NYSAES

- **Borer / larvae:**

White to cream colored, are hairless with yellow-brown legs & dark brown head.

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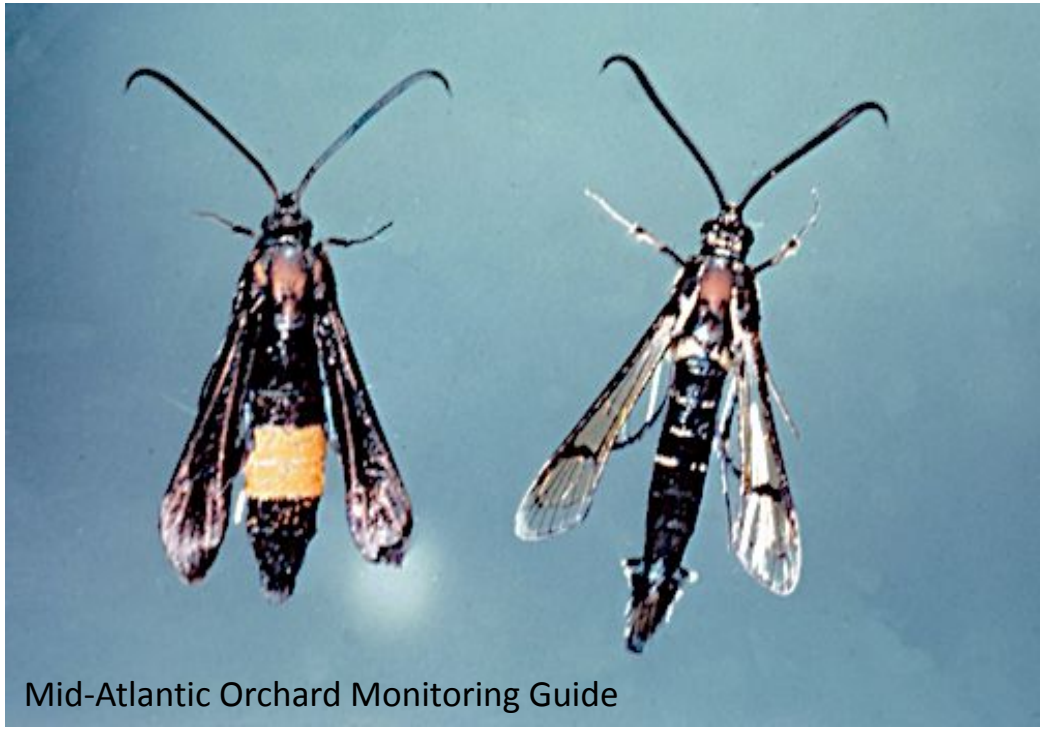
Peach Tree Borer, *Synanthedon sp.* (Lepidoptera: Sesiidae)
Apricot, Plum, Prune, Peach, Cherry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Clear-winged moths (wasp-like)
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- **Peach tree borer**

Synanthedon exitiosa, feeds in the trunk at or just below soil level.

- **Lesser peach tree borer**

Synanthedon pictipes, feeds primarily in the branches and limbs, injury cracks.

- **Injury: Cankers**


NYSAES

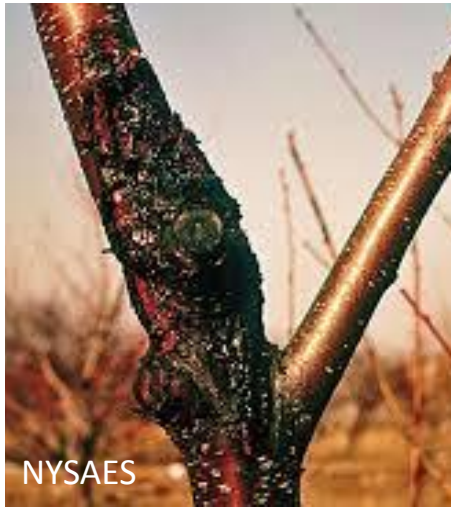
NYSAES


Image Missouri Botanical Garden

Upon larval hatch, larva feed on tree cambium producing **dark frass.**

- Tree responds by producing **gummosis.**

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Peach Tree Borer
Monitoring & Management

Monitoring

- Placement of pheromone traps in early May to determine adult male presence.
- Assess trees for trunk (PTB) and limb (LPTB) damage

Threshold: 1 borer larvae / tree. Fresh frass or gummosus

Photos: R. Bessin
University of Kentucky Entomology

Omafra.gov.

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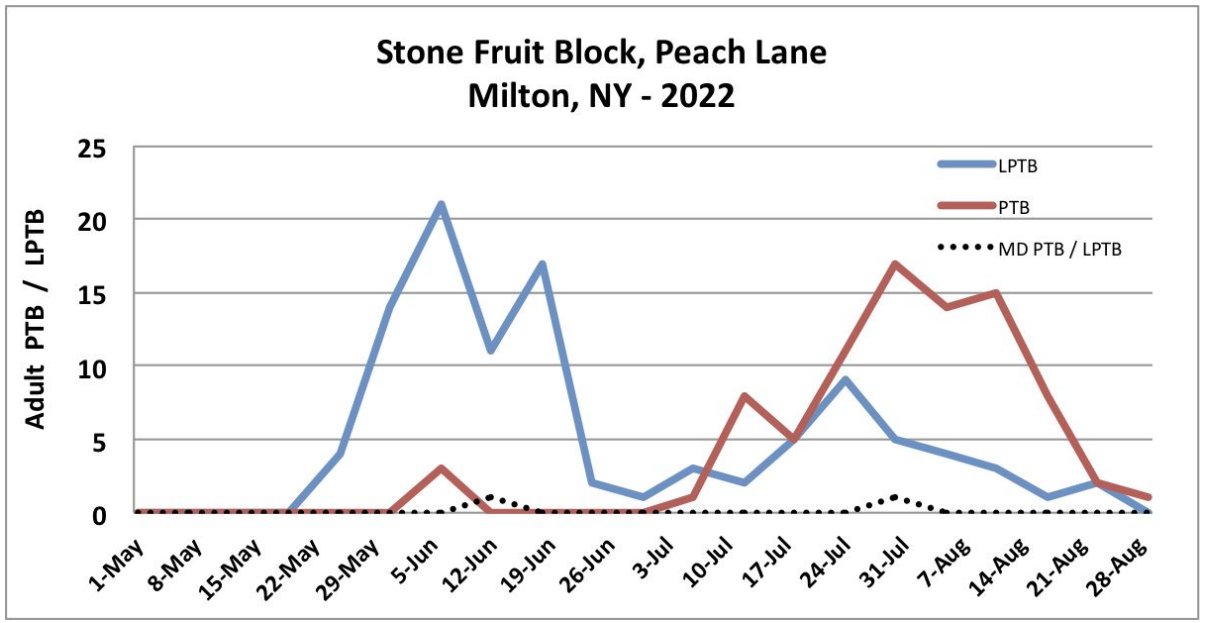
Peach Tree Borer
Monitoring & Management

Monitoring
Presence & 1st flight
Trap Shutdown in MD Blocks

Maintaining trap numbers allows us to assess the efficacy of mating disruption programs.

Grapghs provide historical and efficient visual reference.

Photos: R. Bessin
University of Kentucky Entomology



Omafra.gov.

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Peach Tree Borer
Monitoring & Management

Monitoring

- Placement of pheromone traps in early May to determine adult male presence.
- Assess trees for trunk (PTB) and limbs (LPTB)

Threshold: 1 borer larvae / tree. Fresh frass or gummosus

Photos: R. Bessin
University of Kentucky Entomology

Management:

1. **Mating disruption:** Isomate-PTB Duel pheromone @ 150 / A, prior to 1st flight by Mid-May. (CBC (America) Corp.)

1. **Insecticide applications** to trunk and lower limbs, Late May, Early July, Early August

Omafra.gov.

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Insecticide Management
Peach Tree Borer – Onset of hatching larva

Group	IRAC	Insecticide	Rate	$PHI_{(D)}$	$REI_{(Hrs)}$	Efficacy
Pyrethroids	(3A)	Asana XL	0.66EC	4.8-14.5 fl.oz./A	14	12 High
		Mustang MAXX	1.28-4.0	fl.oz./A	14	12 High
		Warrior II 2.08CS	1.28-2.56	fl.oz./A	14	24 High
Pyrethroid Mectin	(3A/6)	Gladiator EC	19.0	fl.oz./A	21	12 High
Pyrethroid Diamide	(3A/28)	Besiege	6-12	fl oz./A	14	24 High
Neonicotinoid Pyrethroid	(4A/3A)	Endigo ZC	5-5.5	fl.oz./A	14	24 High

Insecticide Management
Lesser Peach Tree Borer – Onset of hatching larva

Group	IRAC	Insecticide	Rate		PHI$_{(D)}$	REI$_{(Hrs)}$	Efficacy
Pyrethroids	(3A)	Ambush 25WP	6.4-19.2	oz./A	14	12	Moderate
		Asana XL 0.66EC	4.8-14.5	fl.oz./A	14	12	Moderate
		Baythroid XL 1EC	1.4-2.0	fl.oz./A	7	12	Moderate
		Mustang MAXX	1.28-4.0	fl.oz./A	14	12	High
		Pounce 25 WP	6.4-16.0	oz./A	14	12	Moderate
		Warrior II 2.08CS	1.28-2.56	fl.oz./A	14	24	High
Pyrethroid Mectin	(3A/6)	Gladiator EC	19.0	fl.oz./A	21	12	High
Pyrethroid Diamide	(3A/28)	Besiege	6.0-12.0	fl.oz./A	14	24	High
Neonicotinoid	(4A/3A)	Endigo ZC	5.0-5.5	fl.oz./A	14	24	High
Pyrethroid		Leverage 360	2.4-2.8	fl.oz./A	7	12	High

Spotted Wing Drosophila
SWD Management in NYS Cherry

- Spotted Wing Drosophila (SWD) is an invasive Southeast Asian species of vinegar fly, first reported in 1939 Japanese literature.
- Female SWD deposits eggs into unripened, healthy fruit.
- Larvae feed on developing fruit, unexposed to insecticide residue.
- Wounded fruit have been found to contain microbial organisms, often leading to increased rot.

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Female Drosophila species

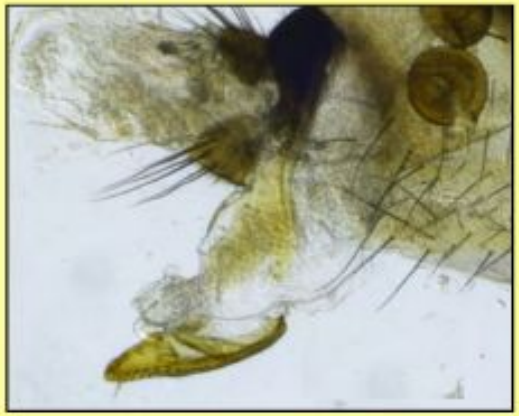
UC Berkeley & UC Cooperative Extension *Photos:* M. Hauser, CDFA

Spotted Wing Drosophila (D. suzukii)

SWD has a large, saw-like, serrated ovipositor with two even rows of teeth that are much darker than rest of ovipositor

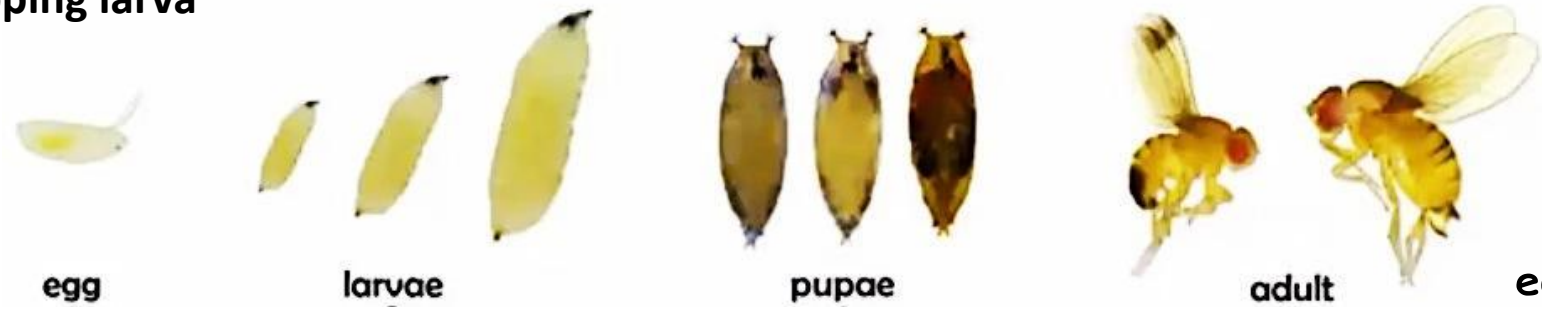
Other Drosophila spp.

have smaller, more rounded ovipositors, sometimes with irregular, poorly defined teeth



Life Cycle of the Spotted Wing Drosophila
Drosophila suzukii (Matsumurai)

- **Earliest 1st emergence & trap capture on 31st May (Orleans), 27th June (Dutchess), 2017**
- **≥6 Generations / year**
- **350 eggs per female**
- **Majority of the population at any time exist in the immature life stage**
- **Insecticides primarily target the adult stage with some activity against the egg and developing larva**



Fruit Affected by SWD

Highest risk	**Moderate risk**	**Alternate hosts**
Strawberries	Peaches	Wild plants with berries, such as…
Raspberries	**Grapes**	**Tartarian Honeysuckle**
Cherries (Tart pref.)	Pears	Snowberry
Nectarines	Apples	Elderberry
Blueberries	Tomato	Pokeweed
Blackberries		Dogwood




SWD Attract and Kill Management 2015

Honeysuckle is a primary host for SWD; *L. tartarica* fruit favored over raspberry in June-August.

Begin to build in high numbers then move from alternate host to crops.

Potential for use as management sites using biological control and attract and kill for SWD in alternate hosts.

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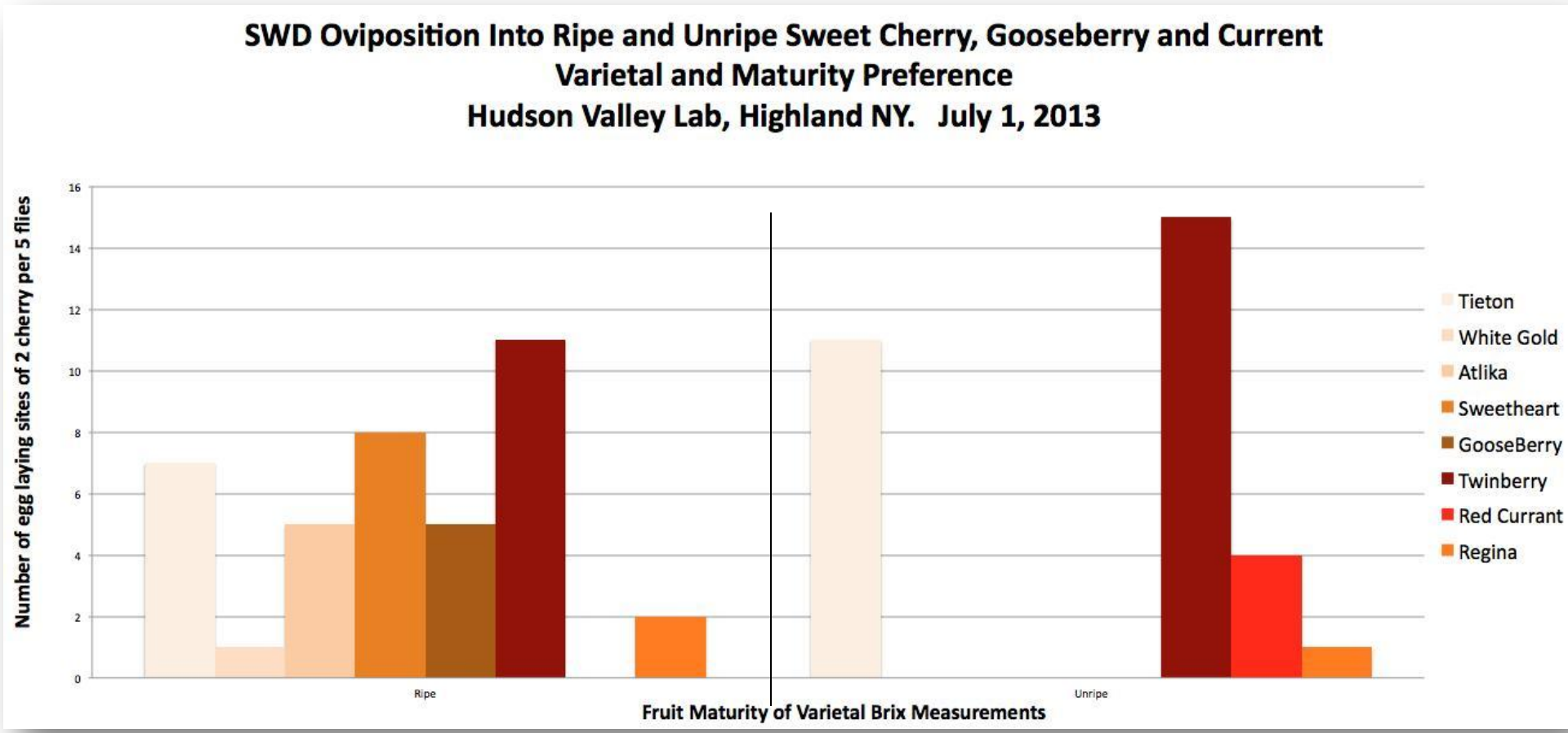

SWD oviposition during pre-harvest and ripened development.

Male and Female flies were introduced to fruit, and allowed 48 hours to oviposit before they were removed and eggs were counted.

Each fruit was isolated with 2 cherry (fruit) of each V. and 5 female SWD adults.

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Chemistries for Fruit Production: SWD

Class	IRAC Code	Examples	SWD Efficacy
Organophosphates	1B	Malathion	Excellent to good
Pyrethroids	3A	Brigade, Danitol, Mustang Max	Excellent
Spinosyns	5	Delegate, Entrust	Excellent to good
Neonicotinoids	4A	Assail	Good to poor
Carbamates	1A	Sevin	Good to poor
Diamide	28	Exirel*	Excellent to good

Survey on insecticide efficacy against SWD, collated by Rufus Isaacs, MSU November, 2013

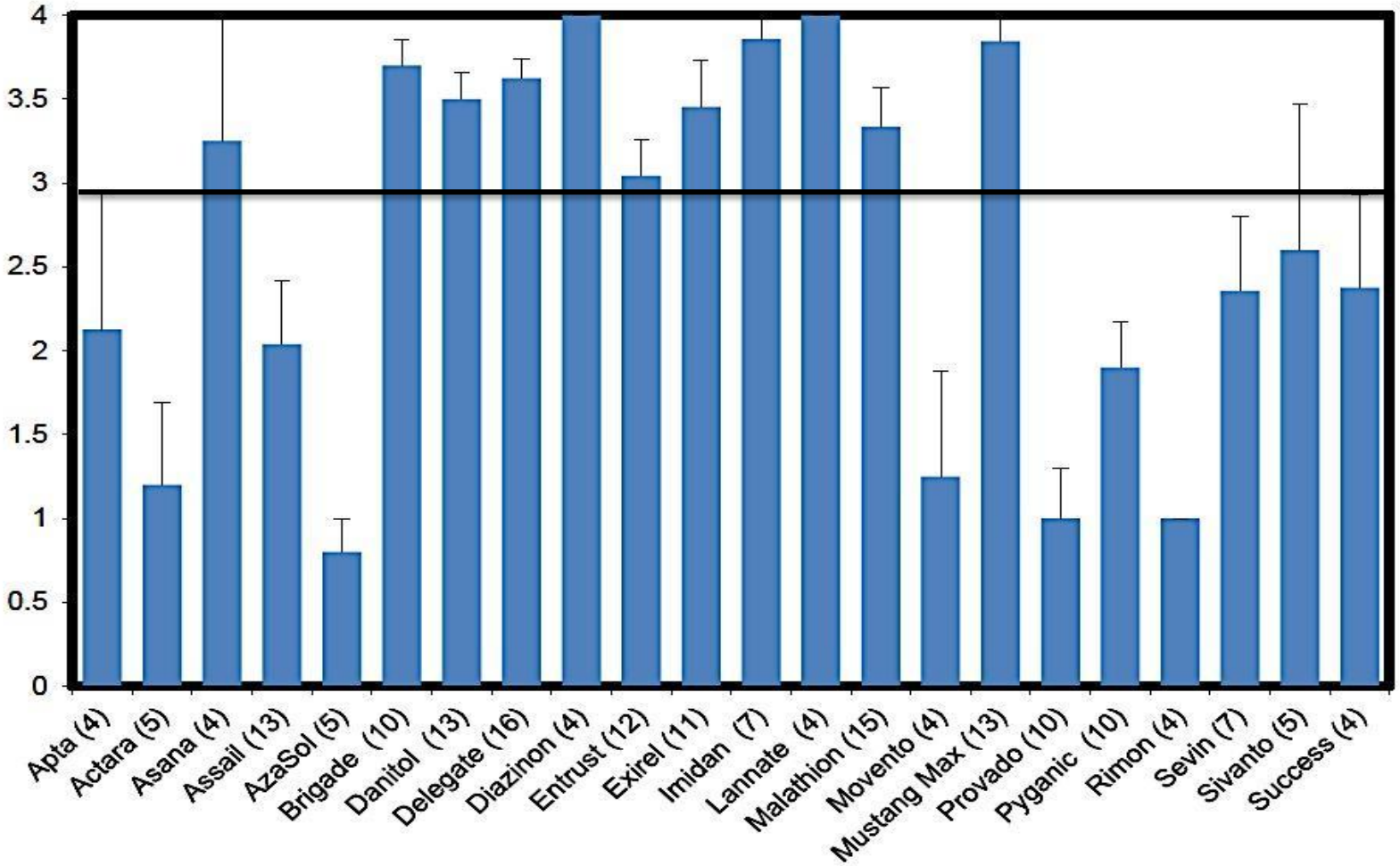
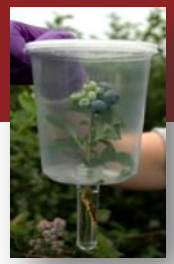
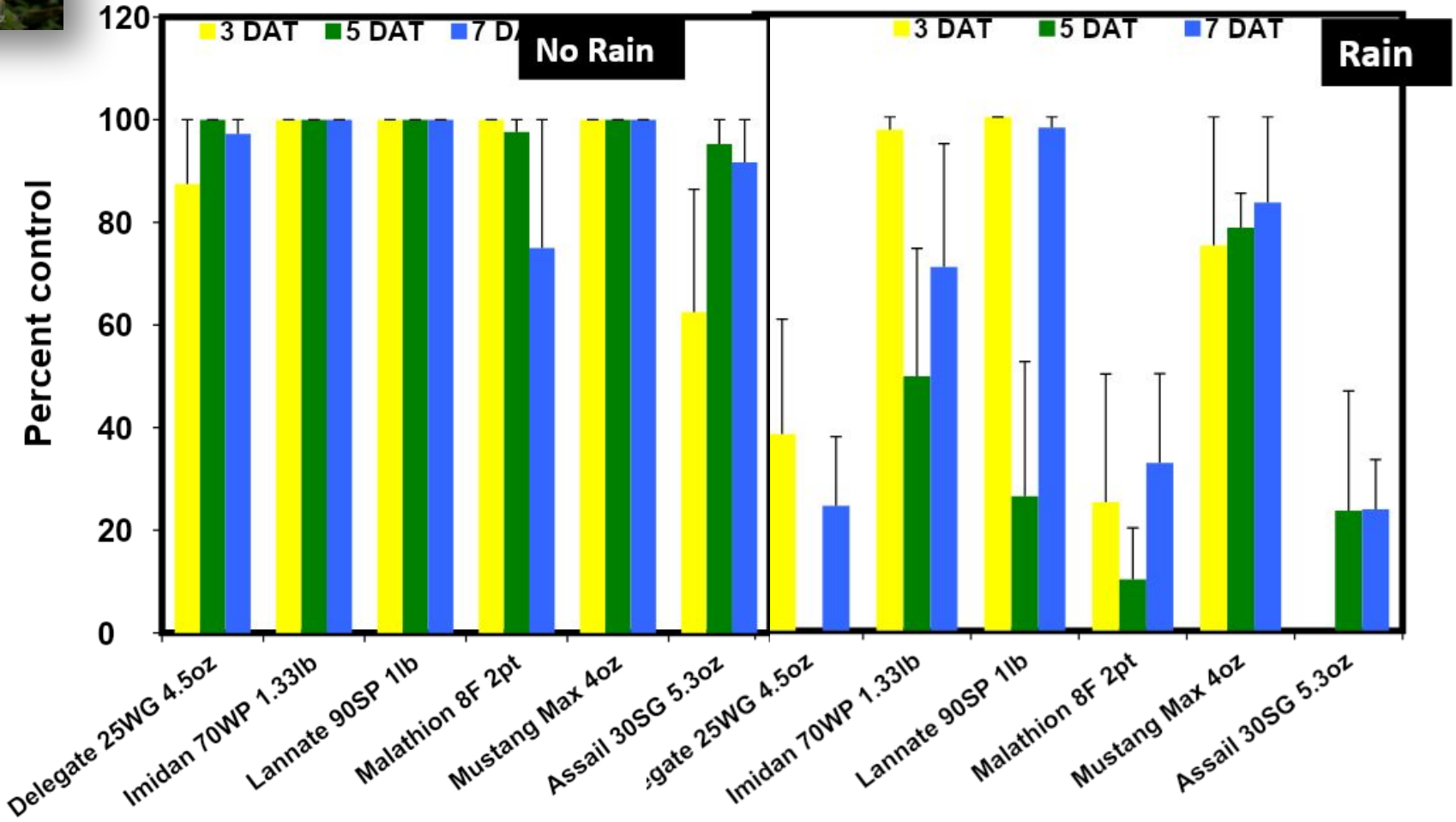


Figure 1. Average ± S.E. efficacy rankings for 22 insecticides that have been tested against SWD in various fruit crops. Insecticides were ranked as not effective (score = 0), weakly active (1), fair (2), good (3), or excellent (4). Only insecticides that had 4 or more submitted are included in the figure, and the number of entries is shown in parentheses below the bars.

Effect of Rain on Some Common Insecticides in Blueberry

From Rufus Isaacs, MSU





0.8 inches of rain on treated bushes
1 day after application

MICHIGAN STATE UNIVERSITY

Rainfastness of insecticides

Insecticide persistence, plant penetration and rainfastness rating			
Compound class	**Persistence (residual on plant)**	**Plant penetration characteristics**	**Rainfast rating**
Organophosphates	Medium - Long	Surface	Low
Carbamates	Short	Cuticle Penetration	Moderate
Pyrethroids	Short	Cuticle Penetration	Moderate - High

Insecticide persistence, plant penetration and rainfastness rating			
Compound class	**Persistence (residual on plant)**	**Plant penetration characteristics**	**Rainfast rating**
Neonicotinoids	Medium	Translaminar & Acropetal	Moderate
Oxadiazines	Medium	Cuticle Penetration	Moderate
Avermectins	Medium	Translaminar	Moderate
IGRs	Medium - Long	Translaminar	Moderate
Spinosyns	Short - Medium	Translaminar	Moderate - High
Diamides	Medium - Long	Translaminar	Moderate - High

Rainfall influences performance of insecticides on the codling moth (Lepidoptera: Tortricidae) in apples. John C. Wise,1 Daniel Hulbert, Christine Vandervoort. Can. Entomol. 149: 118–128 (2017)

Thank you

Questions??

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