Spotted Wing Drosophila: A New Pest of Berry Crops

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THE OHIO STATE UNIVERSITY

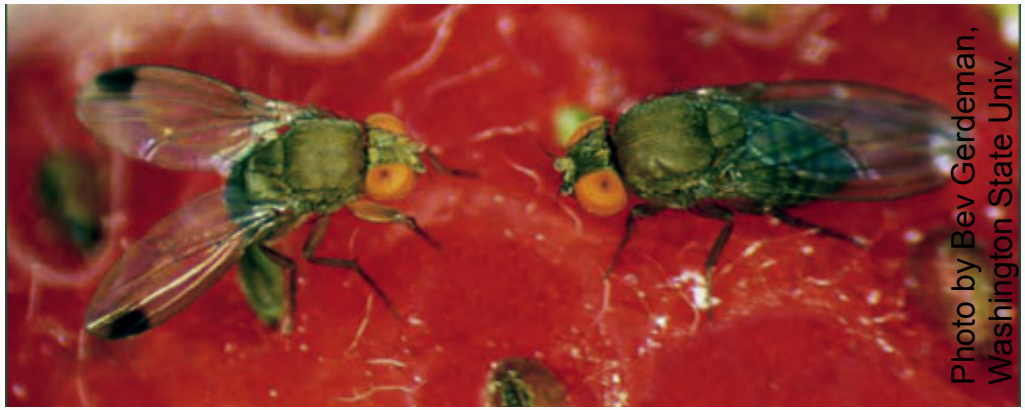
New?

- **Looks like common vinegar flies on overripe, fallen, decaying fruit**
- **The new species attacks <u>healthy</u> ripening fruit**

Hosts

- **Early:** cherries
- **Mid:** raspberries, blueberries, blackberries
- **Late:** grapes
- strawberry, peach, plum
- cherry tomato, kiwi, pear, apple

Injury



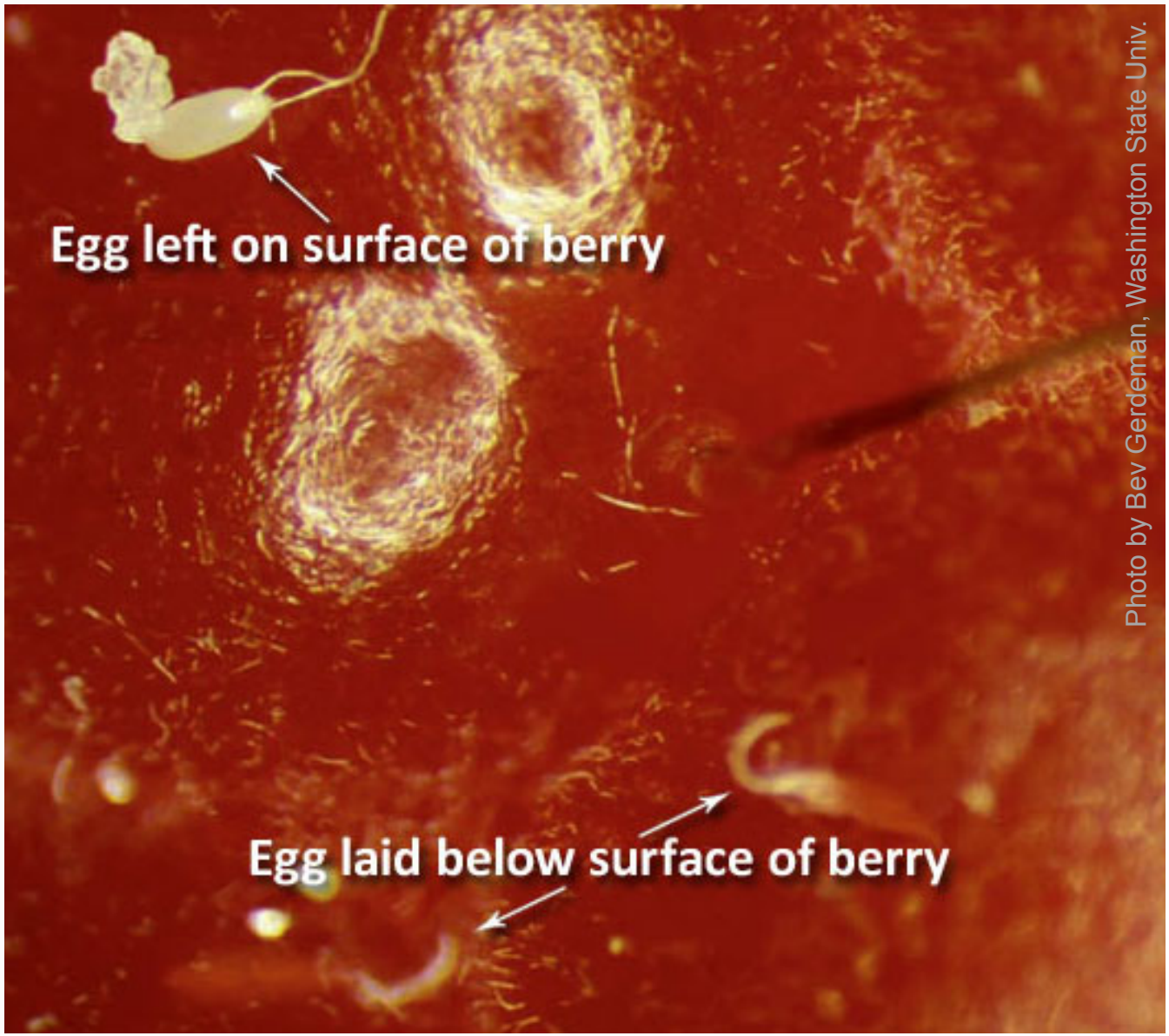
adults

larva

- Egg laying & larval feeding
- Starts as tiny scar on skin of fruit
- Larvae feed inside fruit
- Skin collapses in 2-3 days; molds

Eggs

Egg being deposited by female fly



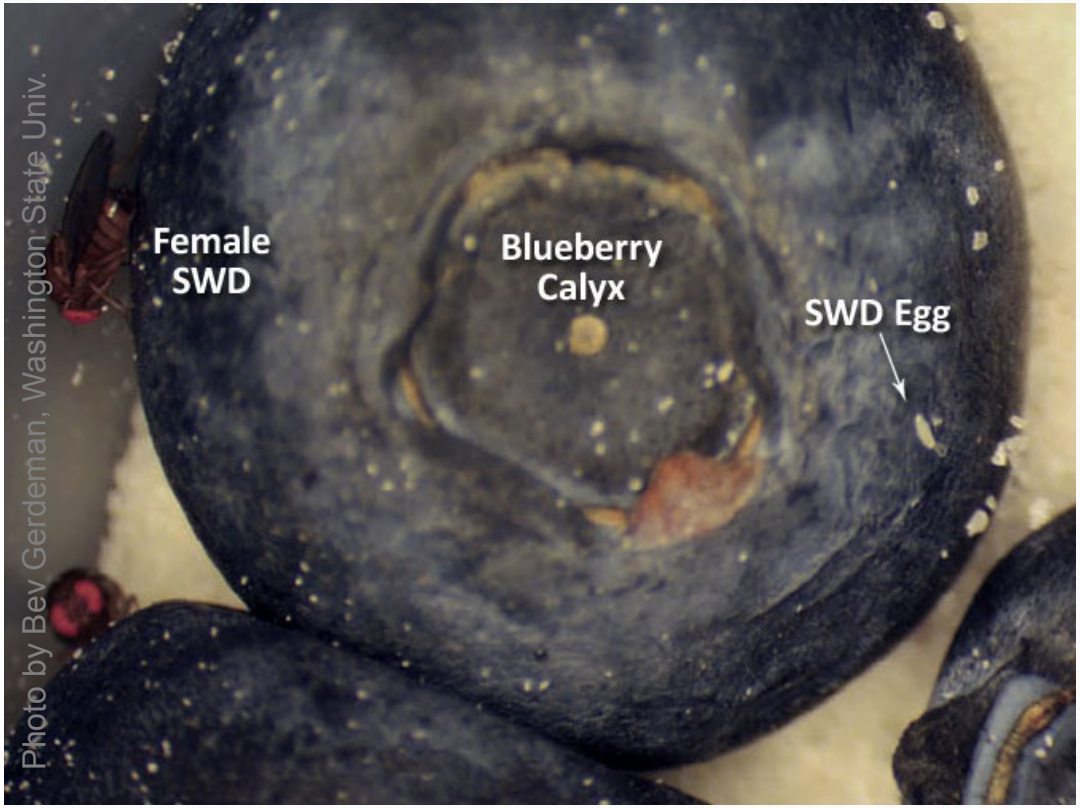
When talking to customers about worms in fruit…

- Say “Larvae”!
- Do not say “Maggots”!

Fruit injury in raspberry

Fruit is susceptible to injury once it has started to turn color

Fruit injury in blueberry

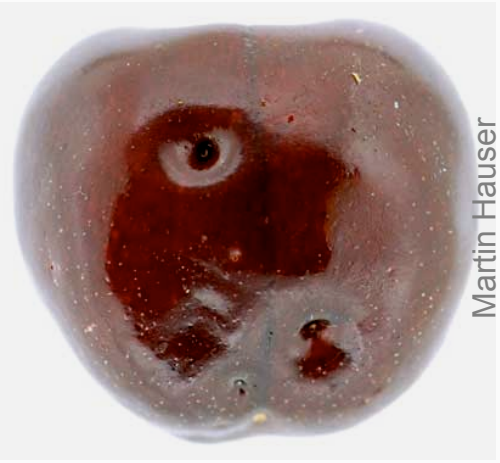


Fruit injury in strawberry

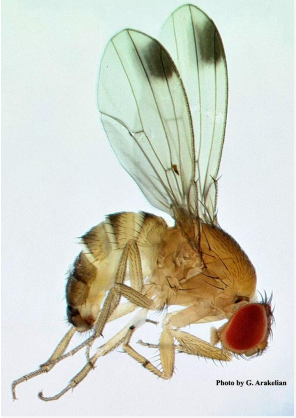
Fruit injury in grape

- **Likely >7.5% brix**
- **Most 17-22 brix**

Fruit injury in cherries



Fruit injury in peach



Origin

- From Asia
- In Hawaii since 1980
- Detected in California in 2008
- 2009: Florida, Washington, Oregon
- 2010: Michigan, Carolinas, Utah

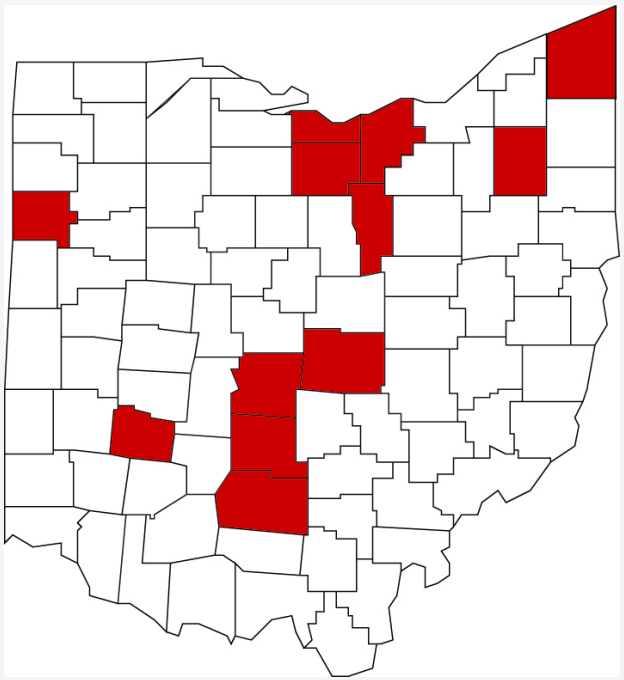
Ohio

- First report:
  - Raspberries
  - September 2011
  - VanWert County
- 2012:
  - First catch 7/12/2012
  - More reports Aug.-Sept. 2012
  - Blackberries, raspberries, grapes
- Many reports July-August 2013
  - Also blueberry, peach, HT strawberry

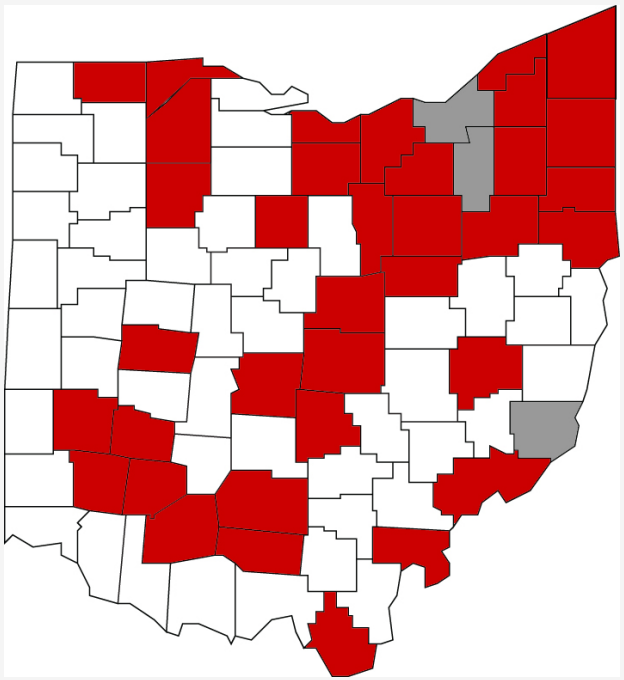
Range in Ohio

- 37 counties positive for SWD in 2013

2011



2012



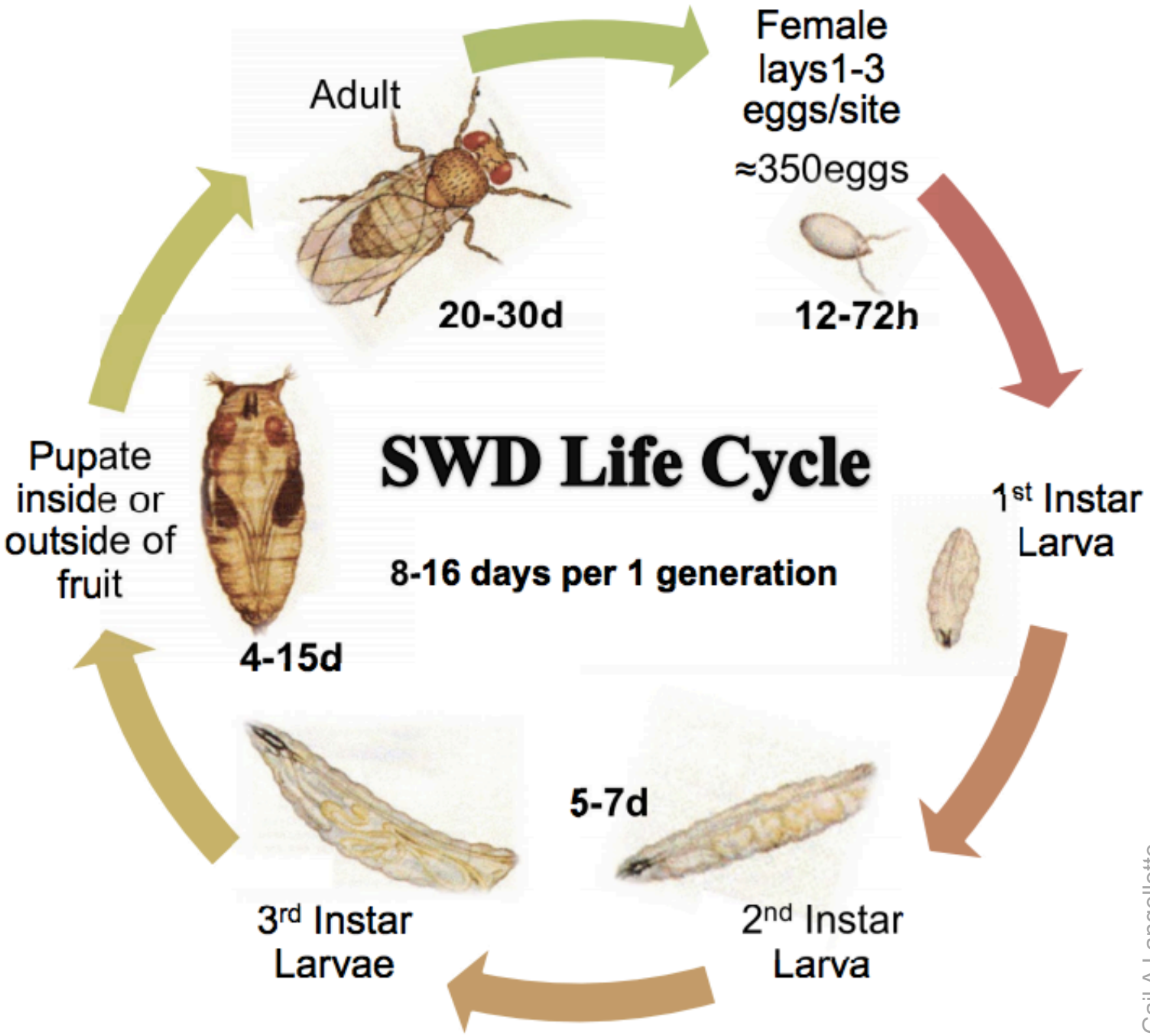
2013

Ohio: SWD reports

- Most reports
  - Blackberries
  - Raspberries
  - Blueberries
- Some reports
  - Peaches
  - Grapes

Ohio: news

- Bad news
  - Widespread
  - Severe damage
- Good news
  - Under control if insecticide program used



Gail A Langellotto

Monitoring spotted wing Drosophila

- Critical to determine if this new pest is present on each farm
- Use vinegar bait traps to monitor adult flies
- Use salt test to monitor larvae in fruit

Traps to monitor adult SWD flies

- Make your own trap
- Option 1:
  - Use 1 quart clear deli container
  - Make ¼” holes around 1 side
- Option 2:
  - 24 oz peanut butter jar
  - Make 5 holes @1”, cover with mesh
  - Add red tape

Bait for traps

- **Apple cider vinegar (1 inch)**
  + a drop of dish soap
- **Alternative: fermenting bait**
  - **Mix: Yeast (1/4 tsp active dry)**
    Sugar (1/2 tsp)
    Flour (2 Tbsp)
    Water (4 tsp)
  - **Put in 4-oz cup with mesh cover**
  - **Float cup on apple cider vinegar in jar trap**

Traps: other options

- **Add yellow sticky card inside jar**

Trap options:
Commercial trap by ConTech

- Great Lakes IPM
  - –$9.45 for 2 traps
- Red color adds attraction
- 2 small holes
- Advantages:
  - –Ready-made, easy to use
  - –Catches fewer non-targets
- Disadvantage: catches significantly fewer SWD than other traps
- Can modify by making more holes

Using traps in fruit crops

- Hang in canopy
- On north side
- Do not dump spent vinegar in field

Bait trap maintenance

- **Once per week:**
  - **Remove trapped insects**
  - **Replace vinegar**
- **If heavy rain:**
  - **Replace vinegar**

Supplies

- Strainer
- Funnel
- Jug to hold spent vinegar
- Vial to hold insects
- Small paintbrush
- 75% ethanol or preservative
- Fresh bait

Ready to identify?

- Threshold: a single SWD adult
- Need to separate:
  - Suspected SWD
  - All others
- Equipment:
  - Minimal: 30x magnifying lens
  - Better: Dissecting microscope

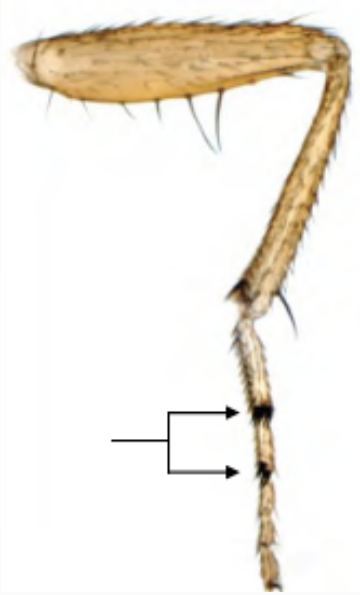
What insects are trapped?

Many!

- Spotted wing Drosophila
- Common vinegar flies
  - Same size, shape as SWD
- Other flies, wasps, moths
  - Some obviously not SWD
  - Some same size, shape as SWD
  - Some with spots on wings

i.d. of adult male

- Spots on wings
- Spots can be absent on young (newly emerged) males
- 2 dark bands of combs on front leg



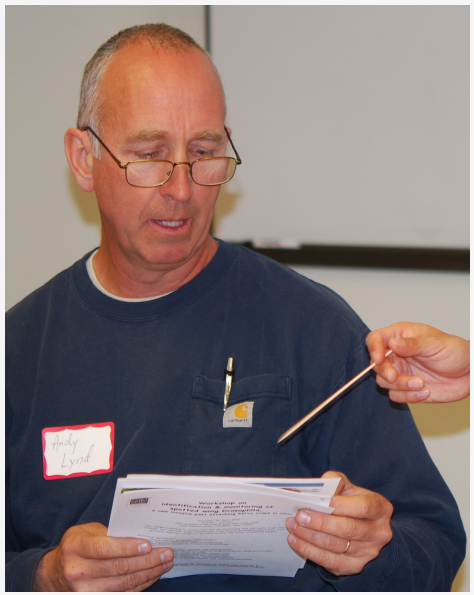
i.d. of adult female

- **No spots on wings**
- **Saw-like ovipositor**
  - **Large, dark, more obvious**

SWD Workshop, April 2013 & 2014

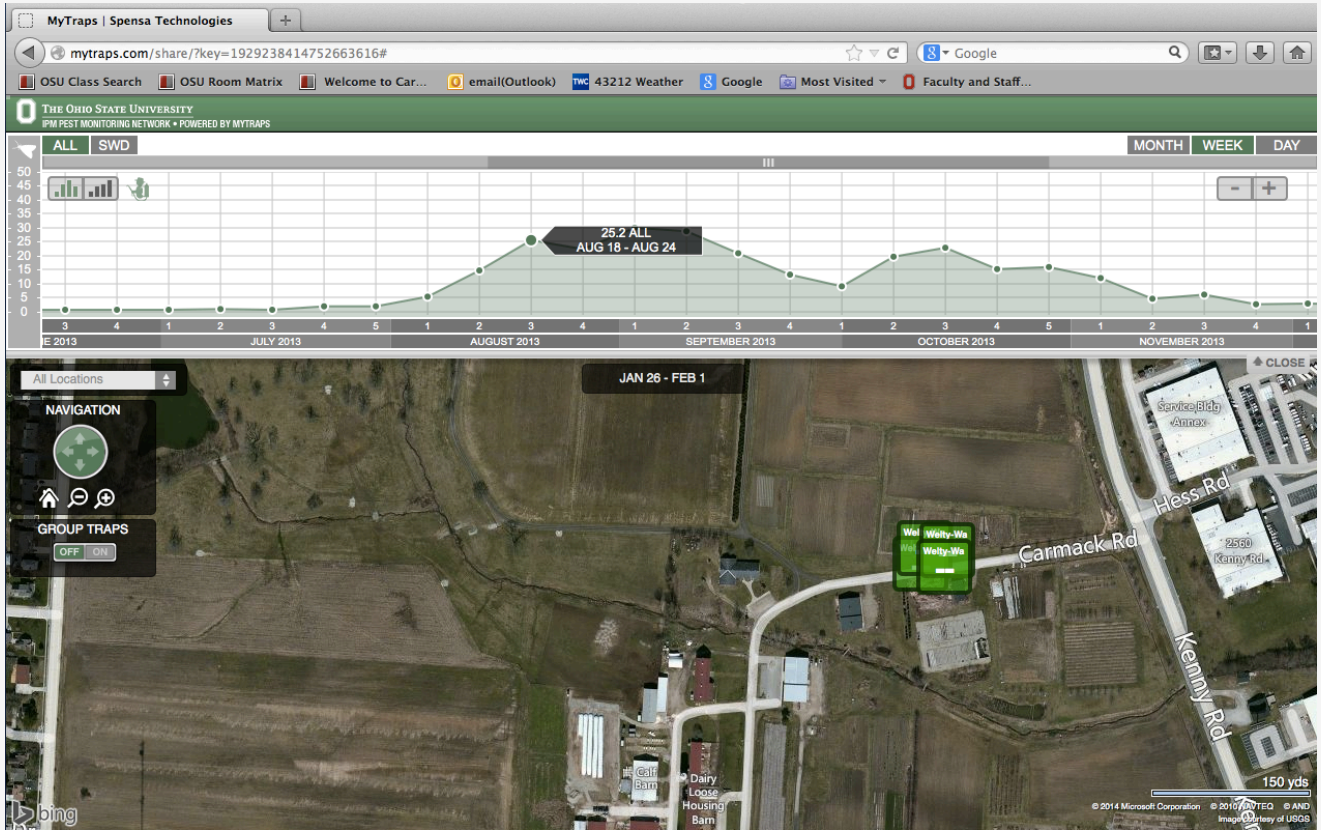




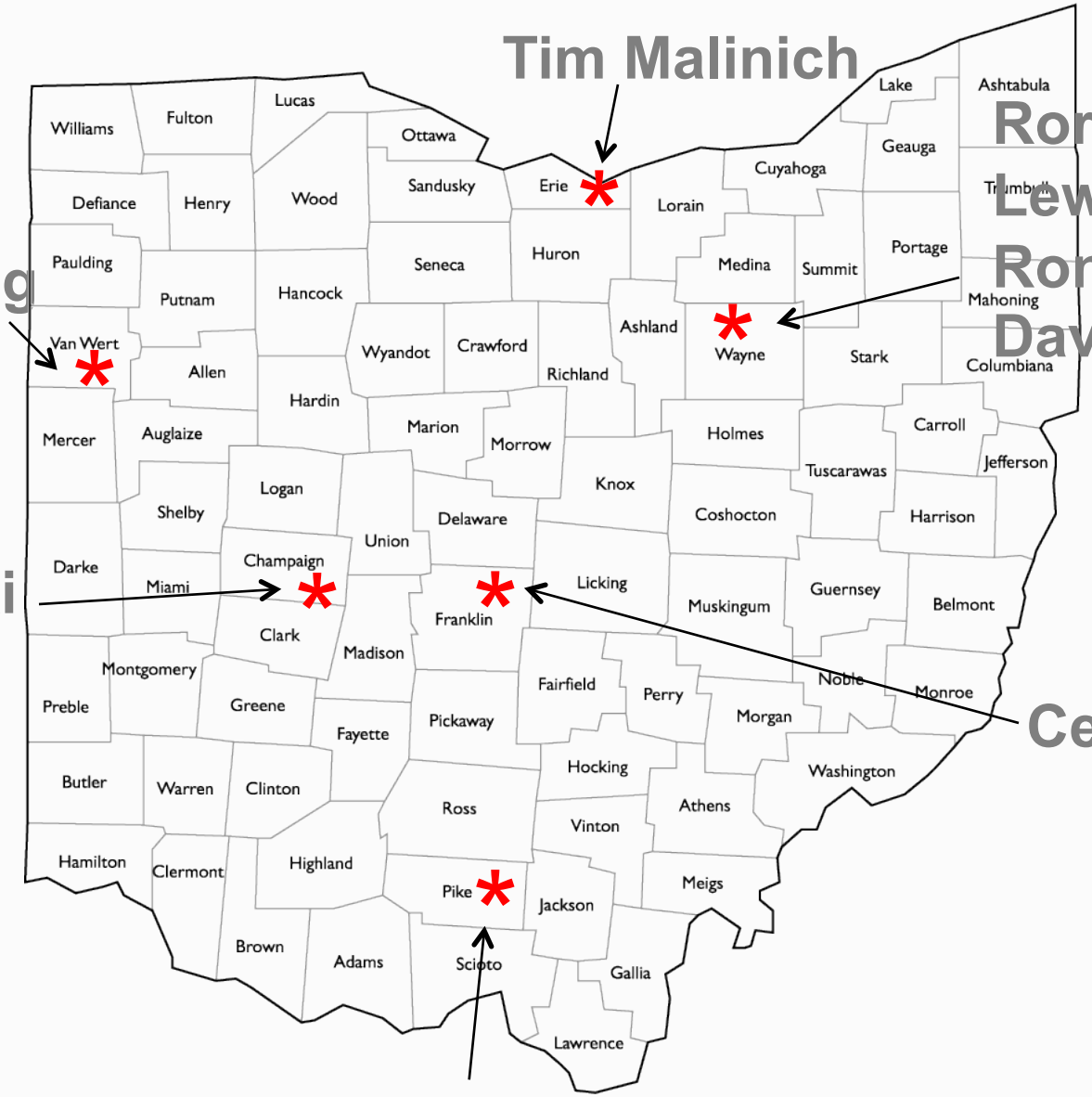




Trap network 2013 & 2014

- **26 traps in 14 counties**
- **trap counts on MyTraps website**
  http://mytraps.com/share/?key=19292384147526636 16



Identifiers with microscopes



Tim Malinich

Rory Lewandowski, Ron Becker, Dave Scurlock

Curtis Young

Jim Jasinski

Celeste Welty

Thom Harker, Gary Gao, & Brad Bergefurd

Need to ship specimens to clinic for species confirmation?

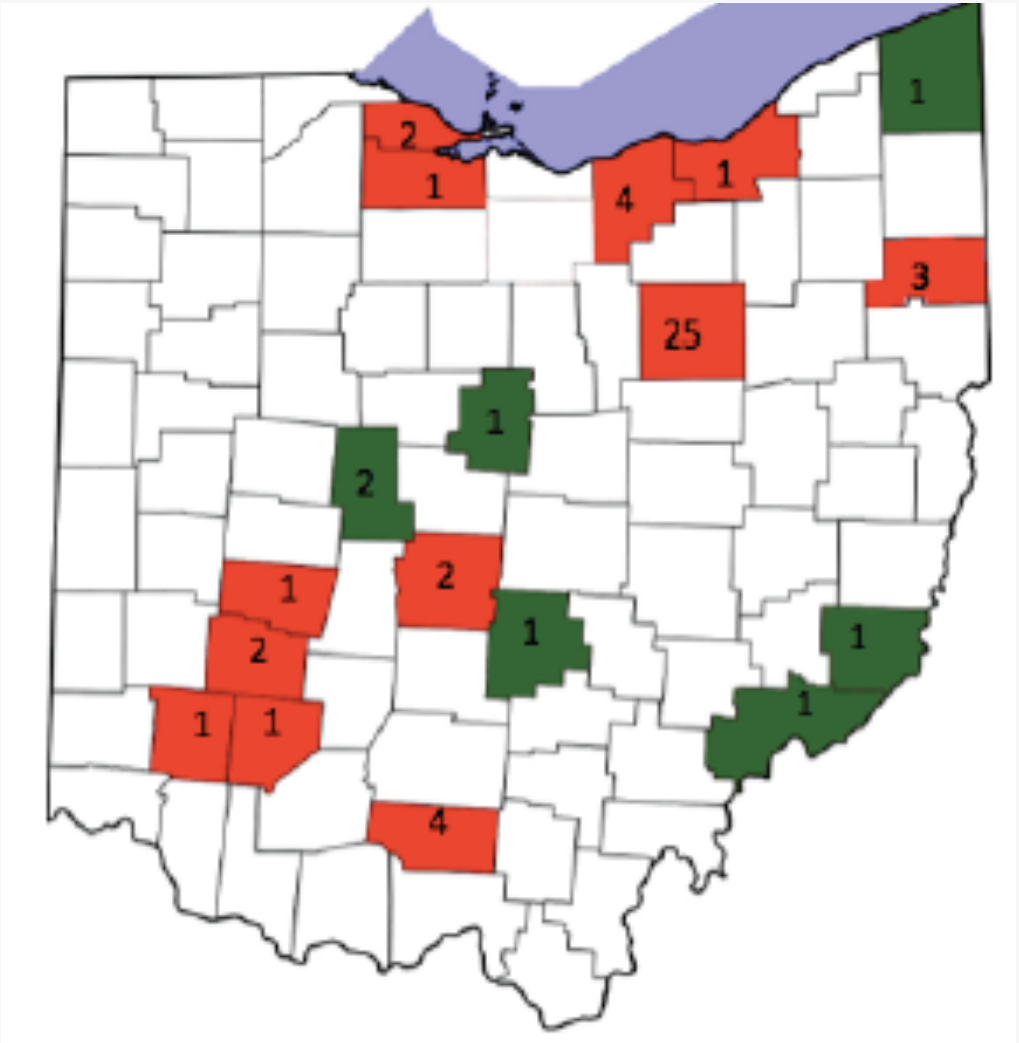
- Via personal courier
  - In alcohol is good
- Via US Mail or FedEx, UPS, etc.
  - Do NOT send in alcohol (hazardous!)
  - Use apple cider vinegar instead

Seasonal trends in traps

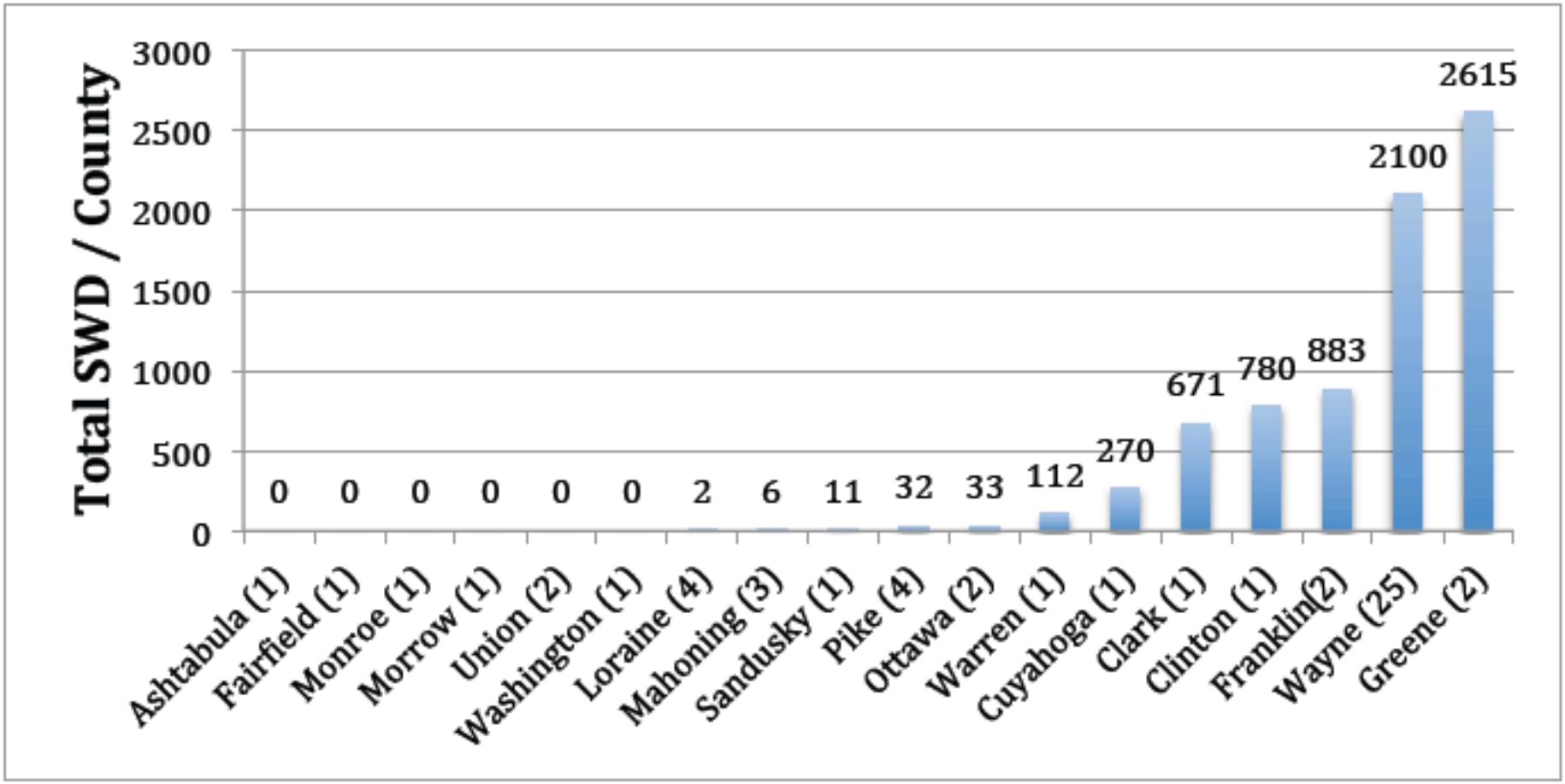
- In most of Pacific NW:
  - First catch March - May
  - Negligible catch until August
  - Peak in October
  - Higher when cool & wet
  - Lower when hot & dry
- Michigan & Ohio:
  - 1st catch mid-June at few sites
  - 1st catch mid-July at most sites

Number of trapping sites, 2014

Red: +
Green: -

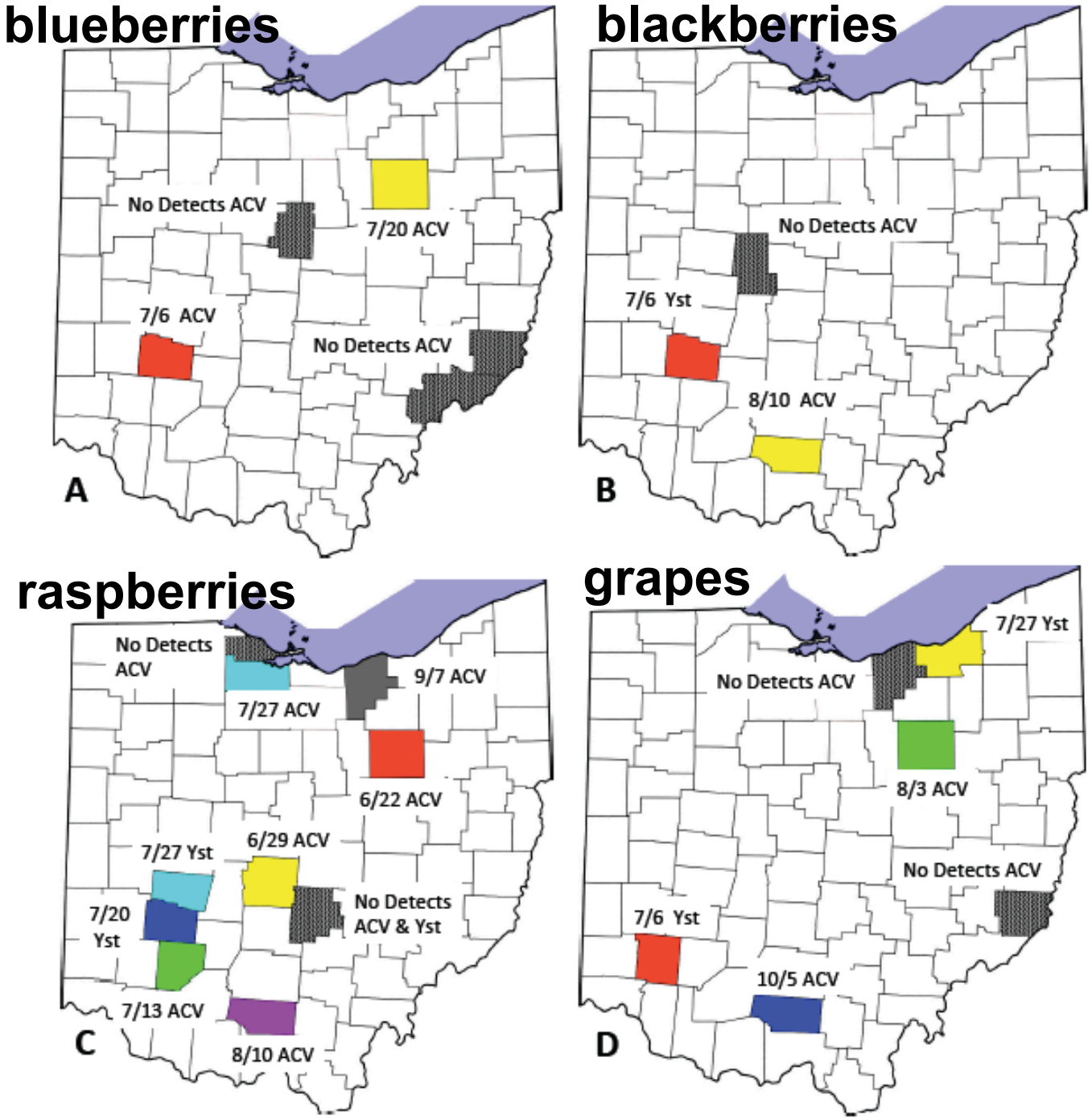


Spotted wing Drosophila in Ohio: results of trapping, 2014

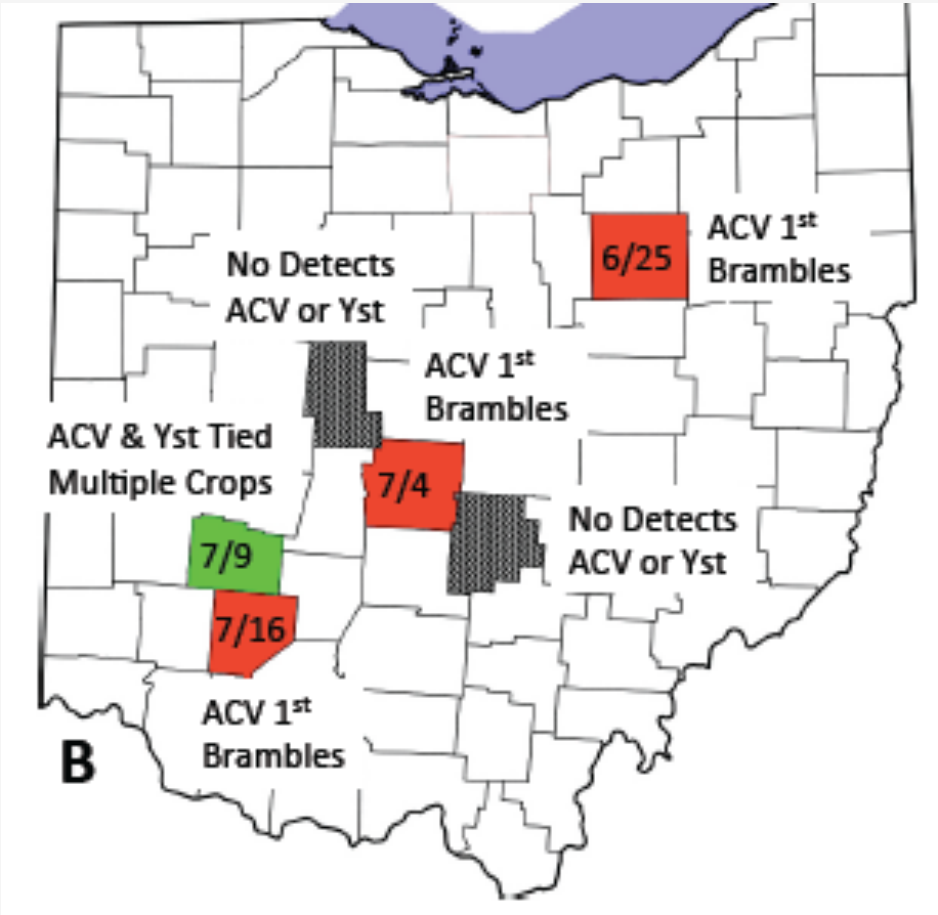


First detect of SWD adults in traps, 2014

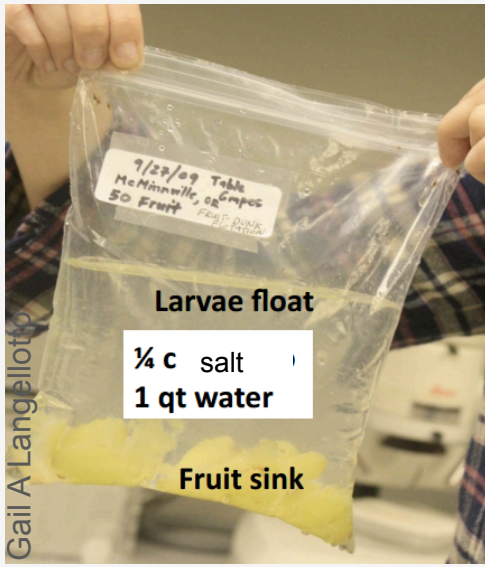
ACV= vinegar
Y = yeast



First detect of SWD adults in traps, 2014: comparison of baits
ACV= vinegar
Y = yeast



Test fruit for SWD larvae with salt test

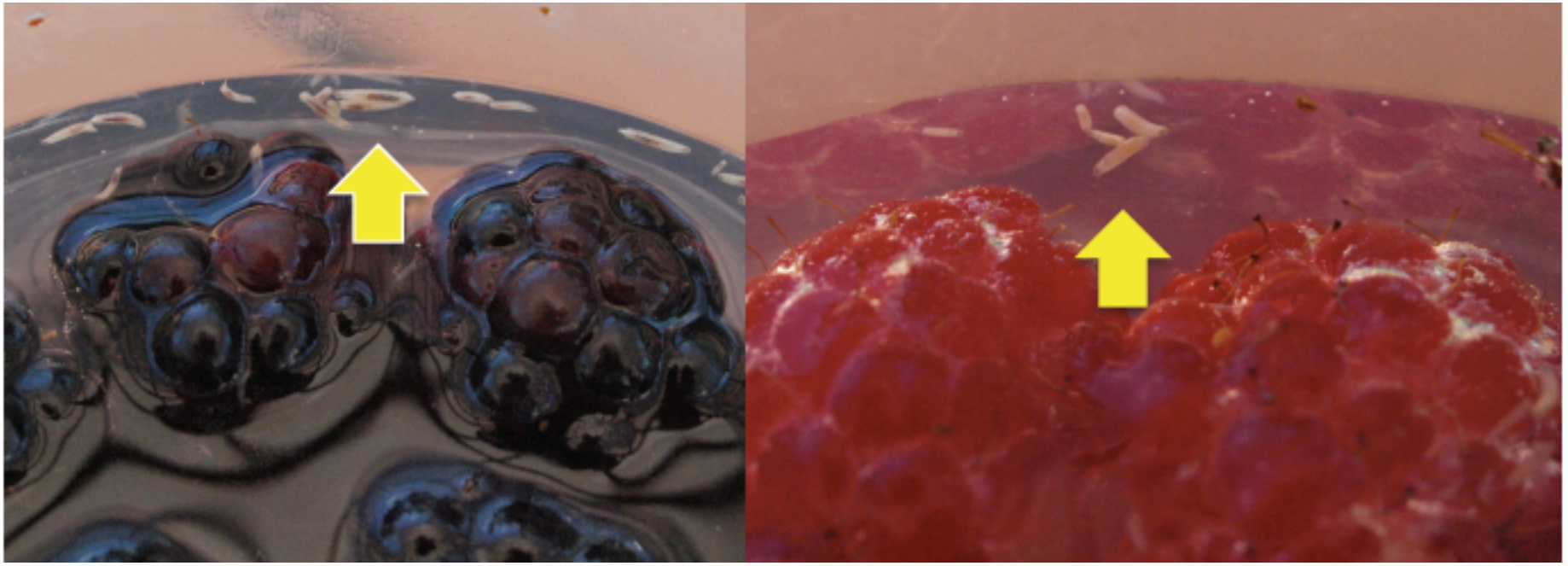


- Put fruit in zip-top bag
- 4 cups warm water + 1/4 cup salt
- Examine for floaters in 15 minutes
- To find smallest larvae, pour through coffee filter

Salt test: proportions

Salt	Warm water
1 Tablespoon	1 cup
¼ cup	1 quart (4 cups)
1 cup	1 gallon

Salt test



salt test results: fruit lots inspected for SWD larvae at Holmes County produce auction

Fruit	Auction lots SWD positive	Auction lots SWD negative	% Positive
mulberry	0	2	0
elderberry	0	8	0
plums	0	1	0
garden huckleberry	0	1	0
ground cherry	0	1	0
grapes	3	32	9
blackberry	3	8	27
red raspberry	12	14	46

salt test results, Holmes County, 2014: red raspberries, by week

Date	+ (infested)	- (clean)
6/25 to 8/5		√
5-Aug	1	0
7-Aug	0	0
14-Aug	1	0
19-Aug	1	1
21-Aug	0	0
26-Aug	0	0
28-Aug	4	0
2-Sep	2	1
4-Sep	1	2
9-Sep	1	1
11-Sep	0	3
16-Sep	0	1
17-Sep	1	3
18-Sep	0	0
26-Sep	0	1
30-Sep	0	1
2-Oct	0	0
9-Oct	0	0
sum	12	14

Non-chemical management

- Netting
- Prompt harvest as soon as ripe
- Chill fruit as soon as harvested
- Sanitation
  - Strongly recommended!
  - Destroy ALL leftover fruit
  - Do every 2 days
  - Culls in clear plastic bags in sun, 1 week

Non-chemical management

Removal of nearby wild hosts

- **Wild blackberry**
- **Pokeweed**
- **Bush honeysuckle**
- **Silky dogwood**
- **buckthorn**

Biocontrol??

- Natives: ~2% parasitism
- Exploration in Korea
  - 4 parasitoid species
  - In quarantine @ Berkeley

Insecticide strategy for SWD control

- **Decisions**
  - When to start spraying?
  - What product(s) to spray?
  - How often to spray?
- **Factors**
  - How often crop is harvested
  - Pre-harvest interval
  - How long residue is active

When to start?

- If the adult flies are detected
- Fruit is susceptible to injury once it has started to turn color

Insecticide choices for SWD control

Efficacy	Group	Product
Most effective	spinosyns	Delegate
	diamides	Exirel
	organo-phosphates	Imidan, Diazinon
	pyrethroids	Mustang Max, Brigade, Pounce, Hero, Danitol, Baythroid, Asana, Warrior
	carbamates	Lannate
Effective	organo-phosphates	Malathion
	spinosyns	Entrust [OMRI]
Moderately effective	neonicotinoid	Assail
	carbamates	Sevin
Slightly	pyrethrins	Pyganic [OMRI]

Insecticides for SWD for gardeners

- **Most effective:**
  - pyrethroids:
    - bifenthrin, permethrin, esfenvalerate, gamma-cyhalothrin
- **Effective:**
  - spinosyns:
    - Captain Jack's Deadbug Brew (spinosad)
  - organophosphates: malathion
- **Moderatley effective:**
  - carbaryl: Sevin
  - acetamiprid: Ortho Flower Fruit & Veg Insect Killer

How often to spray?

When residues no longer active

Product	*Residual activity*
Exirel	5 days
Delegate	5-7 days
Imidan, Diazinon	7 days
Pyrethroids: Asana Brigade Danitol Hero Mustang Max Warrior	7-10 days
Malathion	5-7 days
Lannate	3-6 days
Entrust	**3-5 days**
Pyganic	**1-3 days**

Insecticides for SWD on brambles

Product	*Pre-harvest interval*	*Maximum number of applications allowed* *(if used at max rate)*
Delegate	1 day	3
Mustang Max	1 day	6
Malathion	1 day	3
Entrust [OMRI]	**1 day**	**4**
Danitol	3 days	2
Brigade	3 days	2
Hero	3 days	2
Pyganic [OMRI]	**0 days**	**-**

News: sucrose adjuvant to increase efficacy

- Add sucrose (sugar)
- 1.2 gram/liter
- Assume 50 gal water/acre
- = 1 pound/acre
- With Entrust: reduced larval infestation >50% vs no sugar

Summary: Management of SWD on organic brambles

1. Use bait traps, check weekly
2. If any SWD in traps, start spray program when berries start to color
   - Spray every 5 days until final harvest
   - Alternate:
     - Entrust (1-day PHI) + sugar
     - Pyganic (0-day PHI) + sugar
3. Do a salt test with ripe fruit, weekly, to see if program effective
4. Increase to 3-day schedule if need

Chart for SWD on all crops

(bugs.osu.edu/welty/pdf/SWD_Ohio_handoutV13.pdf

Efficacy	Mode of action group	Product	Residual activity (days)	Pre-harvest interval (PHI)						
				raspberry, blackberry	blue-berry	straw-berry	grape	cherry	peach	plum
Very effective	5	§ Delegate	5-7	1 day	3 days	X	7 days	7 days	14 days	7 days
	5	§ Radiant	5-7	X	X	1 day	X	X	X	X
	28	Exirel	5	X	3 days	X	X	3 days	3 days	3 days
	3A	! Mustang Max	7-10	1 day	1 day	X	1 day	14 days	14 days	14 days
	3A	! Brigade	7-10	3 days	1 day	0 days	30 days	X	X	X
	3A	! Hero	7-10	3 days	1 day	X	30 days	X	X	X
	3A	! Danitol	7-10	3 days	3 days	2 days	21 days	3 days	3 days	3 days
	3A	! Asana	7-10	7 days	14 days	X	X	14 days	14 days	14 days
	3A	! Baythroid	7-10	X	X	X	3 days	7 days	7 days	7 days
	3A	! Warrior	7-10	X	X	X	X	14 days	14 days	14 days
	3A	! Pounce	7-10	X	X	X	X	3 days	14 days	X
	1B	Imidan	7	X	3 days	X	14 days	7 days	14 days	7 days
	1B	!§ Diazinon	7	7 days	7 days	5 days	X	21 days	21 days	21 days
	1A	! Lannate	3-6	X	3 days	X	X	X	4 days	X
Effective	1B	Malathion	5-7	1 day	1 day	3 days	3 days	3 days	7 days	X
	5	Entrust [OMRI]	3-5	1 day	3 days	1 day	7 days	14 days	14 days	7 days
Moderately effective	1A	Sevin	10	7 days	7 days	7 days	7 days	3 days	3 days	3 days
	4A	§ Assail	1-3	1 day	1 day	1 day	3 days	7 days	7 days	7 days
Slightly eff.	3A	Pyganic [OMRI]	1-3	0 days	0 days	0 days	0 days	0 days	0 days	0 days
Not effective	4A	Actara	1-3	3 days	3 days	X	5 days	14 days	14 days	14 days
	4A	Admire Pro	1-3	3 days	3 days	7 days	0 days	7 days	0 days	7 days

! *Restricted-Use Pesticide*

§ *Not allowed in greenhouses or high tunnels*

X *means that the product is NOT ALLOWED for use on that crop.*

Chart for SWD on all crops

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	28	Exirel	5	X	3 days	X	X	3 days	3 days	3 days
	3A	! Mustang Max	7-10	1 day	1 day	X	1 day	14 days	14 days	14 days
	3A	! Brigade	7-10	3 days	1 day	0 days	30 days	X	X	X
	3A	! Hero	7-10	3 days	1 day	X	30 days	X	X	X
	3A	! Danitol	7-10	3 days	3 days	2 days	21 days	3 days	3 days	3 days
	3A	! Asana	7-10	7 days	14 days	X	X	14 days	14 days	14 days
	3A	! Baythroid	7-10	X	X	X	3 days	7 days	7 days	7 days
	3A	! Warrior	7-10	X	X	X	X	14 days	14 days	14 days
	3A	! Pounce	7-10	X	X	X	X	3 days	14 days	X
	1B	Imidan	7	X	3 days	X	14 days	7 days	14 days	7 days
	1B	!§ Diazinon	7	7 days	7 days	5 days	X	21 days	21 days	21 days
	1A	! Lannate	3-6	X	3 days	X	X	X	4 days	X
Effective	1B	Malathion	5-7	1 day	1 day	3 days	3 days	3 days	7 days	X
	5	Entrust [OMRI]	3-5	1 day	3 days	1 day	7 days	14 days	14 days	7 days
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Not effective	4A	Actara	1-3	3 days	3 days	X	5 days	14 days	14 days	14 days
	4A	Admire Pro	1-3	3 days	3 days	7 days	0 days	7 days	0 days	7 days

! Restricted-Use Pesticide

§ Not allowed in greenhouses or high tunnels

X means that the product is NOT ALLOWED for use on that crop.

Insecticides for high tunnels?

For products used for SWD control:

- Label allows in greenhouses:
  - Malathion
- Label prohibits in greenhouses:
  - Delegate
  - Diazinon
- Label 'silent' on greenhouses

therefore ok to use:

- pyrethroids: Asana, Baythroid, Brigade, Danitol, Hero, Mustang, Pounce, Warrior
- Lannate
- Imidan
- Entrust

Observations on farms: 2013

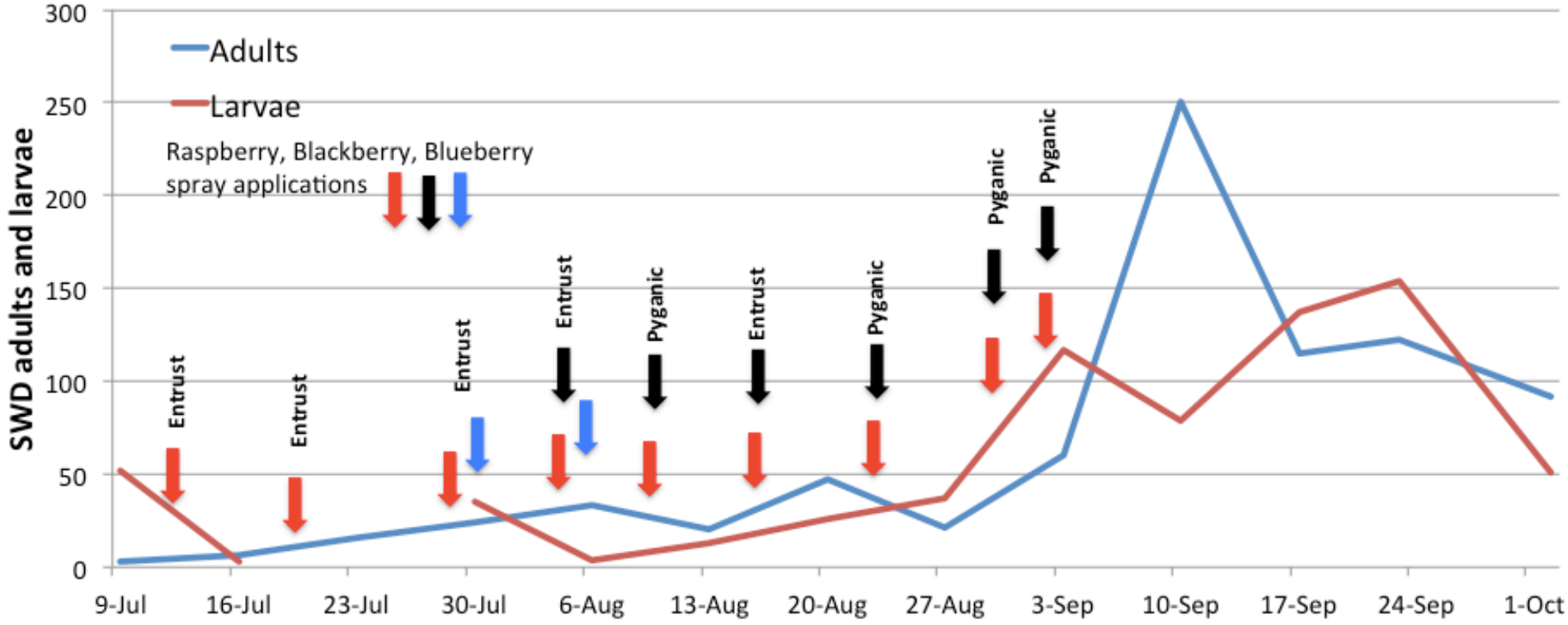

Figure 4. Average SWD adult trap captures and larvae found in raspberries, blackberries and blueberries after Entrust and Pyganic treatments at a monitoring site in southwest Ohio.

Observations on farms: 2014

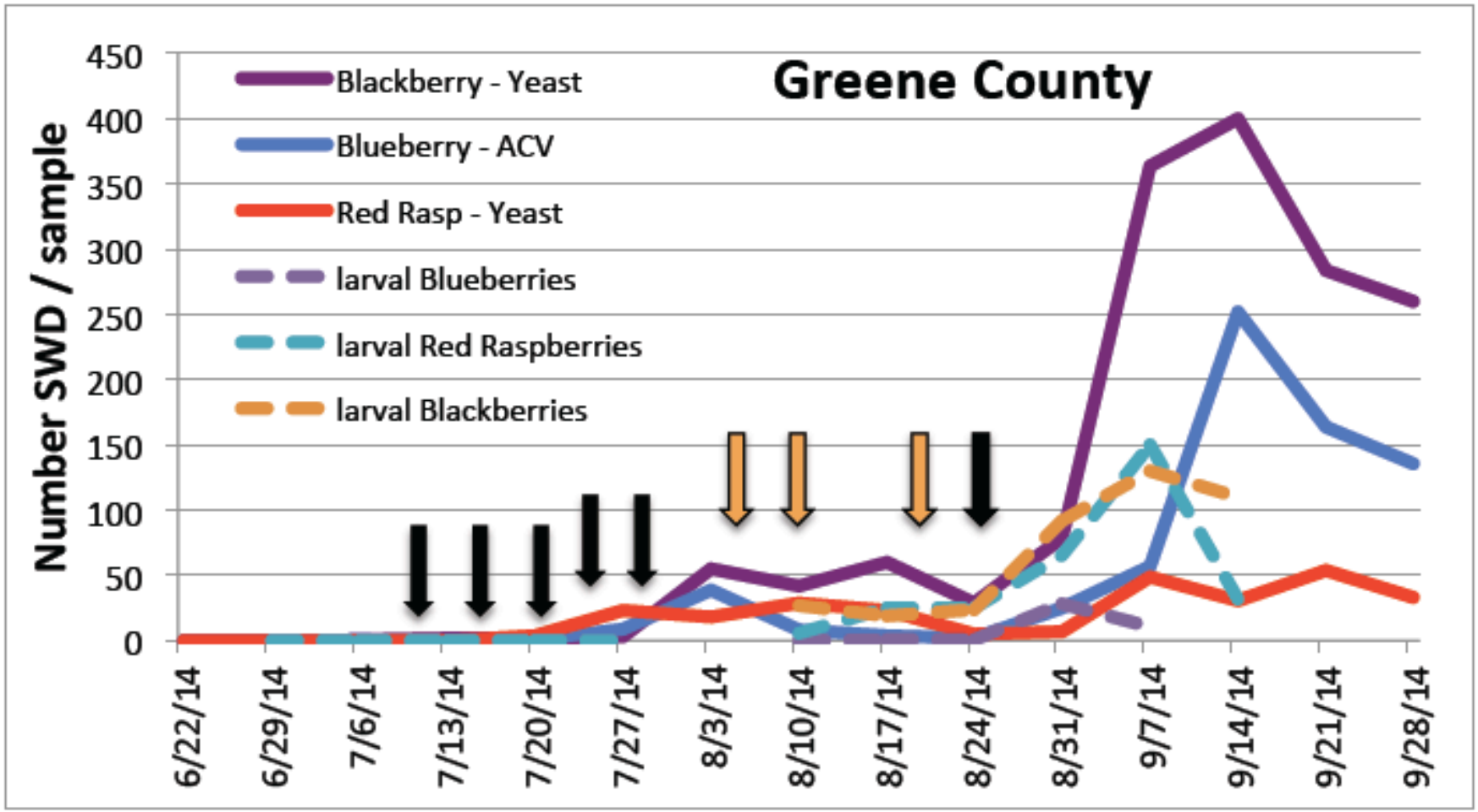

Figure 3. Density of SWD in weekly samples and timing of insecticide sprays on multiple crops in Greene County. Black arrows represents Evergreen EC60 (6oz/A) applied July 10, 15, 19, 22, and 28 on raspberry; orange arrows represents Entrust (3 oz/A) applied August 4, 9, and 18 on raspberry and blackberry. The last black arrow is Evergreen EC60 (3 oz/A) applied on raspberry and blackberry on August 24.

Additional info on SWD

On website: bugs.osu.edu/welty/

- **2-page color info sheet**
  - **Includes insecticides for commercial farms**
- **Instructions for trapping**
- **Instructions for salt tests**
- **Insecticide list for home gardens**
- **Slide show**

the end

Info on fruit & veg. pests
bugs.osu.edu/welty/

Questions?

e-mail: welty.1@osu.edu
office phone: 614 292 2803
cell phone: 614 746 2429