Fruitworm Review

Maggots, Fruit Flies, and Worms, Oh My!

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Fruit IPM Coordinator
NYS IPM Program

Empire State Expo
1/23/2024

Outline

- **Fruitworm life cycle review for blueberries**
- **Approaches to scouting**
- **Cultural and chemical management**

Cherry Fruitworm

Cranberry Fruitworm

Blueberry Maggot

Why do we care about fruitworms and maggots?

- CFW, CBFW, & BBM are present throughout the Northeast
- Fortunately, they are not always a problem:
  - **2006 survey in the southern tier detected only (Shaw, 2007):**
  - BM in 2/10 locations
  - CFW in 1/10 locations
  - CRFW in 6/10 locations

But…
In one location 30% of clusters had eggs

- When present, can cause significant damage
- Management can vary, so it is **identification** in critical
- Use **monitoring** to:
  - Target pesticide applications so they are most effective
  - Optimize time and $$$

Cherry Fruitworm (CFW)

Grapholita packardi

- **Damage**
  - Feed on ***1-2 berries*** per larva
  - Cause early ripening fruit
  - ***Silk berries together, webbing entirely inside fruit***
- **ID**
  - Adult: ***Grayish black*** 5-6mm
  - Larvae: Pink, 8mm, anal comb
  - Eggs: Flat, round/oval, opaque/yellow

WonGun Kim

Photos: Tree Fruit Field Guide, NRAES-169

Cranberry Fruitworm (CBFW)

Acrobasis vaccinii

- **Damage**
  - Feed on ***up to 6 berries*** per larva
  - Cause early ripening fruit
  - ***Mass of webbed sawdust like frass outside fruit***

- **ID**
  - Adult: Grayish-brown forewings, with ***white patches/triangles***
  - Larvae: pale yellowish-green, 15mm
  - Eggs: Oval, irregular, white to yellow

Janet van Zoeren

Photos: MSU
A Pocket Guide to IPM Scouting in Blueberries

CFW & CBFW Life Cycles

- 1 generation per year
- Emerge: early bloom
- Flight: May to early July
- Egg-laying: early fruit set
- Eggs hatch: 3-5 days
- Larvae enter fruit
- Move to overwintering sites
- Pupate in spring after warm weather begins

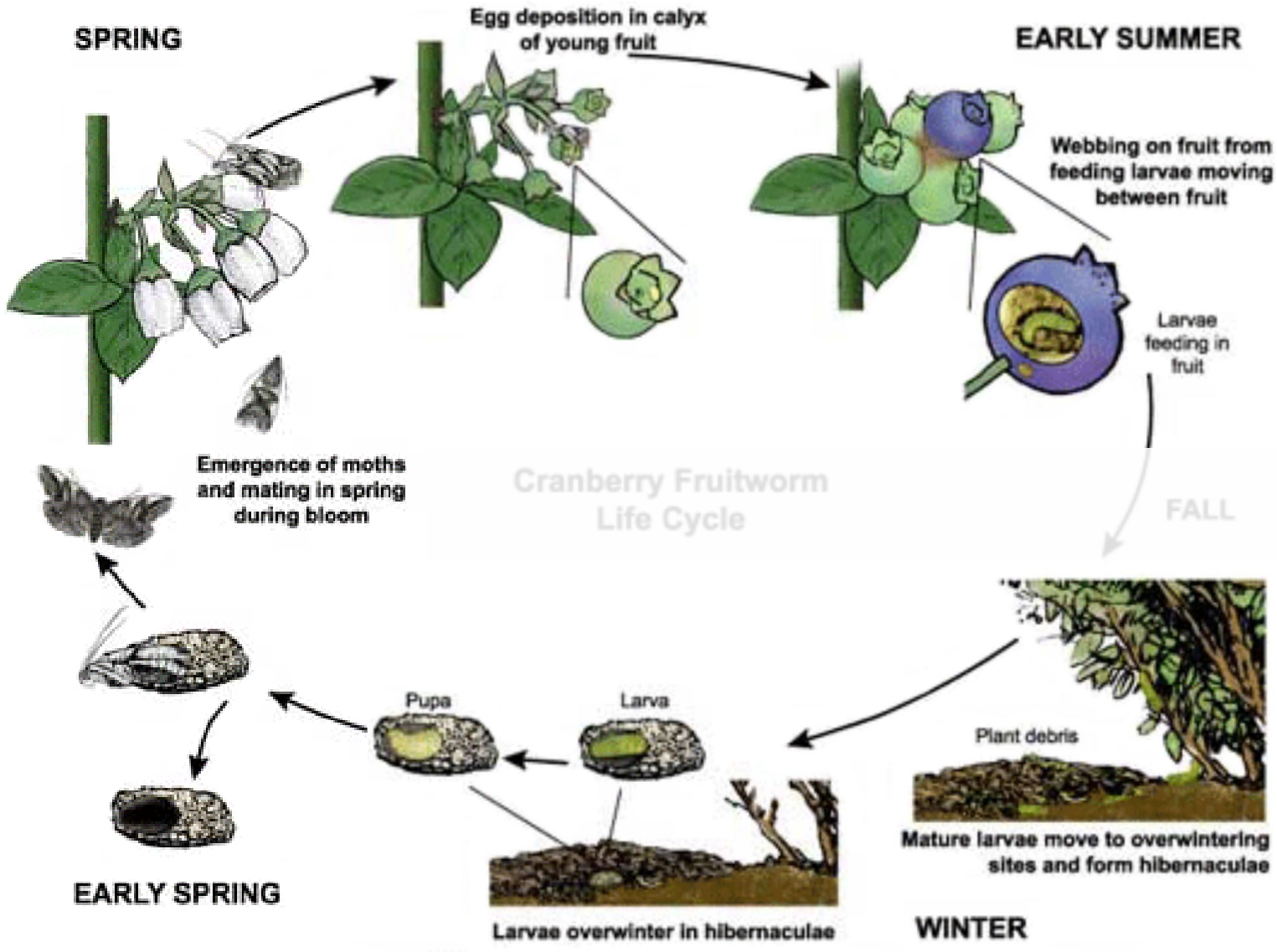


Diagram: WSU

CFW & CRFW Monitoring

1) Adult trap catch

- Begin at start of bloom
- Estimate **population & distribution**
- Predict **egg laying & hatch**
- Use sticky traps with lures

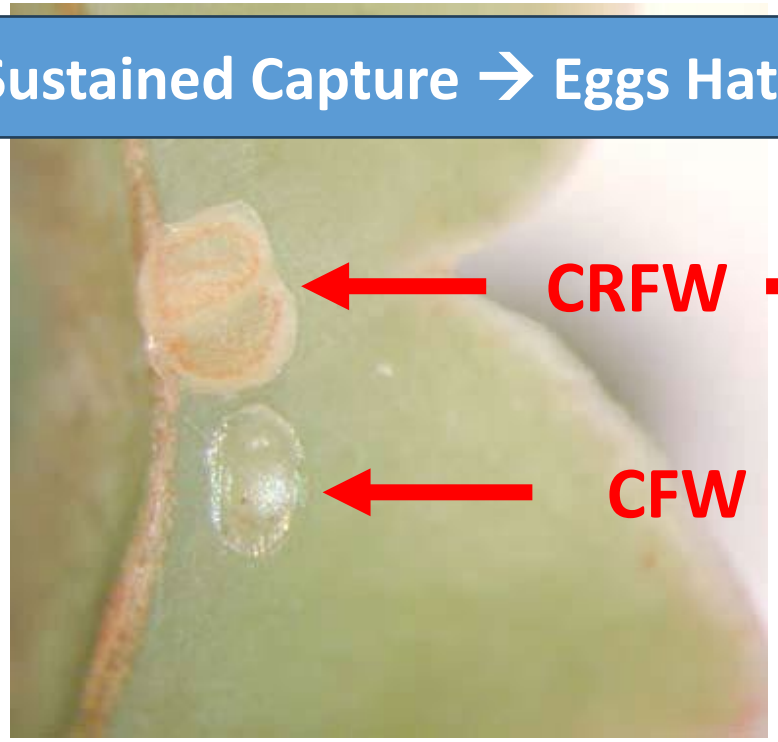
2) Scout for eggs

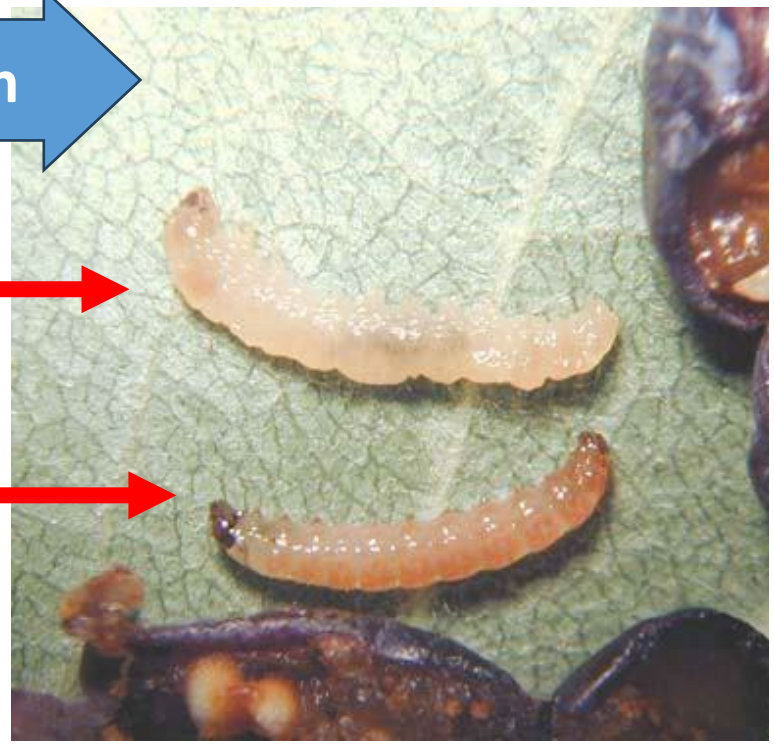
- Begin after adult flight starts
- Early fruit set
- Biofix for egg hatch timing

3) Scout for larvae

- To determine **effectiveness** of management tactics
- Predict pressure **next season**

Sustained Capture → Eggs Hatch





Photos: MSU Blueberry Fruitworm Factsheet

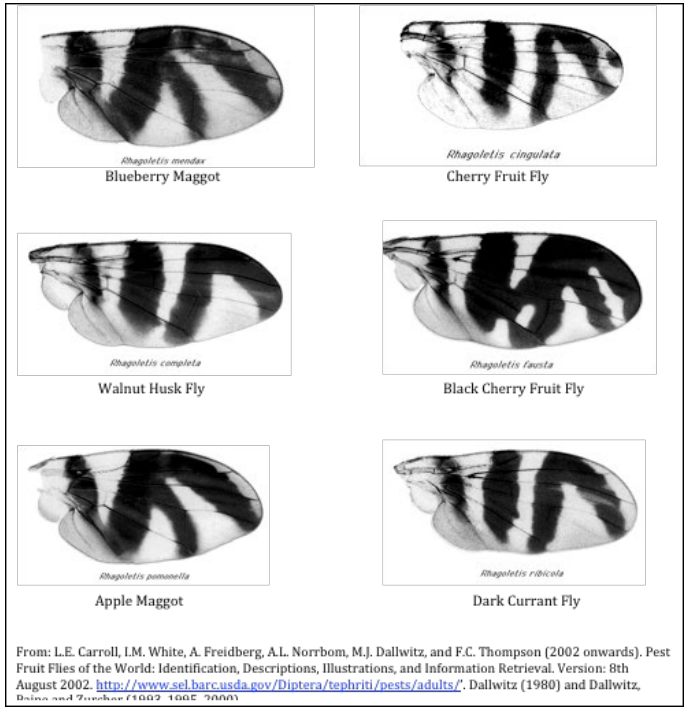
Blueberry Maggot (BBM)

Rhagoletis mendax

- **Damage**
  - Single maggot per fruit
  - Up to 100 eggs per female
  - Early softening/shriveled berries
  - Larvae emerge in processed products

- **ID**
  - Adult:
    - Dark thorax,
    - *White spot end of thorax*
    - M pattern on wings
    - *Watch for many similar species*
  - Larvae: 7mm legless maggot

Photos: R. Isaacs, MSU



Blueberry Maggot (BBM)

Rhagoletis mendax

Life Cycle

- 1 generation per year
- Adults emerge as mid-season varieties turn blue
- Feed/mate 7-10 days ← **Best time for intervention**
- Females lay eggs under skin (1 per fruit)
- Eggs hatch in ~5 days
- Maggot grows inside fruit (2-3 weeks)
- Mature larvae drop to ground, pupate
- Overwinter as pupae in top few inches of soil

Photo: R. Isaacs, MSU

Blueberry Maggot (BBM)

Rhagoletis mendax

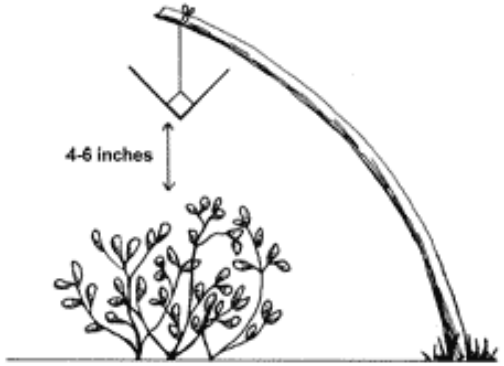


Figure 6. Field trap placement.

Monitoring

- Yellow sticky cards
- V-shape
- Begin in early June
- Feeding attractant
  (ammonium acetate, ammonium carbonate)

- *Activity is similar in timing to **SWD***
  (During fruit ripening)

Photo: R. Isaacs, MSU

Management

Cultural & Mechanical

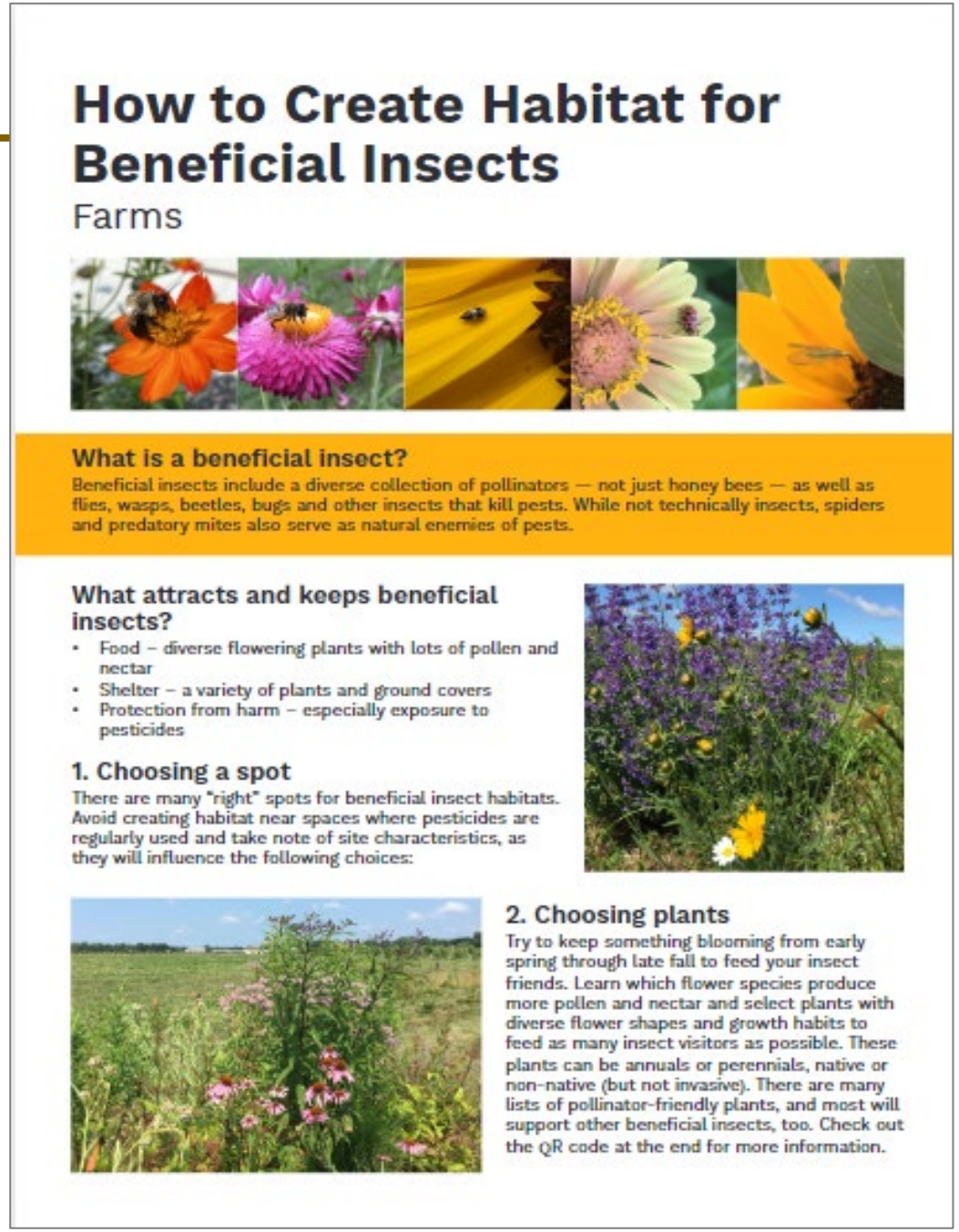
- Remove other **hosts/habitat**: weeds, wild blueberry, huckleberry
- **Harvest thoroughly** to reduce populations
- **Pick off pre-mature** coloring fruit
- **Heat treat** or **freeze** fruit to kill larvae
- **Clean soil and equipment** to avoid transfer of larvae

Management

Biological

- These pests are native insects
- Many **parasitic flies** and **wasps** are present
- Select insecticides that have **lower toxicity**
  - **B.t. insecticides:** Javelin, DiPel
  - **Insect Growth Regulators**
- Conservation biocontrol
  - Create habitat that supports beneficial insects
  - Provide: food, shelter, protection

NYS IPM Program – Biocontrol
https://cals.cornell.edu/new-york-state-integrated-pest-management/eco-resilience/biocontrol



How to Create Habitat for Beneficial Insects

Farms

What is a beneficial insect?

Beneficial insects include a diverse collection of pollinators — not just honey bees — as well as flies, wasps, beetles, bugs and other insects that kill pests. While not technically insects, spiders and predatory mites also serve as natural enemies of pests.

What attracts and keeps beneficial insects?

- Food – diverse flowering plants with lots of pollen and nectar
- Shelter – a variety of plants and ground covers
- Protection from harm – especially exposure to pesticides

1. Choosing a spot

There are many "right" spots for beneficial insect habitats. Avoid creating habitat near spaces where pesticides are regularly used and take note of site characteristics, as they will influence the following choices:

2. Choosing plants

Try to keep something blooming from early spring through late fall to feed your insect friends. Learn which flower species produce more pollen and nectar and select plants with diverse flower shapes and growth habits to feed as many insect visitors as possible. These plants can be annuals or perennials, native or non-native (but not invasive). There are many lists of pollinator-friendly plants, and most will support other beneficial insects, too. Check out the QR code at the end for more information.

Management

Biological

- Choosing plants to support beneficials
- Pollen & nectar
- Refuge & habitat
- Maintain bloom
- https://cornell.app.box.com/v/plants-naturalenemies-handout

Choosing plants that support beneficial insects

New York State Integrated Pest Management Program

This is not an exhaustive list. Look for plants whose flowers produce lots of pollen and nectar that is easy for insects to access. Most plants in the aster, carrot, and mint families will support beneficial insects.
For digital copies, contact Betsy Lamb (eml38@cornell.edu) or Amara Dunn (arc55@cornell.edu).

Common name	Scientific name	Approx. bloom time in CNY						Height	Light	Native to US?	Plant family	Duration of plant (NY)
		May	Jun	Jul	Aug	Sep	Oct					
Canada anemone	*Anemone canadensis*	X	X					1-2 ft		yes	Ranunculaceae	perennial
Columbine	*Aquilegia canadensis*	X	X					2-3 ft		yes	Ranunculaceae	perennial
Golden alexanders	*Zizia aurea*	X	X					1-2 ft		yes	Umbelliferae	perennial
Sweet alyssum (1)	*Lobularia maritima*	X	X	X				0.25-0.75 ft		no	Brassicaceae	annual
Blue wild indigo	*Baptisia australis**		X					3-5 ft		yes	Fabaceae	perennial
Cornflower, Bachelor's buttons	*Centaurea cyanus*		X	X				1-3 ft		no	Asteraceae	annual
Beardtongue	*Penstemon digitalis**		X	X				2-4 ft		yes	Plantaginaceae	perennial
Ohio spiderwort	*Tradescantia ohiensis*		X	X				2-3 ft		yes	Commelinaceae	perennial
Coreopsis	*Coreopsis spp.**		X	X	X			2 ft		yes	Asteraceae	perennial
New York ironweed	*Vernonia noveboracensis*		X	X	X			5-8 ft		yes	Asteraceae	perennial
Common yarrow	*Achillea millefolium*		X	X	X	X		1-3 ft		both	Asteraceae	perennial
Catmint	*Nepeta spp.**		X	X	X	X		1.5-2 ft		yes	Lamiaceae	perennial

*Multiple species in this genus support beneficial insects, but may have different bloom times or growth habits/requirements.
(1) In the brassica family, so may not be good near other brassicas

Part to full sun full sun

Management

Chemical – CFW & CBFW

- Timing & coverage is critical!
- Target **egg hatch** & **emerging larvae**
- Short window when not protected in fruit
- During bloom – *use bee-safe insecticides!*

Low pressure blocks
May be able to control with post-bloom applications

Sustained Capture → Eggs Hatch

In MI, CBFW: ~85-485 DD Base 50

- **1st spray:** ~1wk after sustained capture
- **Re-apply:** again in 2wks

CBFW & CFW Insecticide Options

	Group	Materials (A.I.)
Conventional	1A&B – Carbamates & Organophosphates	**Lannate** (methomyl) **Malathion** (malathion)
	4 - Neonicotinoids	**Assail** (acetamiprid)
	3A – Pyrethroids	**Brigade**, **Biventure** (bifenthrin)
	28 – Diamides	**Altacor** (chlorantraniliprole) **Exirel** (cyantraniliprole) **Verdepryn** (cyclaniliprole)
	22A – Oxadiazines	**Avaunt** (oxadiazine)
	7C – Juvenile Hormone Mimic	**Esteem**, **Senstar** (pyripoxyfen) 
Organic	Neem extract	**Aza-direct, AzaGuard** (azadiractin) 
	Bacillus thuringiensis	**Dipel, Leprotec** (B.t.) 
	Spinosyns	**Entrust** (spinosad) 

The label is the law: Always read and follow label instructions.
Make sure your application of the material is compatible with pest, timing, crop, rate, etc. in your state.

Management

Chemical – BBM

- Flies **emerge over a two-month** period to lay eggs
- Requires **multiple sprays** with a short PHI

- **First spray** within 1 week after sustained catch ("sustained" means several flies per week)
- **Continue spraying** according to the label
  This targets the female fly laying eggs
  Important to maintain coverage

- *Likely to be controlled with applications targeting **SWD***

BBM Insecticide Options

	Group	Materials (A.I.)
Conventional	1A&B – Carbamates & Organophosphates	**Lannate** (methomyl) **Malathion** (malathion) **Imidan** (phosmet)
	4A - Neonicotinoids 4D - Butenolides	**Assail** (acetamiprid) **Admire, Alias** (imidacloprid) **Sivanto Prime** (flupyradifurone)
	3A – Pyrethroids	**Brigade**, **Biventure** (bifenthrin)
	28 – Diamides	**Exirel** (cyantraniliprole) **Verdepryn** (cyclaniliprole)
	7C – Juvenile Hormone Mimic	**Esteem**, **Senstar** (pyripoxyfen)
Organic	Neem extract	**Aza-direct, AzaGuard** (azadiractin)
	Kaolin clay	**Surround**

The label is the law: Always read and follow label instructions.
Make sure your application of the material is compatible with pest, timing, crop, rate, etc. in your state.

Take-aways

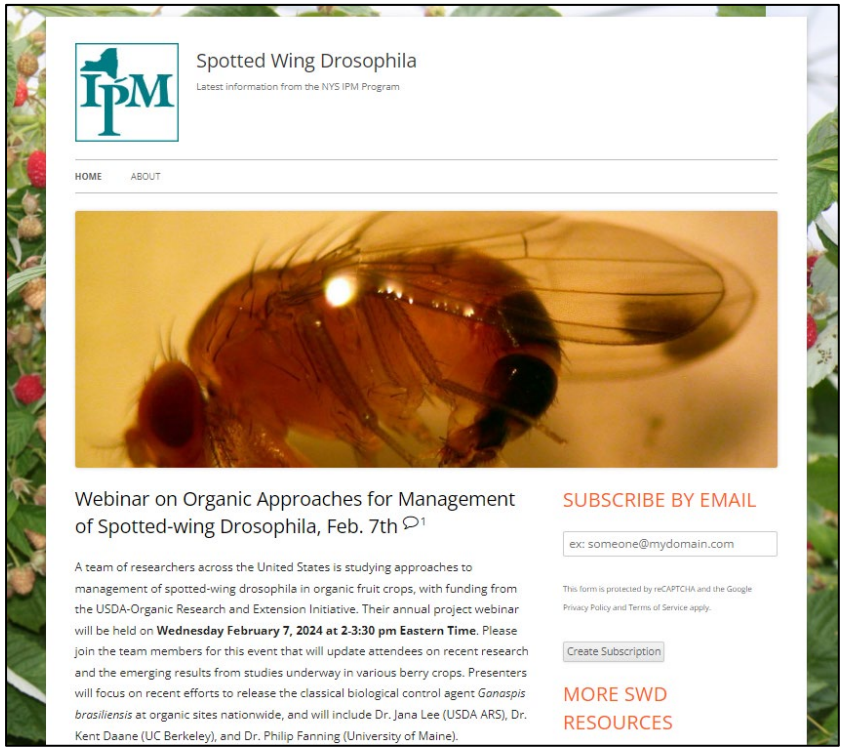
- **CFW, CBFW, & BBM** present throughout the Northeast
- **Monitor** & **Trap** to identify pest presence, distribution, timing
- Use **cultural** and **mechanical** tactics to reduce populations
- For **chemical control**, timing and coverage is critical

Resources

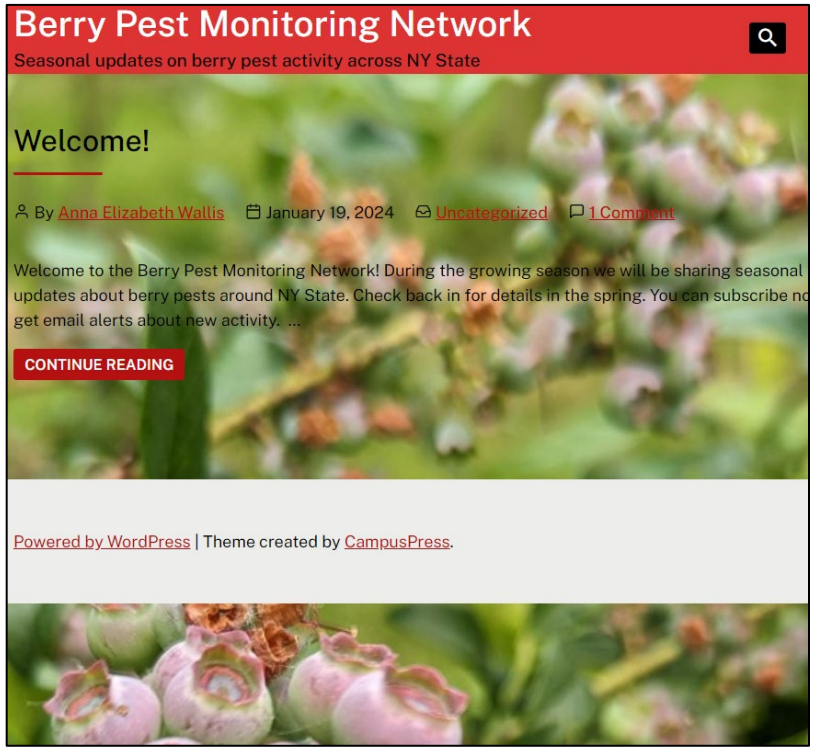
- A Pocket Guide to IPM Scouting in Highbush Blueberries https://www.canr.msu.edu/blueberries/uploads/files/BlueberryGuide-online-FINAL.pdf
- MSU Extension Blueberry Maggot Factsheet https://www.canr.msu.edu/news/fruitworm_management_in_blueberries
- MSU Extension Fruitworm Factsheet https://www.canr.msu.edu/uploads/files/Fruitworm%20Factsheet%201.pdf
- University of Wisconsin-Madison Blueberry Maggot Factsheet https://hort.extension.wisc.edu/articles/blueberry-maggot/
- University of Florida Factsheet https://entnemdept.ufl.edu/creatures/FRUIT/MOTHS/Acrobasis_vaccinii.html
- WSU Fruitworm Factsheet https://s3.wp.wsu.edu/uploads/sites/2166/2018/01/Cranberry-Fruitworm-WSU.pdf

Berry Websites

SWD Monitoring



Berry Pest Monitoring



Cornell Berry Blog

2024 Berry Pest Survey

Are you monitoring for SWD on your farm? We'd like to know!
Please complete this *brief* survey by scanning the QR code below:

http://tinyurl.com/mc5j6yc8

Questions?

Anna Wallis
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Fruit IPM Coordinator
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AgriTech

New York State Agricultural
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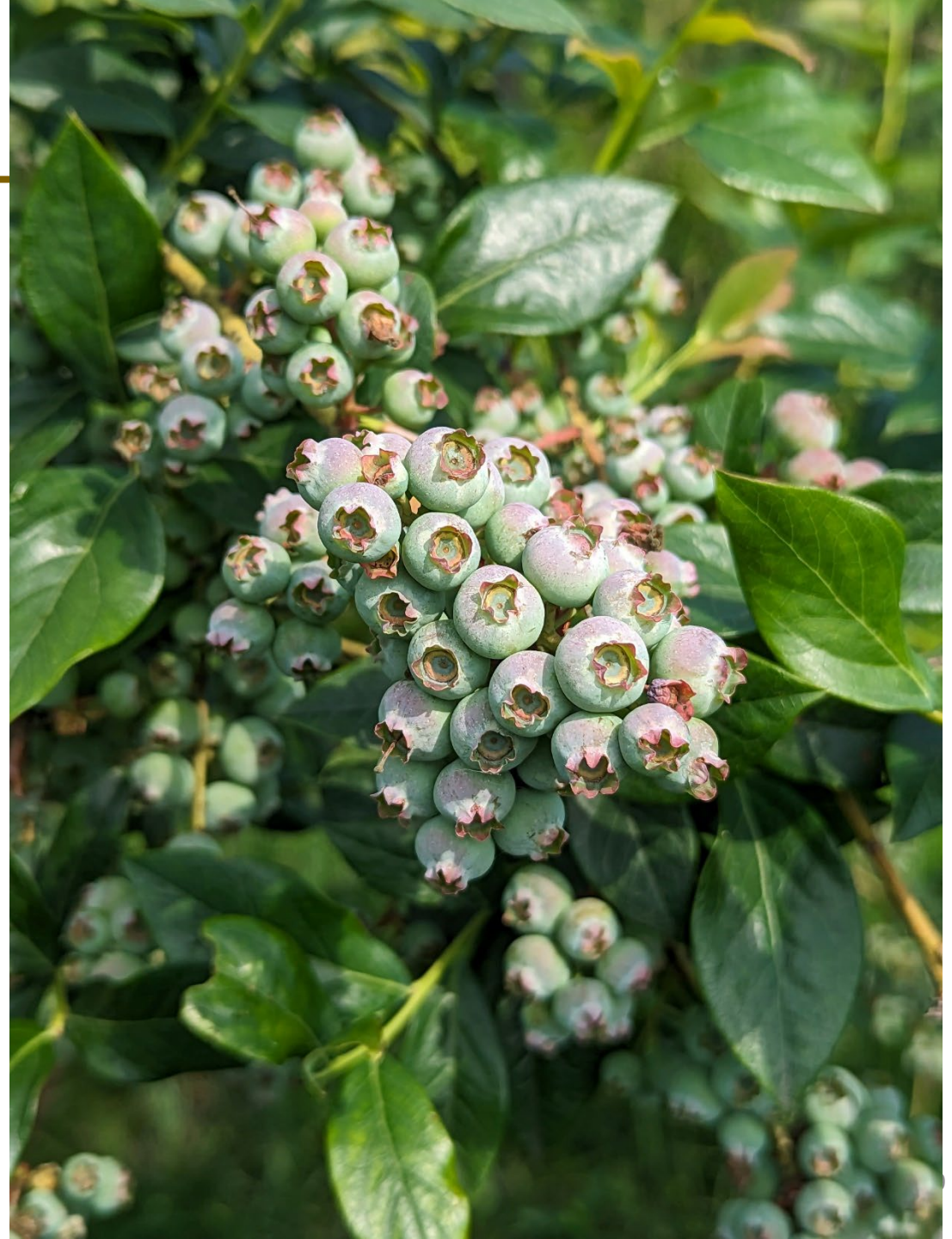


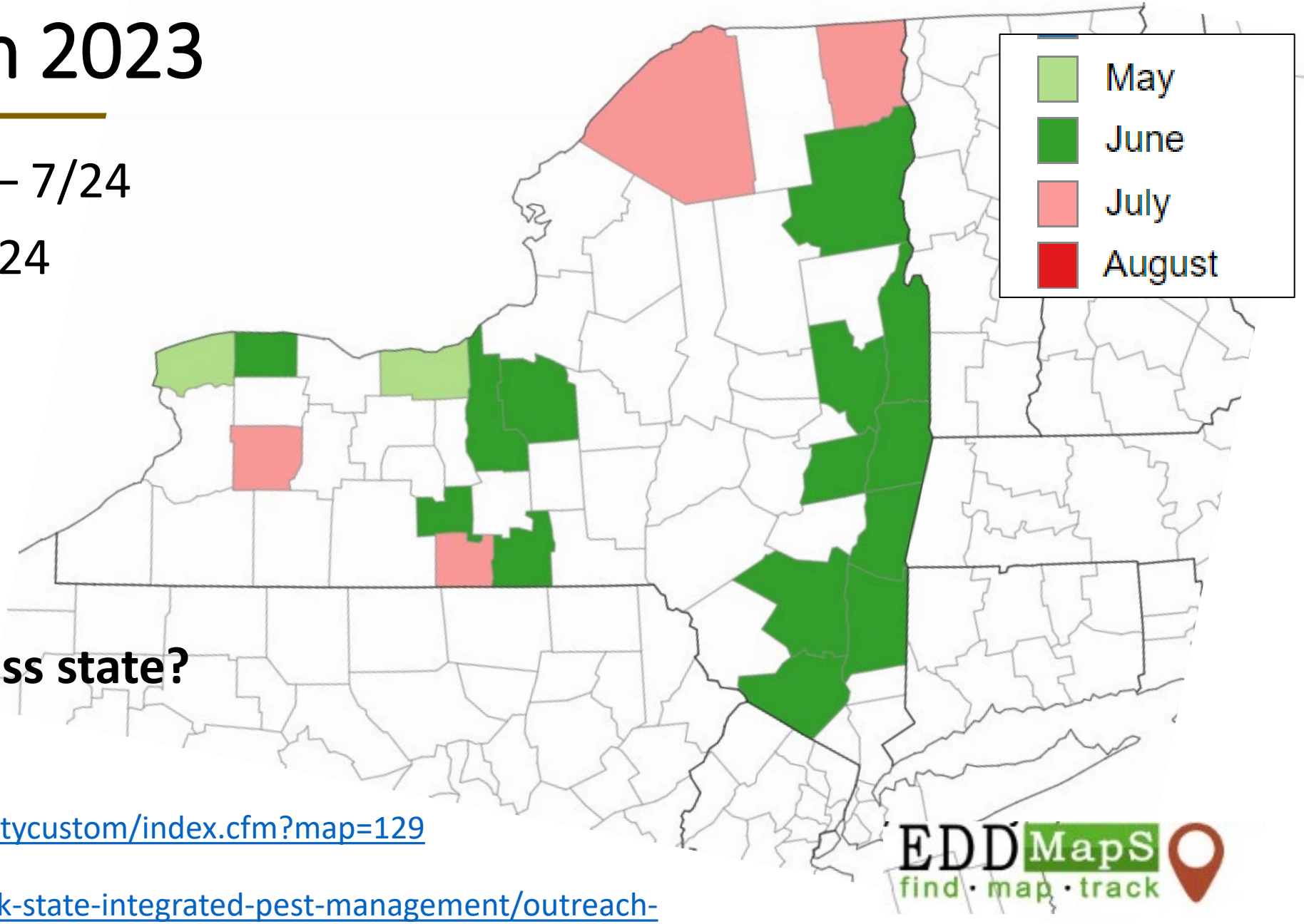
Spotted Wing Drosophila

http://fruit.cornell.edu/spottedwing/

http://blogs.cornell.edu/swd1/

SWD Detection 2023

- First captures: 6/12 – 7/24
- Sustained: 6/26 – 7/24
- About 2 weeks later than ‘typical’



Are there trends across state? (geographic location)

https://maps.eddmaps.org/countycustom/index.cfm?map=129

https://cals.cornell.edu/new-york-state-integrated-pest-management/outreach-education/whats-bugging-you/spotted-wing-drosophila

Traps

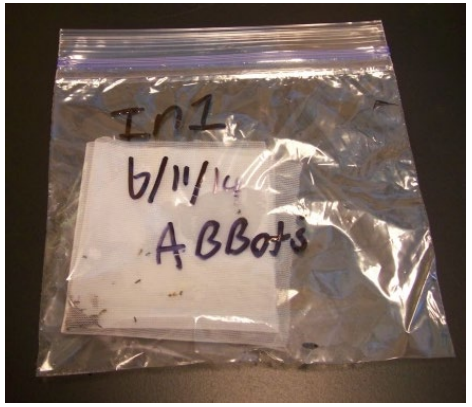
Jar Trap

Sticky Trap

Jar Trap Use

SWD jar trap in a raspberry planting

Collect insects by pouring the drowning solution through the piece of mesh fabric.



Place mesh fabric filter in a labeled plastic bag and into the cooler.

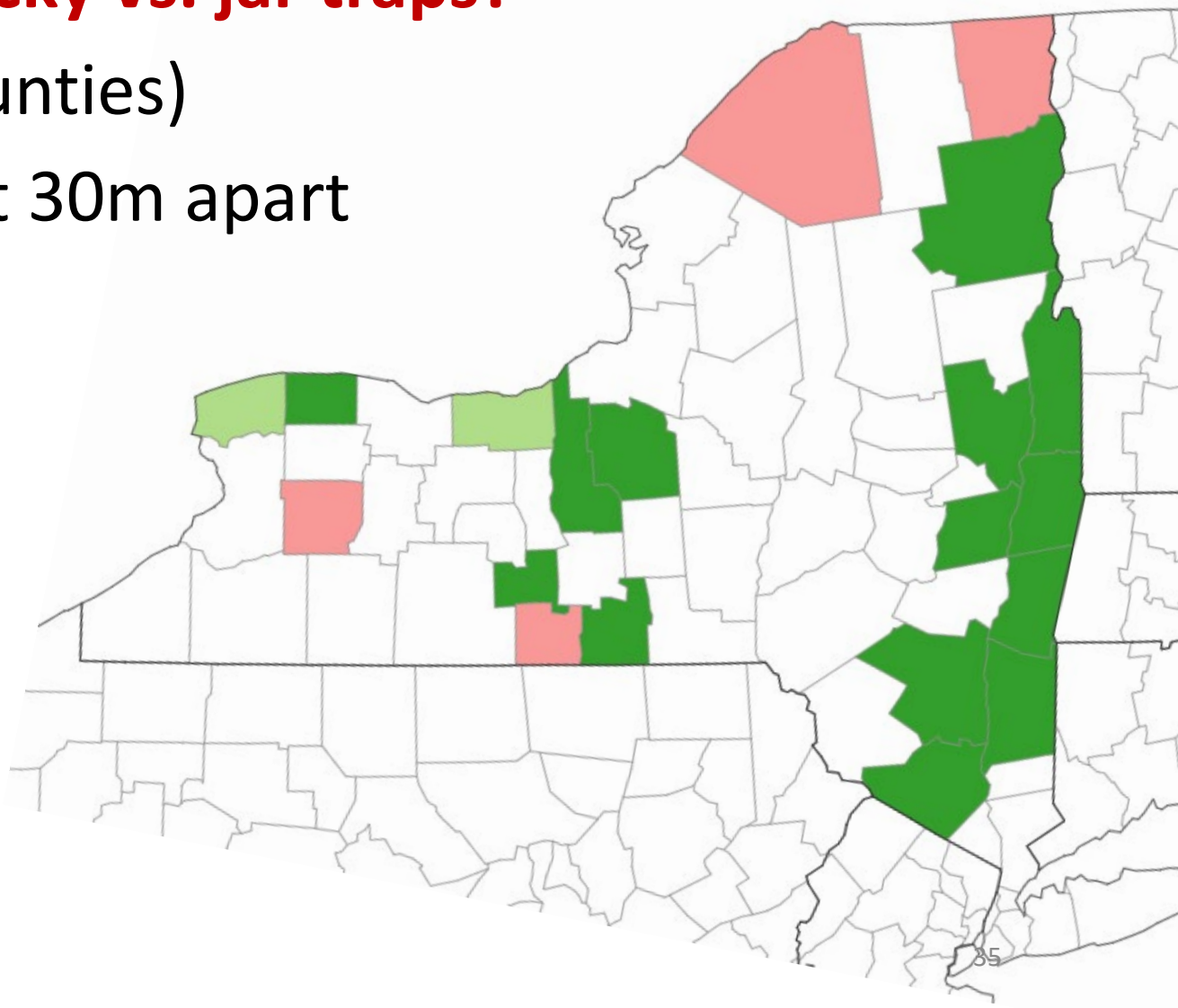
Identify and count SWD using a microscope

Sticky Trap Use

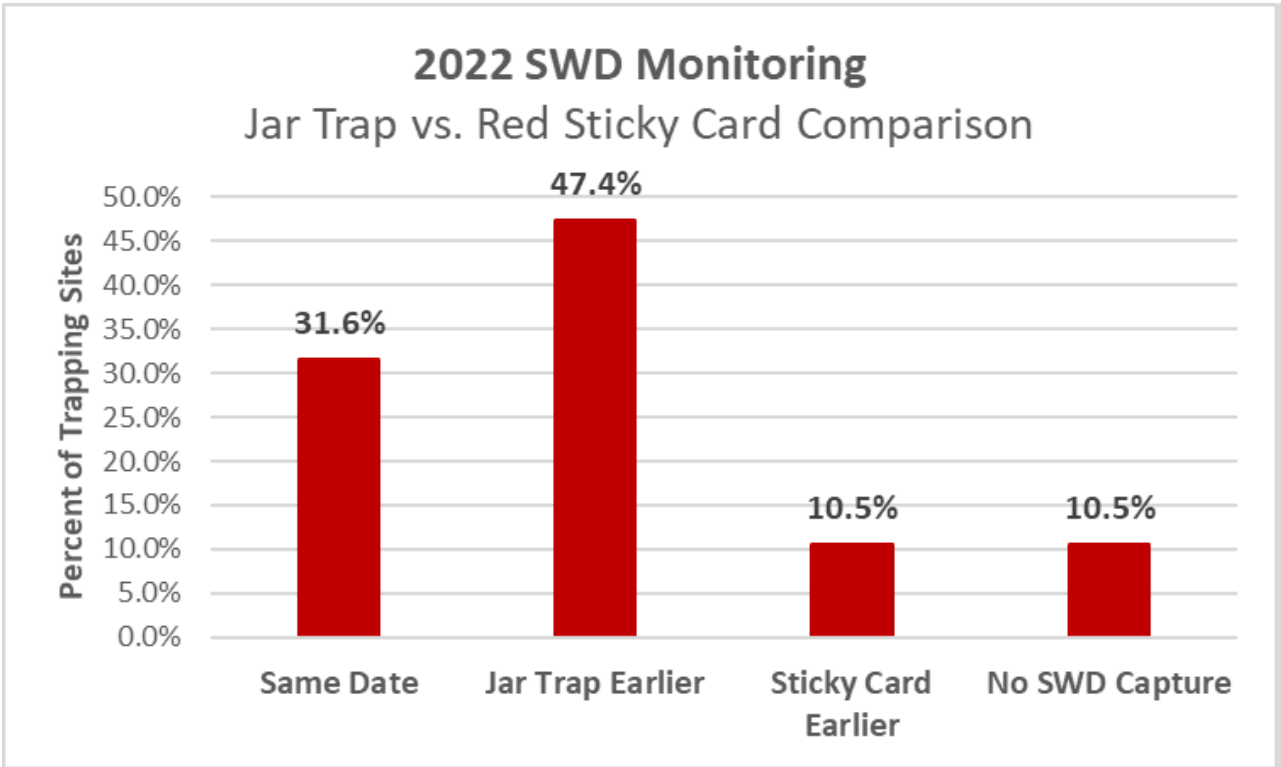
2022 & 2023 Trap Comparison Sites

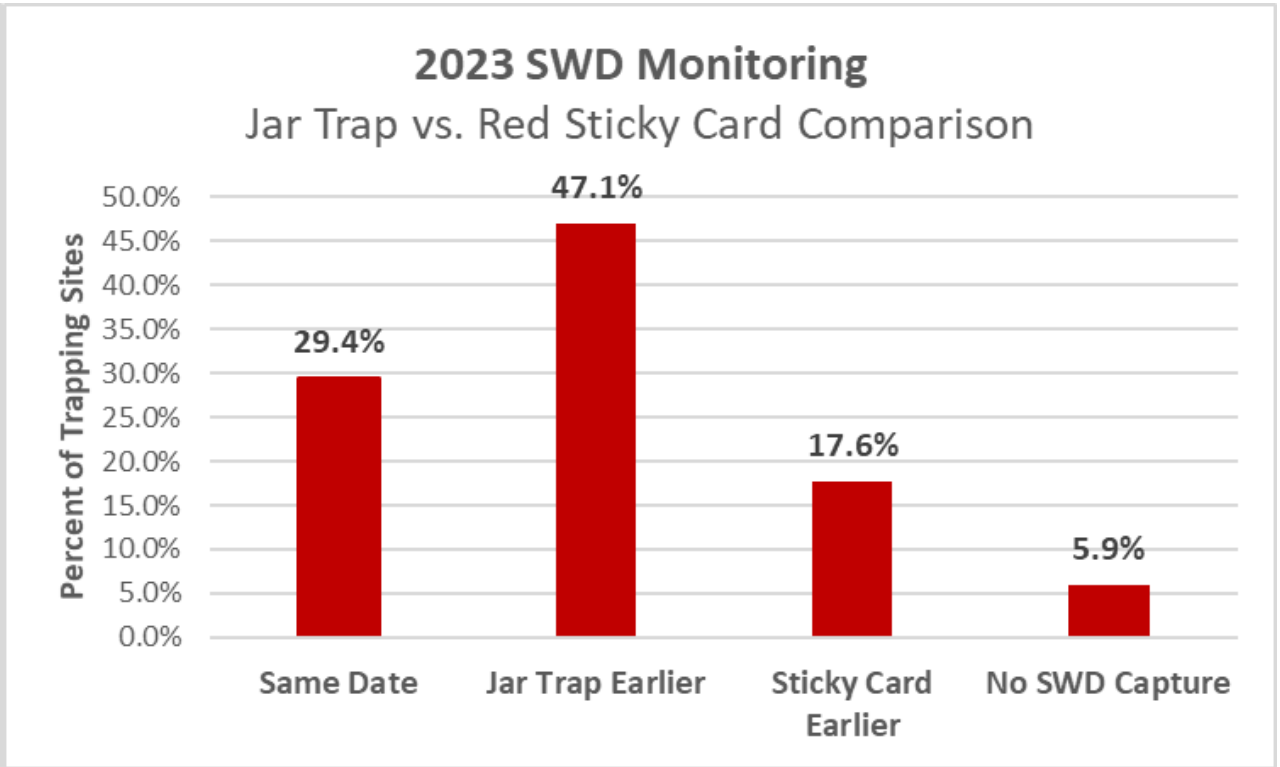
Does detection differ between sticky vs. jar traps?

- 19 or 17 total paired sites (13 counties)
- Traps along “hedge rows” at least 30m apart
  - 2 jar
  - 2 sticky
- Brambles and blueberries
- Traps checked weekly May-July
- Detection
  - 1st Capture
  - Sustained (2 consecutive weeks)



2022 & 2023 SWD Trap Comparison Results





Conclusions & Future work

- Jar vs. sticky traps – performed similarly for 1st detection of SWD
- Success/Choice of trap may depend most on the user (cost, comfort level)

Future work

- Other traps/colors to test in future
- Alternative method – Salt Floatation Method?

Yellow sticky cards in round cage (top) and sleeve cage (bottom).
Photos: Erica Pate and Hannah Fraser, OMAFRA.