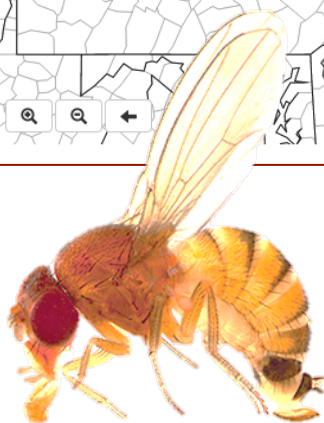
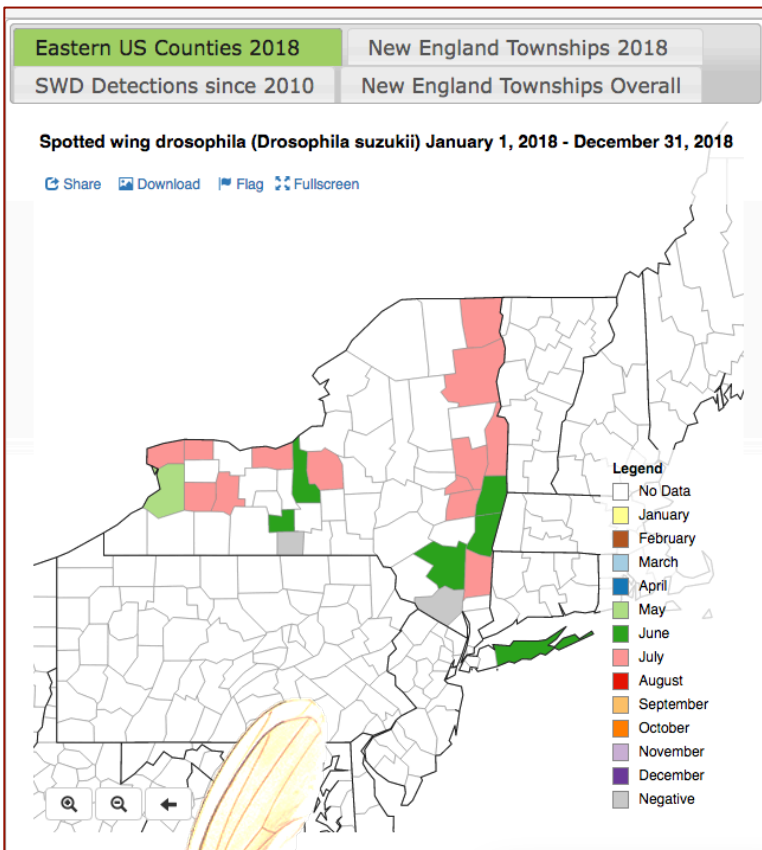
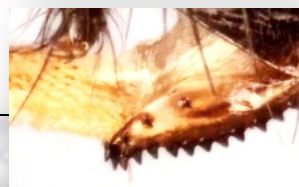


Managing Spotted Wing Drosophila, *Drosophila Suzukii* Matsumara, In Raspberry.



Female SWD



EDD MapS
Early Detection & Distribution Mapping System

<https://www.eddmaps.org/swd/>

<https://blogs.cornell.edu/jentsch/small-fruit/>

Biology

- Presence of SWD in NYS in September 2011 (L. McDermott)
- Overwintering habitat and survival still unknown.
 - Possibilities of small pockets of SWD in urban compost
 - Very low survival in studies (Loeb)
- SWD occupies a relatively non-competitive niche
 - Able to penetrate and oviposit into un-ripened fruit using a highly sclerotized & serrated ovipositor .
- 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.
- 3-10 generations in NY

Fruit at highest risk from SWD

- **Raspberries**
- **Blackberries**
-
- Strawberries
- Blueberries
- Nectarines
- **Honeysuckle *L. tartarica*** is a primary host for SWD; fruit favored over raspberry in June. Migration to fruit in July.



June 2018 - Labeled Insecticides for Control of Spotted Wing Drosophila in New York Berry Crops – Quick Guide

Compiled by Greg Loeb, Laura McDermott, Peter Jentsch & Juliet Carroll, Cornell University. Updated regularly.

RASPBERRIES & BLACKBERRIES										
PRODUCT	AI ¹	IRAC group ²	EPA#	RATE/A	REI ³	DTH ⁴	Max. Prod/A/yr (ai)	Total applic's	Spray Interval	Probable efficacy
^@Entrust Naturalyte (2ee) ^a	spinosad	5	62719-282	1.25-2 oz	4 hr	1 d	9 oz (0.45 lb)	3 per crop	> 6 d	Good to Excellent [#]
^@Entrust SC (2ee) ^a	spinosad	5	62719-621	4-6 fl oz	4 hr	1 d	29 fl oz (0.45 lb)	3 per crop	> 6 d	Good to Excellent [#]
@Delegate WG	spinetoram	5	62719-541	3-6 oz	4 hr	1 d	19.5 oz (0.305 lb)	6	> 4 d	Excellent [#]
*Brigade WSB (2ee)	bifenthrin	3A	279-3108	8-16 oz	12 hr	3 d	2 lb (0.2 lb)	1 post bloom	-	Excellent
*Brigade EC (2ee)	bifenthrin	3A	279-3313	3.2-6.4 fl oz	12 hr	3 d	12.8 fl oz (0.2 lb)	1 post bloom	-	Excellent
*Danitol 2.4EC	fenpropathrin	3A	59639-35	16 fl oz	24 hr	3 d	32 fl oz (0.6 lb)	2	-	Excellent
*Mustang Maxx Insecticide	zeta-cypermethrin	3A	279-3426	4 fl oz	12 hr	1 d	24 fl oz (0.15 lb)	6	> 7 d	Excellent
^Pyganic EC 1.4	pyrethrin	3A	1021-1771	1 pt-2 qts	12 hr	0 d	-	-	-	Fair to Poor
^Pyganic EC 5.0	pyrethrin	3A	1021-1772	4.5-18 fl oz	12 hr	0 d	-	-	-	Fair to Poor
Assail 30SG (2ee)	acetamiprid	4A	8033-36-70506	4.5-5.3 oz	12 hr	1 d	26.7 oz (0.5 lb)	5	> 7 d	Good [#]
Malathion 5EC (2ee)	malathion	1B	19713-217	3 pts	12 hr	1 d	9 pts (6.0 lb)	3	> 7 d	Good
Malathion 8 Aquamul (2ee)	malathion	1B	34704-474	2 pts	12 hr	1 d	6 pts (6.0 lb)	3	> 7 d	Good
Malathion 57 (2ee)	malathion	1B	67760-40-53883	3 pts	12 hr	1 d	9 pts (6.0 lb)	3	> 7 d	Good
^AzaSol		UN	81899-4	6 oz in 50 gal	4 hr	0 d	-	-	-	Fair to Poor
Molt-X	azadirachtin	UN	68539-11	10 oz in 50 gal	4 hr	0 d	-	-	-	Fair to Poor
^Grandevo	<i>Chromobacterium subtsugae</i> strain PRAA4-1 and spent fermentation media	UN	84059-27	2-3 lb	4 hr	0 d	-	-	≤ 7 d	Fair to Poor [#]
^Venerate XC	<i>Burkholderia</i> spp. strain A396 and spent fermentation media	UN	84059-14	1-4 qts	4 hr	0 d	-	-	≤ 7 d	Poor

¹ In organic production, Entrust must be rotated with different IRAC insecticides, consider Grandevo or products containing the AI's azadirachtin or pyrethrin.

² Refer to label for details and additional restrictions.

³ Adding sugar (sucrose) at 2 lb/100 gal water as a feeding stimulant will increase efficacy.

⁴ Approved for organic use in NY.

⁵ After two consecutive applications must rotate to different mode of action.

¹ Active Ingredient.

² Mode of Action, based on IRAC group code (UN = unknown).

³ Re-entry Interval (hr = hours).

⁴ Days to Harvest (d = days).

SWD Management

- Raspberry & Blackberry: 3-4 day intervals

- Cherry: 4-7d

- Blueberry: 7d

- Strawberry: 4-7d

Granular sugar at 2 lbs./100 gal. will increase attractiveness of insecticide (Assail 30SG)

Weathering will significantly reduce efficacy of insecticide residue.

Excellent sanitation will reduce SWD populations.

Canopy and water management will make the environment less favorable.

Insecticide sprays will kill SWD adults and thereby reduce egg laying.

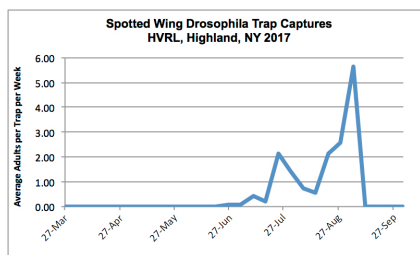
Cool infested berries immediately after harvest.



- Commercially available traps and lures by Scentry and Trece effectively capture SWD adults for use in determining presence in and outside of the crop.
- Fruit can be inspected for evidence of egg laying and larval feeding. Small holes in berries made by the larvae may leak juice when the berry is gently squeezed; this is especially diagnostic on blueberry. Eggs are placed beneath the surface but the respiratory tubes can be seen with magnification



Respiratory 'horns' in raspberry fruit



Developing a Behaviorally Based Attract and Kill System for SWD

- **Color important;** black and red routinely outperformed other colors.
- **A spherical shape:** size greater than 2.5 cm acceptable.
- **Baits enhance SWD capture**
- **SWD infestation in raspberries reduced by 50% when sphere with sugar and bait in caged studies. Sprayed fruit + AtK in combination most effective in managing SWD compared to either alone under high pressure.**
- **Sucrose improves insecticide activity** against *Drosophila suzukii* J. Econ. Entomol. 1 – 14. DOI: 10.1093/jee/tou100.
- **Adding Yeasts with Sugar increases efficacy**
- **Increased attractiveness of bait using bread yeast, *Saccharomyces cerevisiae***
- Exceeds the attractiveness of commercial products GF-120® and Nu-Lure®,
- Addition of the sugar-yeast bait to Entrust increased fly mortality 4-fold in early-season bioassays with green and yellow cherries, reducing eggs laid and larval infestations by 50%

HVRL Studies: Highest efficacy and reduced cost of baits included

- 25% Red Raspberry Concentrate
- 75% Apple Cider Vinegar
- Brewers yeast: *Saccharomyces cerevisiae*
- Boric acid comparable to Spinosad as a toxicant to reduce egg laying in fruit
- **Moist disks more efficacious than dry disks**

ATK Construction

- 3" substrate woven polypropylene netting as a base
- Super Absorbent Polymer (SAP)
- Gelatin
- Red raspberry concentrate
- Apple cider vinegar
- Brewers yeast
- 1% A.I. employing Boric Acid (OMRI)
- AtK solution applied at 2 mL/disk



Table 1. Evaluations Of Attract and Kill stations For Controlling Spotted Wing Drosophila in Raspberry ^a. Hudson Valley Research Lab. Highland N.Y. - 2016



Treatment / Spacing	Timing	% Reduction in Oviposition at each Site			
		WW	PFP	Trapani	All Sites
Boric Acid 18" (Red)	1x Weekly	58.2 a	70.4 a	78.2 a	68.9 c
Boric Acid 36" (Yellow)	1x Weekly	50.6 a	64.3 a	69.8 a	61.6 bc
Means		54.4	67.4	74.0	65.3
Boric Acid 18" (Red)	2x Weekly	63.4 a	59.5 a	86.1 a	69.7 c
Boric Acid 36" (Yellow)	2x Weekly	47.3 a	45.5 a	91.3 a	61.4 bc
Means		55.4	52.5	88.7	65.6
Untreated Disk 36" (Green)		13.4 a	44.8 a	55.2 a	37.8 b
Untreated Control		0.0 a	0.0 b	0.0 a	0.0 a
P value for transformed data		0.7993	0.0001	0.8108	0.0013

^a Evaluation made on Raspberry June to September. Data were transformed using $\log_{10}(x+1)$ using Fishers Protected LSD ($P \leq 0.05$). Treatment means followed by the same letter are not significantly different. Arithmetic means reported.

Objectives for SWD Exclusion System

- 1 Reduce SWD infestation to raspberry
- 2 Reduce or eliminate chemical inputs for SWD control
- 3 Provide easy entry and pleasing environment for PYO small fruit access
- 4 Reduce weed and grass using landscape mat to reduce SWD pupal survival
- 5 Design structure to maintain low initial costs using high tensile wire
- 6 Design a dynamic structure to withstand wind conditions
- 7 Incorporate bumblebee pollination for increased fruit set
- 8 Provide optimum use of Attract and Kill to enhance SWD management
- 9 Allow for biological control of SWD pupa (optimize relative humidity (*B. bassica*))
- 10 Reduced Bird Feeding
- 11 Provide evacuation for birds at open ends

SWD Exclusion / ATK System Costs		200' row netted 20' wide 6.5' high at center and sides				
			Labor	Hourly Wages		
	Costs	Costs	Hours	\$12.00		Notes
8' Posts		\$58.80	3	\$36.00		
Netting		\$732	1	\$12.00		\$0.14
High Tensile Wire		\$40.50	6	\$72.00		200,0
30" Ground Anchors		\$60.00	2.5	\$30.00		
4' Ground Anchors		\$60.00	1.5	\$18.00		
Bushings		\$0.04	1	\$12.00		
Zip Ties		\$3.00	1	\$12.00		
Ground Cloth		\$240.00	1	\$12.00		\$0.67
Ground Cloth 6" Staples		\$13.20	1	\$12.00		
Ratchet tensioners		\$27.00	1	\$12.00		
Grippler Tensioners		\$18.00	1	\$12.00		
End Post Cams		\$8.70	0.5	\$6.00		
Tubing		\$2.29	1	\$12.00		
Binder Clips		\$22.22	1	\$12.00		
4' Ground Conduit		\$4.50	3	\$36.00		
10' Net Support Conduit		\$17.50	1	\$12.00		
10' Post Separator Conduit		\$3.50	1	\$12.00		
90 plumbing elbows		\$3.60	0.5	\$6.00		
Sandbags		\$44.70	1	\$12.00		
Total material & labor costs		\$1,359.55	Total hours 30	\$348.00	\$1,707.55	
Attract and Kill Costs		Total Costs				
ATK		\$122.50				
Weekly Maintenance		\$60.00				
Solution (ACV+RRC+Borax)		\$30.00				
Weeding		\$60.00				
Exclusion System: Total Costs			\$1,707.55			
7 Year			\$243.94			
14 Year (replace net year 8)			\$199.45			