Tarnished Plant Bugs, Mites, and Other Strawberry Insect Pests

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Commercial Fruit IPM In-Service Training
October 10, 2012
Fruit Research Station
Clarksville, AR

Training Agenda:

What is Insect Pest Management?

Tour online resources

Identification of fruit pests

Calculating degree days (DD)

Season Sampling Plan - files in Online DropBox:

History - 2011 trap/damage data

By fruit crop (apple/peach; bramble and grape):

- Seasonal phenology of key insect pests
- Sheets identifying damage, time to scout, pest ID, name
- Pest monitoring procedures
- Making pest management decision (economic thresholds)

New pests? Barbara will check traps for BMSB and SWD

Insect Pest Management (IPM)

- Identify the pest and its damage
- Understand pest life cycle relative to crop growth stages (phenology)
- Annually, by crop or cultivar block record history of pest phenology, abundance & % damage
- Know when and how to sample for each pest
- Is there an economic threshold that alerts you to need for a spray?
  - Example: 1 plum curculio/trap/week
- If you need to spray - what to spray and when?
- Alternate insecticide/ miticide sprays with different modes of action (IRAC#) to delay resistance development

Home
Fruit Blogs
PM Product Suppliers
Degree days
Fruit Newsletter
Pecan
Viticulture
Organic
Articles / Talks
Spray Guides
Efficacy Tables

Pest Alert:

Spotted Wing Drosophila in Arkansas

Stink Bugs and Pecan Weevils Damaging Nuts

Arkansas Pest Management News- click here

New Fact sheets:

Brown Marmorated Stink Bug

Spotted Wing Drosophila

Raspberry Crown Borer

Link: http://comp.uark.edu/~dtjohnso/

Specific Online Resources from Webpage: *Fruit / Nut Pest Management*

Fruit Pest Management home page:

- http://comp.uark.edu/~dtjohnso/

Scouting suppliers: I use Great Lakes IPM:

- http://comp.uark.edu/~dtjohnso/PM_Suppliers.html

Degree day calculator:

- http://comp.uark.edu/~dtjohnso/DD_calculator.html

Fruit Newsletters:

- http://comp.uark.edu/~dtjohnso/Arkansas_Fruit_Newsletter.html

Fruit spray guides & IRAC # (Mode of Action):

- http://comp.uark.edu/~dtjohnso/Management_and_Spray_Guides.html

Efficacy tables:

- http://comp.uark.edu/~dtjohnso/Spray_Efficacy_Tables.html

Cornell University Diagnostic Tool for Berry Crops

Click: http://www.fruit.cornell.edu/berrytool/

STRAWBERRY **RASPBERRY** **BLUEBERRY** **BLACKBERRY** **Currant & Gooseberry**





Strawberry: http://www.fruit.cornell.edu/berrytool/strawberry/STRparts.htm

STRAWBERRY PLANT PEST SYMPTOMS, WHEN TO MONITOR, AND ARTHROPOD PEST DESCRIPTION

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

Pest Symptoms on Plant	When and How to Look	Arthropod Description	Arthropod Common Name
Stunted or dead plants with roots pruned	After planting, dig up dying or stunted plants to check for presence of white grubs in soil	Grubs, ½" to 2", "C"-shaped, white with 6 legs	White grubs
Misshapened fruit	First flower buds to first bloom, check weekly 30 strawberry flower clusters and sweep net adjacent blooming weeds (clover, vetch, curly dock, alfalfa) to detect adult bugs	Adult, ¼", oval, yellow "Y" marking between wings, stylet mouthparts; Nymph, 1/4", pale green to greenish-brown	Tarnished plant bug
Stem of flower bud girdled, bud dies and falls off	As flower buds swell, look for girdled flower bud stems or jar 30 clusters onto a white paper plate to detect adult weevils.	Adult weevil, 1/10", snout, dark-reddish brown body; Larva, 1/10", white, legless inside flower buds	Strawberry bud weevil or Strawberry clipper
Leaves rolled or tied together by silk	From bloom on, look for leaves held together with silk	Caterpillar, ½", green, very wiggly when leaf is unfolded	Leafrollers
Sticky honeydew on leaflets that is clear becomes moldy black	In spring or fall, check for aphids on underside of newer leaflets	Aphid, 1/12", pear-shaped, light-green to green, soft-bodied, and with or without wings	Aphids
Leaves bronzed (loss of chlorophyll) or webbed with fine silk	Weekly from early-November to harvest, **use hand lens** to determine percentage of leaves with spider mites present	Mite, 1/3 mm long, 8 legs, yellow with green spots or whole body red	Spider mites (two species)
Ripening fruit look soft or sunken	Weekly, determine presence of pest by floating white fly larvae from 30 randomly collected ripening fruit in a bag of salt water (½ lb salt in gal. water)	Adult fly, 1/8", female has serrated ovipositor, male has spotted wing, 2 black combs on front legs; Larva, white, headless	Spotted wing drosophila (new invasive pest of ripening, soft-skinned fruits)

White Grubs

- **Damage**: Grubs prune off roots of transplanted strawberries
- **Biology**: some white grub species have 2 yr. life cycle in soil
- **Cultural tactic**: transplant into fields kept fallow of grass for 2 yrs. = allow white grubs to die (no roots to feed on) or mature and exit soil as May beetles
- **Composted manure** may attract green June beetles to lay eggs and larvae (large grub) to tunnel in soil and uproot strawberries in fall

Tarnished Plant Bug

***Lygus lineolaris* (Palisot de Beauvois)**

Cornell Fact Sheet (HANDOUT):

http://nysipm.cornell.edu/factsheets/berries/tpb.pdf

Damage:

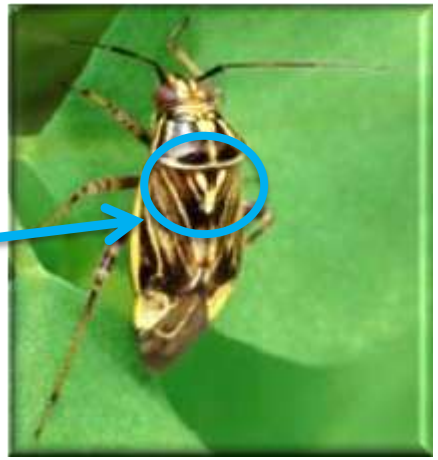
- Apple, peach, brambles, strawberry
- Suck on individual strawberry seeds – hollow and straw brown
- "Cat-faced" or "button-berry" fruit have apical seediness
- Deformed or undersized fruit

Source: Cornell TPB Fact Sheet

Tarnished Plant Bug ID

Adult:

- ¼” long, oval, greenish-brown
- Yellow “Y” marking between wings
- piercing-sucking mouthparts

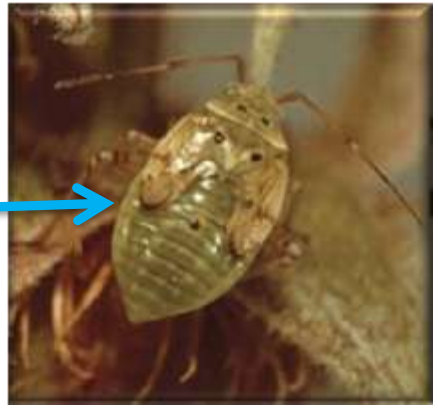


Eggs

- laid in plant tissue
- hatch into nymphs in a couple weeks

Nymph:

- 1/10” to 1/4” long
- Pale green to greenish-brown
- Later instars develop wing pads



Source: Cornell TPB Fact Sheet

Why were tarnished plant bugs (TPB) so bad, especially in 2012?

Problem:

Early 1st bloom by 1 Mar. in Arkansas

Adult TPB were active by early Mar. and nymphs by 1st Apr.

Strawberry growers experienced economic damage from TPBs in Delta region from Memphis to Lonoke to Cabot

Why the increase in numbers of TPB?

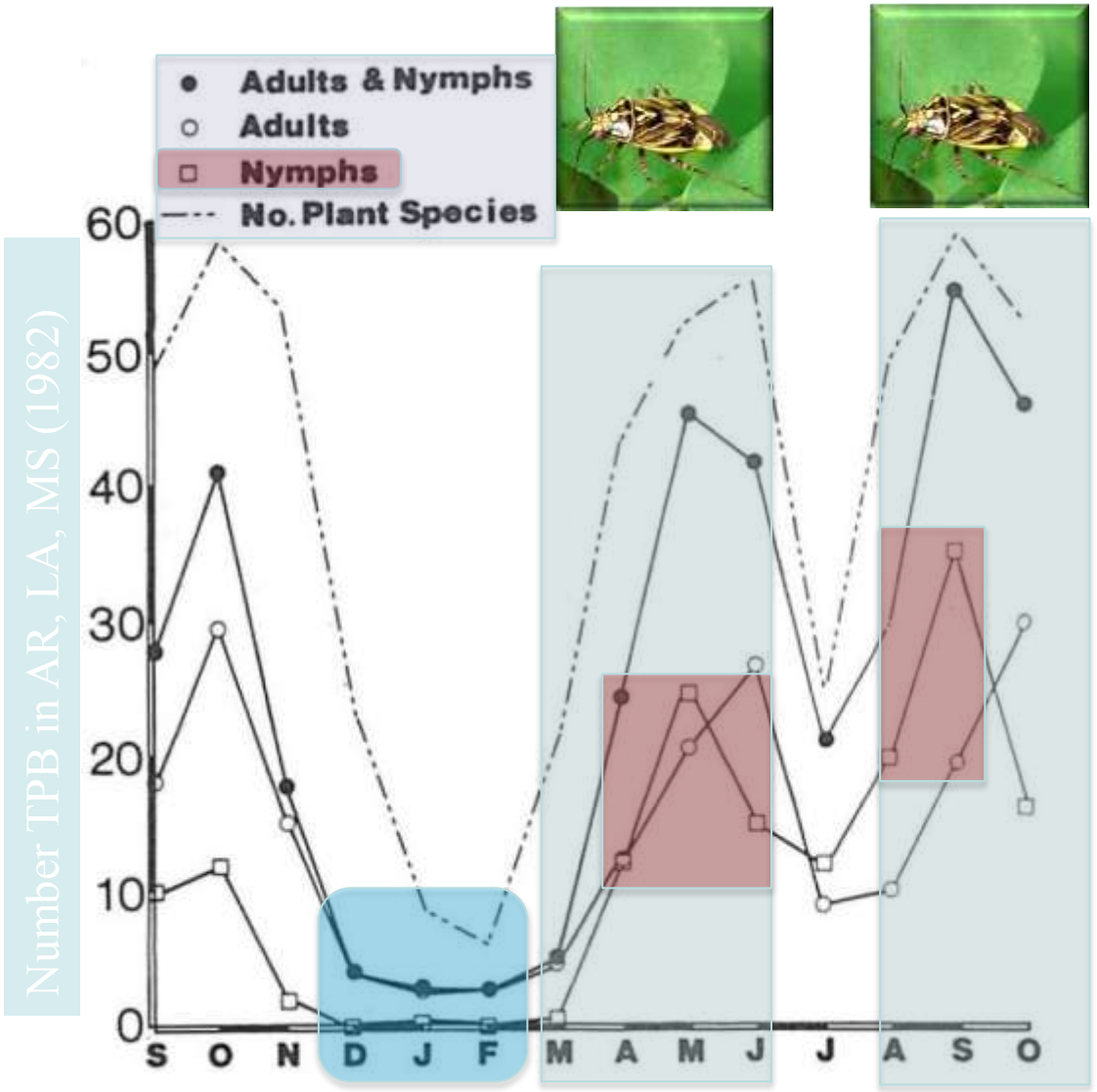
Number of TPB overwintering is large due to planting *Bt* cotton and *Bt* corn and success of boll weevil eradication program - result in fewer sprays in row crops for worms and weevils so fewer TPB killed

Warm 2011 produced 4 generations and mild winter allowed more TPBs to successfully overwinter

Resistance to pyrethroid insecticides? use another mode of action

Tarnished Plant Bug Biology

- Overwinter as adults
- 2 generations per year
- Adults become active on flowers of many weed hosts from Mar. to June and from Aug. to Sept.
- Nymphs occur from early Apr. to May and from Aug. to Oct.



Source: Snodgrass et al. 1984. Environ. Entomol. 13:110- 116.

Spring Hosts of Tarnished Plant Bugs

http://nycgarden.blogspot.com/

http://www.swcolorado wildflowers.com

Narrowleaf vetch

Jan Kops - Flora Batava (1807)

http://www.drmcbug.com/Spring.htm

http://www.hear.org/pier/imagepages/singles/ 800px-Medicago_arabica-001.htm

Source: Snodgrass et al. 1984 Environ. Entomol. 13:110- 116.

Fall Hosts of Tarnished Plant Bugs

Photo: Jennifer Anderson @ USDA-NRCS PLANTS Database

Hairy aster

Lamb's quarters

Photo: Wildman
http://www.wildmanstevebrill.com

Source: Snodgrass et al. 1984 Environ. Entomol. 13:110- 116.

Tarnished Plant Bug Monitoring

- Pre-bloom, sample weekly 30 flower clusters across the field (5 clusters at 6 locations)
- Knock nymphs free from plants and flowers buds onto a white colored paper plate
- Set white sticky cards in strawberry row to detect bug flight

Tarnished Plant Bug Pre-bloom Control

- ***1st instar TPB nymphs are easiest to kill***
- *Spray threshold, if > 4 flower clusters are nymph infested*
- Follow-up spray may be made after bloom if TPB are still present, but check pre-harvest interval (PHI) before selecting material

DO NOT SPRAY INSECTICIDES DURING BLOOM

Source: Massachusetts Berry Notes 5/6/11

Tarnished Plant Bug Control Immediately Pre-bloom

Recommended Insecticides (mode of action; active ingredient):

– Sevin (*1A; carbaryl*)

– Malathion (1B) or Brigade WSB or Athena (*3A; Bifenthrin*) (Dr. Greg Loeb, Cornell U.)

– Danitol (*3A; fenpropathrin*) (Dr. Rufus Isaacs, Michigan S.U.)

– Assail (*4A; imidacloprid and acetamiprid*)

– Rimon (*15; Novaluron*) applied prior to egg hatch (Mark Bolda, U. CA-Extension)

* **Remember to rotate insecticides to different IRAC # (mode of action)**

Source: Massachusetts Berry Notes 5/6/11

Strawberry Clipper Recommendations

Monitor:

- When flower buds start swelling and temperatures exceed 65˚F, check for clippers in areas close to fencerows, shelterbelts and field margins
- Detect weevils by jarring from flower buds onto a white paper plate

Treat strawberry border if:

- Research suggests that strawberry plants are able to compensate for clipper damage
- Traditionally, spray if > 3 clipped primary buds per 3’ of row
- Research indicates threshold > 20 clipped buds per 3’ of row

Strawberry Clipper Insecticides and rate/acre (IRAC # = MoA, active ingredient)

Sevin XLR Plus at 1-2 qt/A (1A; carbaryl)

Lorsban 4EC at 2 pt/A (1B; chlorpyrifos)

Athena 0.87EC at 7-17 fl oz/A (3A; bifenthrin)

Brigade 10WP (WSB) at 6.4-32 oz/A (3A; bifenthrin)

Danitol 2.4EC at 16-21.3 fl oz/A (3A; fenpropathrin)

Actara 25WDG at 4 oz/A – also suppresses TPB (4A; thiamethoxam)

Source: 2012 Midwest Small Fruit and Grape Spray Guide
https://ag.purdue.edu/hla/hort/documents/id-169-2012.pdf

True Armyworm

2012 warm Mar.-Apr. accelerated growth of winter wheat, a crop that served as a host plant for armyworms

Identification: 1/8" to 1-1/2" long

- Small larvae appear pale green to brownish
- Mature larvae marked with two orange, white-bordered strips on each side

Damage: feed at night on grasses - problem more concentrated in northeastern to southern part of Arkansas

Monitoring: scout for larvae at night when they're most active or during day lift up dead, chewed grass on the ground to look for larvae

Control:

pyrethroids (3A) are best choice - spray late in the day, or

Radiant (5; Spinetoram) or Rimon (15; Novaluron)

Source: Hay & Forage Grower 1 May 2012: Kelly Loftin

High Tunnel Strawberries

(Dr. Garcia and David Dickey)

Nov. 25, Dec. 2, 2011 – cutworms were damaging strawberry foliage and chewing small holes in green and ripe berries

- Control: applied Deliver ™ (11A; *Bt*) insecticide

Jan. 27, 2012 - cutworms and crickets causing damage

- Control: applied Deliver and Malathion

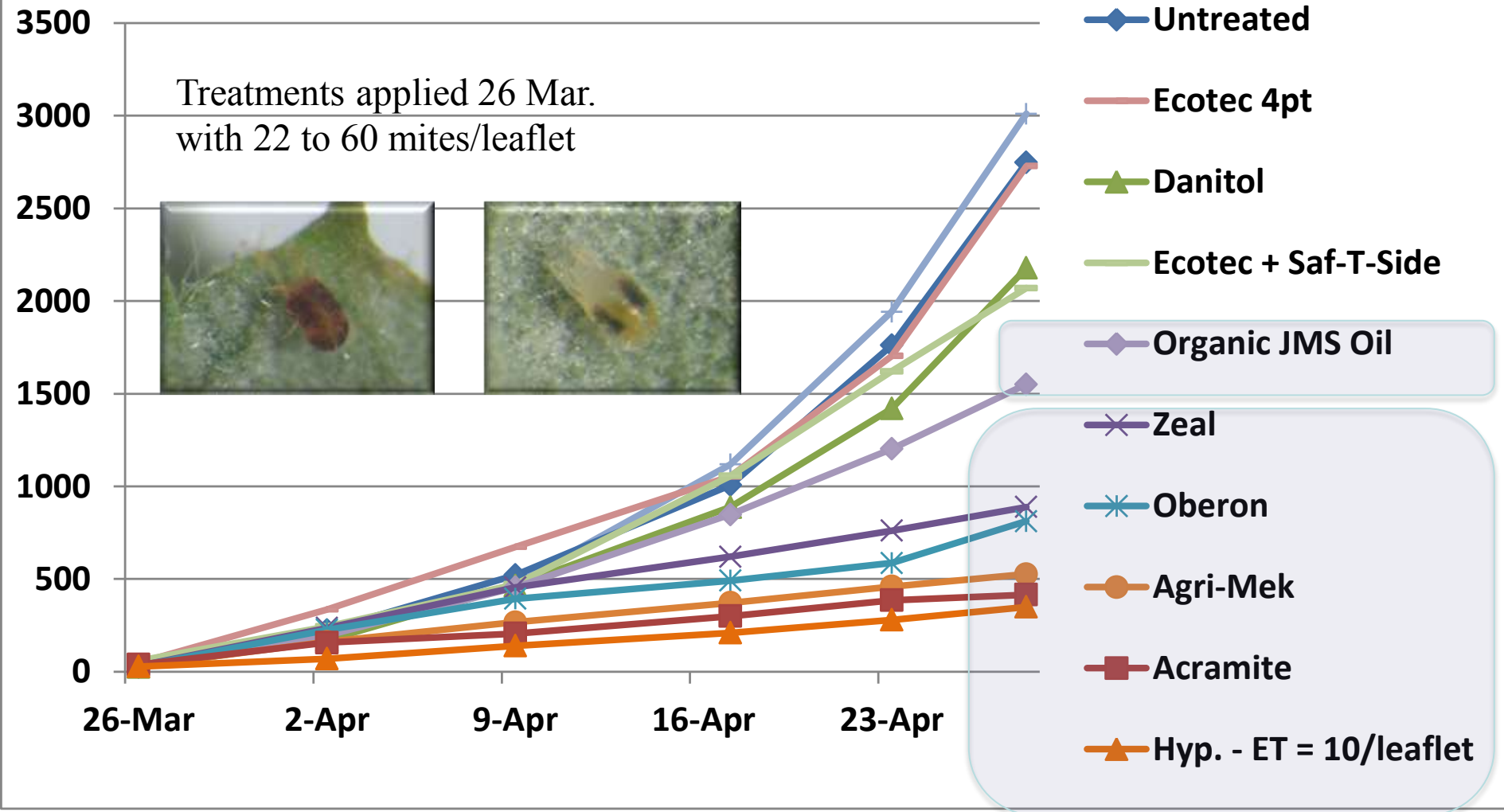
High Tunnel Strawberries

(Dr. Garcia and David Dickey)

Dec. 8 – spider mites bronzing leaves

- **Control**: applied two miticides - Agri-Mek (kill larvae only) on 8 and 19 Dec., and Oberon (kill eggs/larvae) on 30 Mar.
- **Result**:
  - Albion mite damage reduced yield, some mites on Radiance and Elyana, and a few on Festival
  - By 22 Feb. = 35 mites/ Albion leaflet
    - ✓ Oberon applied on 30 March did not kill predator mites already on Albion and Elyana

Cumulative TSM Mite Days (Burrack et al. 2009)



Strawberry Miticides and Mite Stages Affected

Miticide	REI (hrs)	PHI (days)	Stages controlled	Residual activity (days)	IRAC #
Savey	12	28	ovicide/larvicide	60	10A
Agri-Mek	12	21	motile stages	28	6
Apollo (*Do not use after Green tip*) (not for strawberry)	12	21	ovicide	long	10A
Vendex	48	14	mobile stages	30	12B
Zeal	12	7	All stages	long	10B
Envidor (not for strawberry)	12	7	all stages	40	23
Nexter (formerly Pyramite) (not for strawberry)	12	7	Immatures	< 28	21A
Acramite	12	3	motile stages	28	UN
Oberon (translaminar)	12	3	Eggs & nymphs	14-21	23
Brigade (foliar/systemic)	12	0	?		3
Kanemite (acequinocyl)	12	1	Knockdown/residual Harmless to predator mites	21 d between trts	20
Malathion	12	3	suppressant	Short/contact	1B
Insecticidal soap	0	0	Marginally effective	Short/contact	suffocant

- Miticide choice restricted to those with short PHI
- **Note**: Burrack (NCSU) found Agri-Mek, Acramite, Oberon and Zeal miticides all reduced numbers of motile spider mites and eggs for up to 3 weeks.
- JMS Stylet Oil reduced motile spider mites with sprays applied at 3 week interval.

HANDOUT

Relative Efficacy, IRAC # (mode of action) and Availability

Handout

HANDOUT

Table 7. Effectiveness of Pesticides for Control of Strawberry Insects and Mites

Midwest Grower Supply & Winfield Available?	CHEMICAL	Clipper	Cyclamen mite	Eastern flower thrips	Leafhoppers	Leafrollers	Root weevils	Rootworms	Slugs	Sap beetles	Spider mites	Spittlebug	Tarnished plant bug	White grubs	IRAC #
X	Acramite	-	-	-	-	-	-	-	-	-	+++ M	-	-	-	UN
X	Admire	-	-	-	-	-	-	-	-	-	-	-	-	+++	4A (Neo)
X	Agri-mek	-	-	-	-	-	-	-	-	-	+++ M	-	-	-	6
X	Assail	-	-	-	++	-	-	+	-	++	-	-	++	-	4A (Neo)
X	Brigade	+++	-	+++	++	-	-	-	-	+++	+	+++	+++	-	3A (Pyr)
X	Danitol	-	-	+++	++	-	-	-	-	++	+	+++	+++	-	3A (Pyr)
X	Diazinon	-	-	-	+	++	+	-	-	++	-	++	+	++	1B (OP)
No	Dibrom	-	-	-	-	-	-	-	-	++	-	-	-	-	1B (OP)
No	Endosulfan (Thionex)	-	+++	++	+	-	-	-	-	+	-	+++	+++	-	2A (Ocl)
X	Intrepid	-	-	-	-	++	-	-	-	-	-	-	-	-	18 (IGR)
No	Kanemite	-	-	-	-	-	-	-	-	-	++ M	-	-	-	20B
No	Kelthane	-	++	-	-	-	-	-	-	-	+ M	-	-	-	UN
X	Lorsban	+++	-	+++	-	-	-	-	-	-	-	-	-	-	1B (OP)
X	Malathion	-	-	-	-	-	-	-	-	+	-	-	++	-	1B (OP)
?	Metaldehyde	-	-	-	-	-	-	-	++	-	-	-	-	-	
X	Oberon	-	-	-	-	-	-	-	-	-	++ M	-	-	-	23
X	Provado	-	-	-	++	-	-	-	-	-	-	-	-	-	4A (Neo)
X	Radiant	-	-	++	-	+++	-	-	-	-	-	-	-	-	5 (Spin)
X	Savey	-	-		-	-	-	-	-	-	+++ M	-	-	-	10A
X	Sevin	-	-	-	++	+	-	-	-	-	-	++	-	-	1A (Car)
X	Sluggo	-	-	-	-	-	-	-	+++	-	-	-	-	-	
X	SpinTor	-	-	++	-	++	-	-	-	-	-	-	-	-	5 (Spin)
X	Vendex	-	-	-	-	-	-	-	-	-	+ M	-	-	-	12B
X	Zeal	-	-	-	-	-	-	-	-	-	+++ M	-	-	-	10B

Efficacy rating system: +++=Highly effective; ++=moderately effective; +=slightly effective; -= ineffective or not sufficient data.

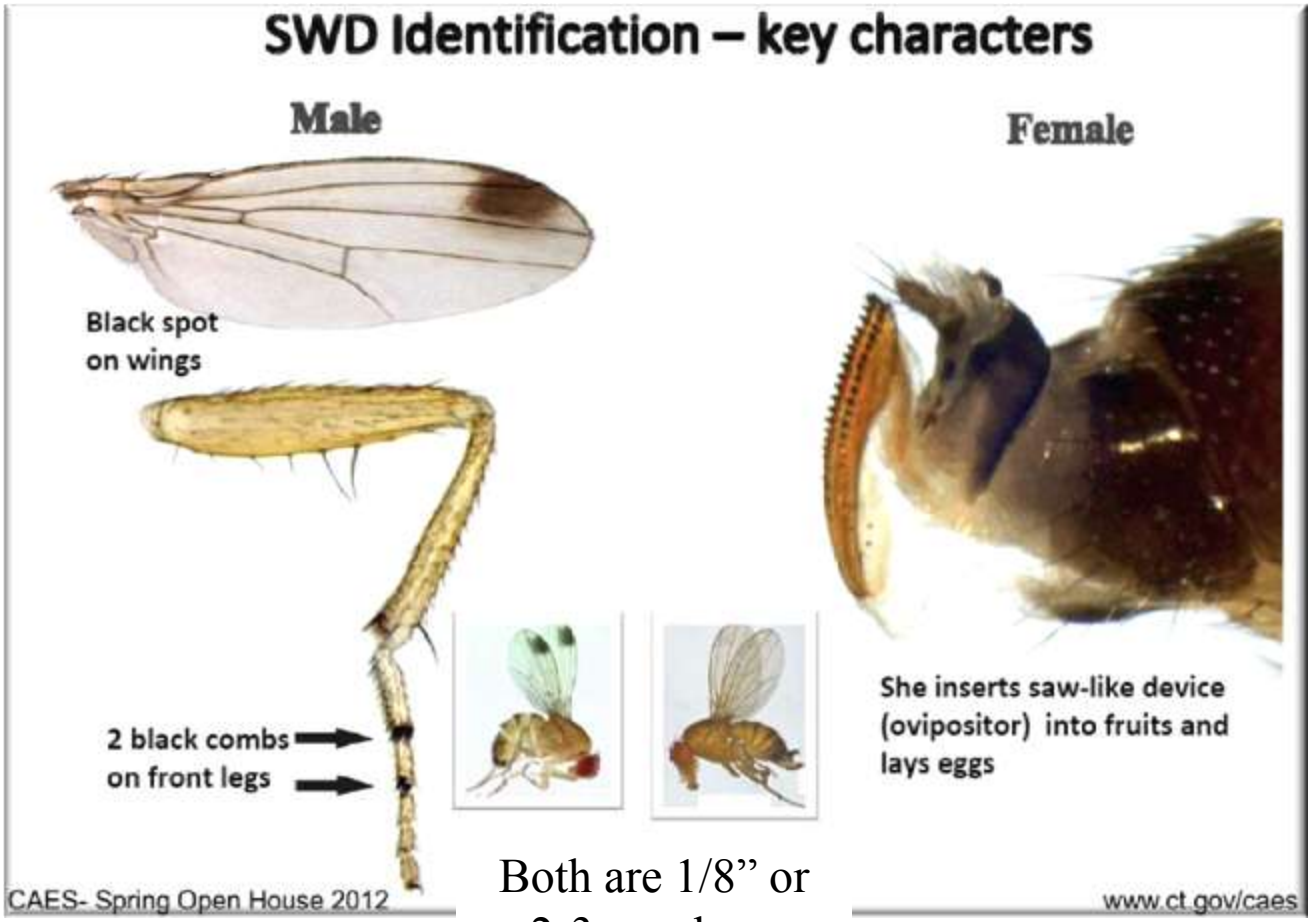
X	**Rimon**												+++		

Source: 2012 Midwest Small Fruit and Grape Spray Guide
https://ag.purdue.edu/hla/hort/documents/id-169-2012.pdf

Be on Look Out for Spotted Wing Drosophila in Arkansas

Handout: http://www.uaex.edu/Other_Areas/publications/PDF/FSA-7079.pdf

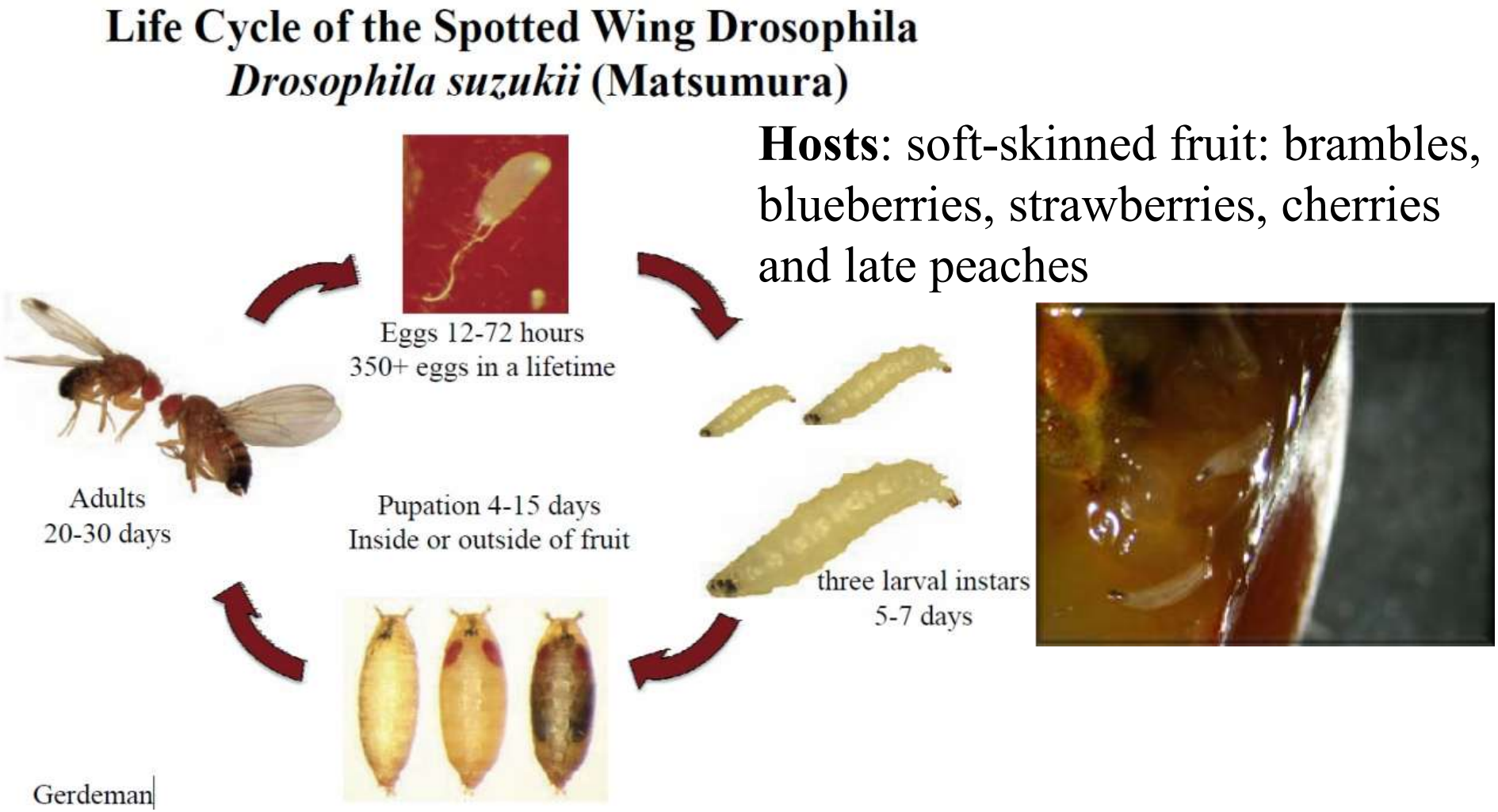
Males have:
- wing spot
- black spines on front legs
- big red eyes



Both are 1/8” or 2-3 mm long

Females have:
- serrated ovipositor
- big red eyes
- no wing spot

Spotted Wing Drosophila Biology (Cowles)



Hosts: soft-skinned fruit: brambles, blueberries, strawberries, cherries and late peaches

Cowles slides:
http://www.ct.gov/caes/lib/caes/documents/plant_science_day/plant_science_day_spring/2012/cowles_spring_open_house_2012.pdf

Monitoring for Spotted Wing Drosophila

- **Make traps:** clear 1 qt deli cups with plastic lid, drill several 3/16" diameter holes in upper sides and lid, add 2" of liquid bait inside (click video: http://www.extension.org/pages/60592/monitoring-for-blueberry-pest-spotted-wing-drosophila-video)
- **Baits (re-bait weekly)**:
  1. "Modified Super bait" - 88 fl oz. water, 32 fl oz. cheap Concord or Niagara grape juice, 6 fl oz. molasses, 3 fl oz. apple cider vinegar, 1 teaspoon unscented dish soap (flies sink)
  2. Yeast bait - 2 teaspoons active dried yeast, 1 teaspoon sugar, 2 cups water; mix and let stand overnight

Detect Spotted Wing Drosophila Larvae in Fruit

- Randomly collect a 30 ripe fruit sample
- Add fruit to black pan or clear baggie
- Add solution of 1 qt water + ¼ cup sugar (or ¼ cup salt) to baggie
- Use ¼" screen to push fruit to bottom to allow larvae to float to surface for 30 min.
- Click video: http://horticulture.oregonstate.edu/content/spotted-wing-drosophila-fruit-dunk-flotation
- To identify, rear some larvae with ripe fruit in baggie to adult flies

Recommended Bramble SWD Sprays

- Spray if you find SWD larvae in ripening fruit or > 1 SWD male in baited trap per week
- Follow 5 to 7 day spray interval or re-apply after rain
- Rotate to different Class / IRAC# / mode of action

Class	Trade name	Active ingredient	PHI (days)	Days of residual activity#
Organophosphate	Malathion	malathion	1*	5-7
Pyrethroid	Mustang Max	zeta-cypermethrin	1	7
	Danitol	fenpropathrin	3	7
	Asana	esfenvalerate	7	7
	Brigade	bifenthrin	3	7
Spinosyn	Delegate	spinetoram	1	7
	Entrust (organic)	spinosad	3	3-5
Pyrethrum	Pyganic (organic)	pyrethrum	0	2

*Check the label for the specific Malathion formulation you are using for the correct PHI. Some formulations may allow 0.5 day PHI.
Estimated residual activity from experience with other insect pests in Michigan and from SWD studies in Oregon.

Source: http://www.ipm.msu.edu/SWD/ManagementRecommendations-RaspberryBlackberryAug2011.pdf

Recommended Blueberry SWD Sprays

(rotate to different Class / IRAC# / mode of action)

Insecticides for SWD control in blueberries

Class	Trade name	Active ingredient	PHI (days)	Days of activity#
Organophosphate	Malathion* Imidan	malathion* phosmet	1* 3	5-7* 7
Pyrethroid**	Mustang Max Danitol Asana Brigade/Bifenture	zeta-cypermethrin fenpropathrin esfenvalerate bifenthrin	1 3 14 1	7 7 7 7
	Hero	bifenthrin+zeta cypermethrin	1	7
Carbamate	Lannate	methomyl	3	3-5
Spinosyn	Delegate Entrust (organic)	spinetoram spinosad	3 3	7 3-5
Pyrethrum	Pyganic (organic)	pyrethrum	0.5	2-3

* The new label for Malathion 8F allows only 1.25 pints per acre and this rate has not been tested in efficacy trials. A maximum of three applications are allowed per season. Also, check the label for your specific Malathion formulation for the correct PHI. Most are one day, but some may allow 0.5 day PHI.
** Residual control will be reduced during hot sunny weather.

Source: http://www.ipm.msu.edu/SWD/ManagementRecommendsBlueberry-June2011.pdf

Questions?







FIGURE 2. MALE SWD with black spot on wings and large red eyes.
Photo: Davis et al. (2010)