Blueberry Insect Pest Management

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Outline

- Blueberry IPM
- Cranberry fruitworm
- Blueberry aphid
- Spotted wing drosophila
- Blueberry bud mite
- Blueberry gall midge

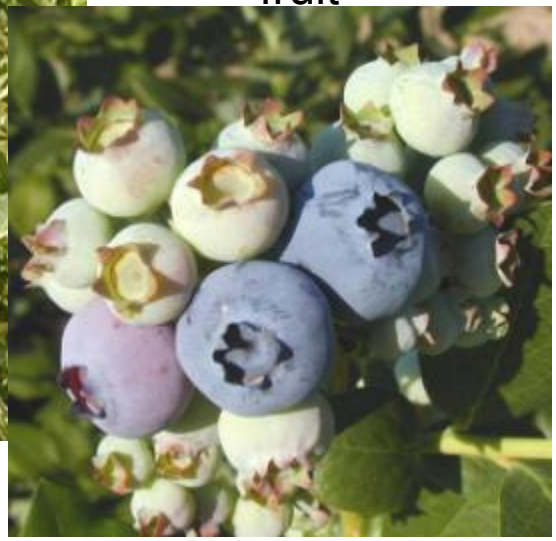
Insects may be present in blueberry fields to feed on, or infest:

buds

flowers

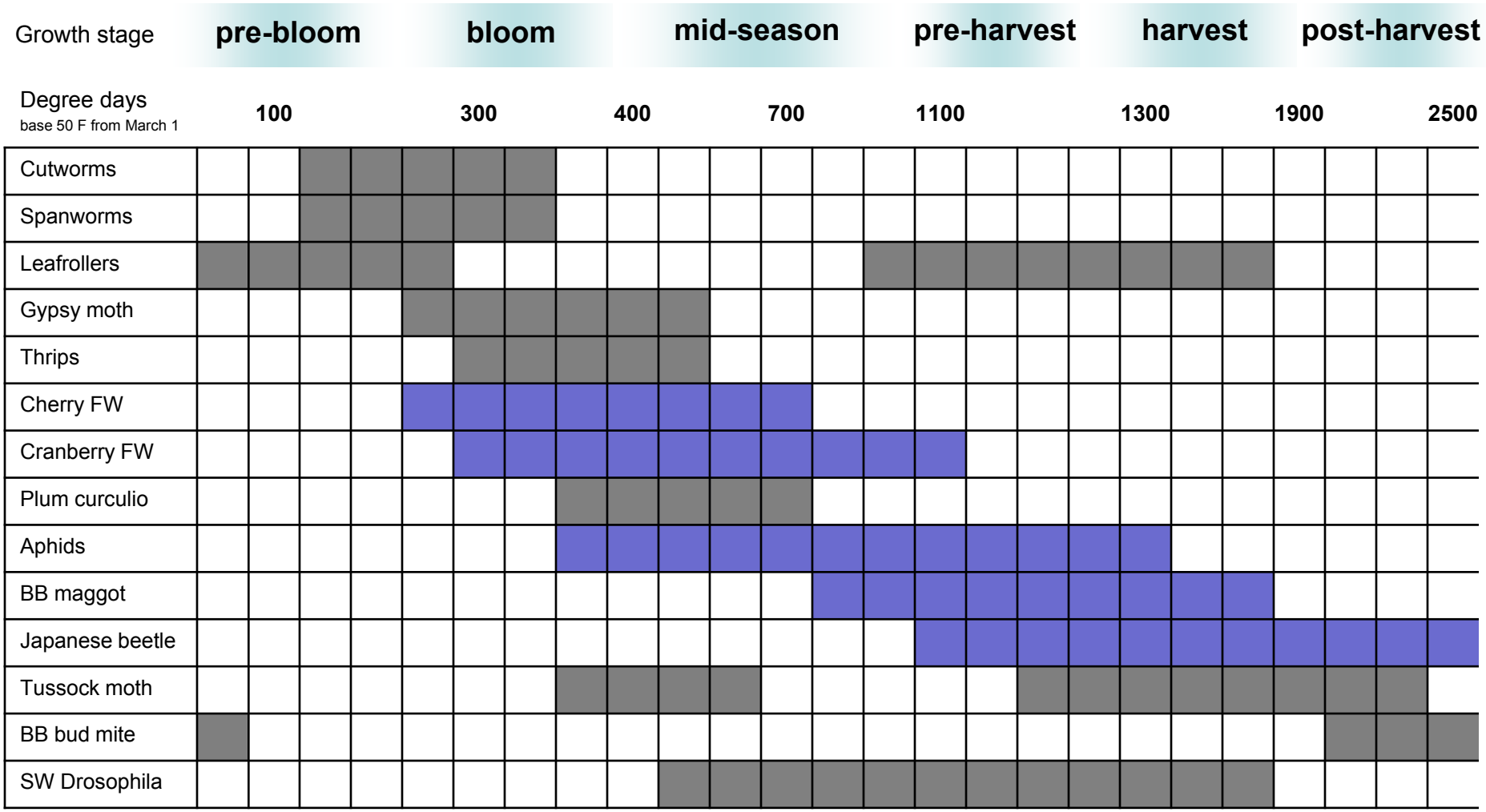
leaves and stems

fruit



and roots….

Main activity and management periods of blueberry insect and mite pests



Bars show period when scouting and management of the pest is most important. Blue = key pest

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Guthion phaseout update

- US-EPA phasing Guthion out of blueberries by Sept 2012.

Changes for 2011

- **Guthion WP yearly max. at 1.5 pounds/ac.**
- **Aerial application of Guthion is now banned.**

- Maximum single application of 1.5 pounds.

- 7 day REI and PHI, except in U-pick fields (30 or more days).

- 60 ft buffer zone to bodies of water, occupied dwellings, and recreational areas.

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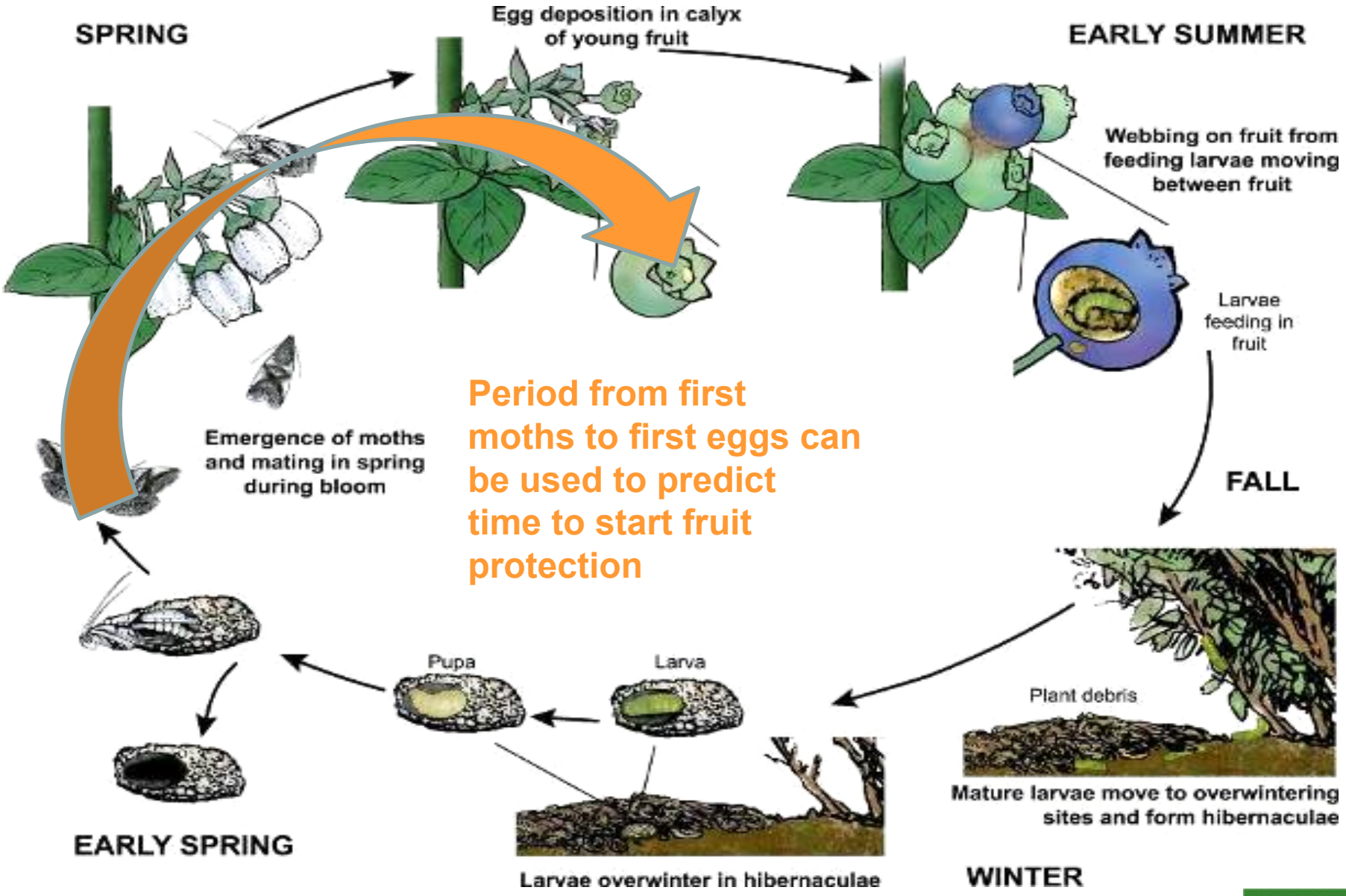
Cranberry fruitworm life cycle



Cranberry fruitworm on fruit

Eggs

Larvae

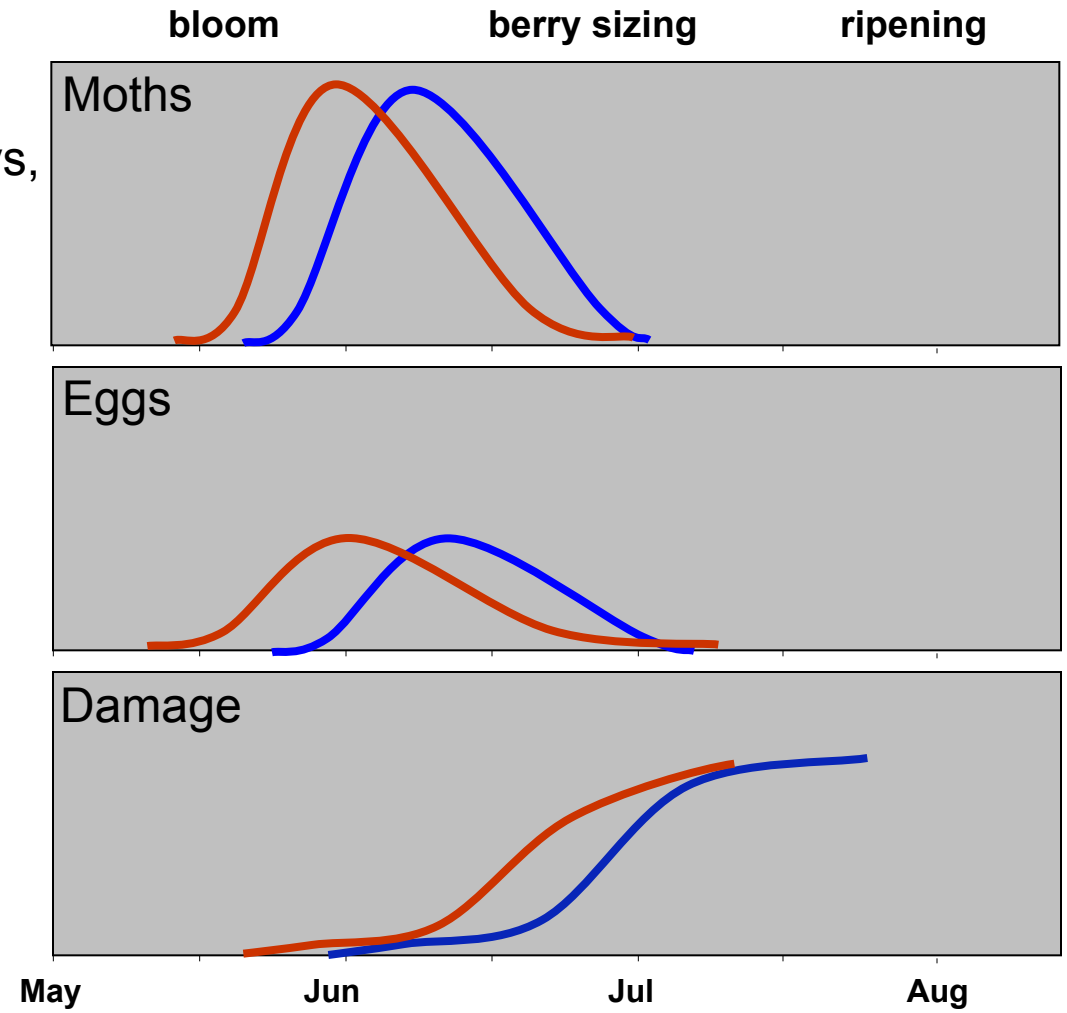
Insect phenology is based on temperature

Key events can be predicted most accurately using degree days, not the calendar

Events happen on different dates, but at the same degree days each season

Blue line = cool season

Red line = warm season



Growing degree days

$$GDD = \frac{T_{\max} + T_{\min}}{2} - T_{\text{base}}$$

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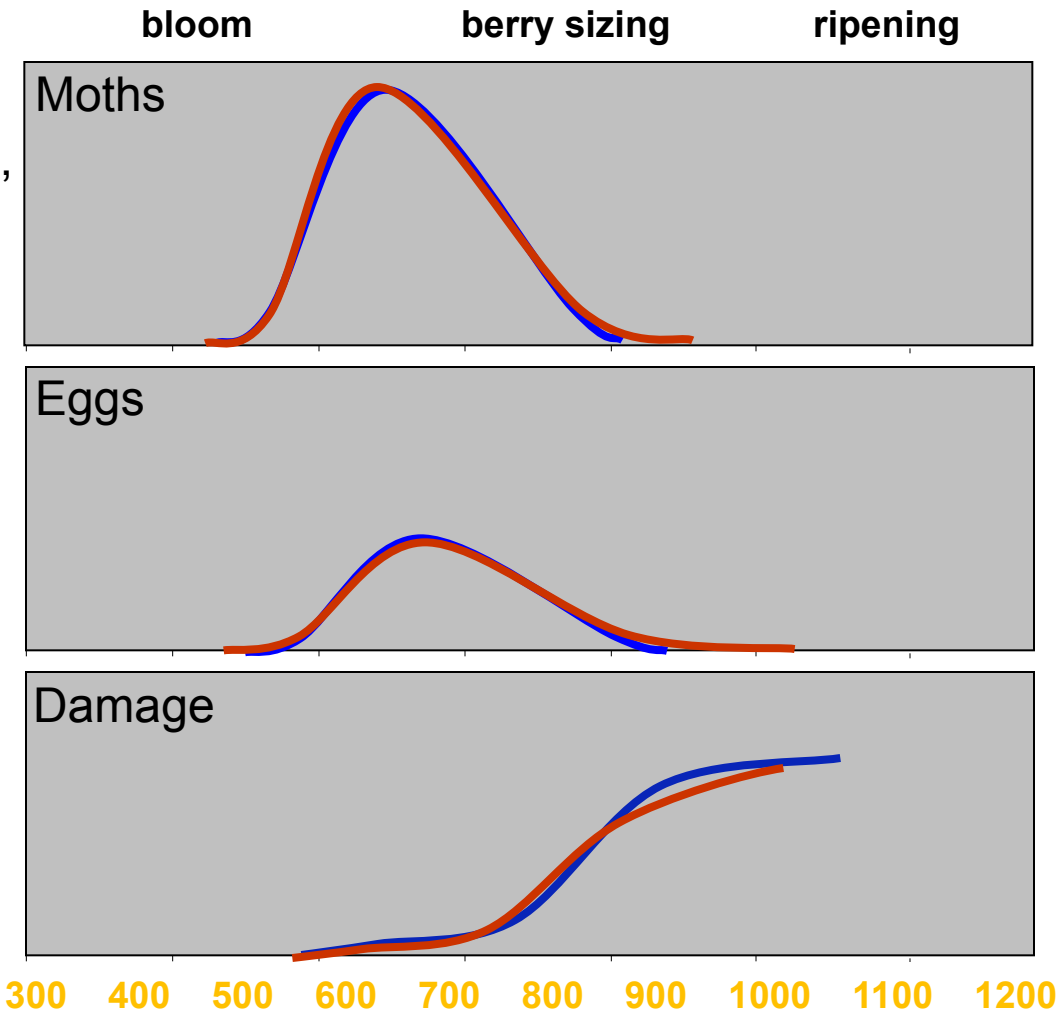

Growing degree days

$$GDD = \frac{T_{\max} + T_{\min}}{2} - T_{\text{base}}$$

Using the degree day model to identify the start of CBFW flight

- Put traps out at the start of flowering
- One trap/10 ac in top of bushes, at edge of fields
- Check twice a week to identify first sustained catch of moths
- Count DD from day before sustained moth catch
- First eggs predicted **85 GDD** later

Trap check	Site 1	Site 2	Site 3	Site 4
6/3	0	2	0	0
6/6	0	0	0	3
6/9	1	0	0	0
6/13	0	0	0	**10**
6/17	0	**2**	0	17
6/21	**1**	5	0	25
6/24	2	9	0	10
6/27	4	0	**5**	4
6/30	10	0	17	2
7/2	25	2	11	1

Gray boxes indicate date to start counting DD to predict start of egglaying

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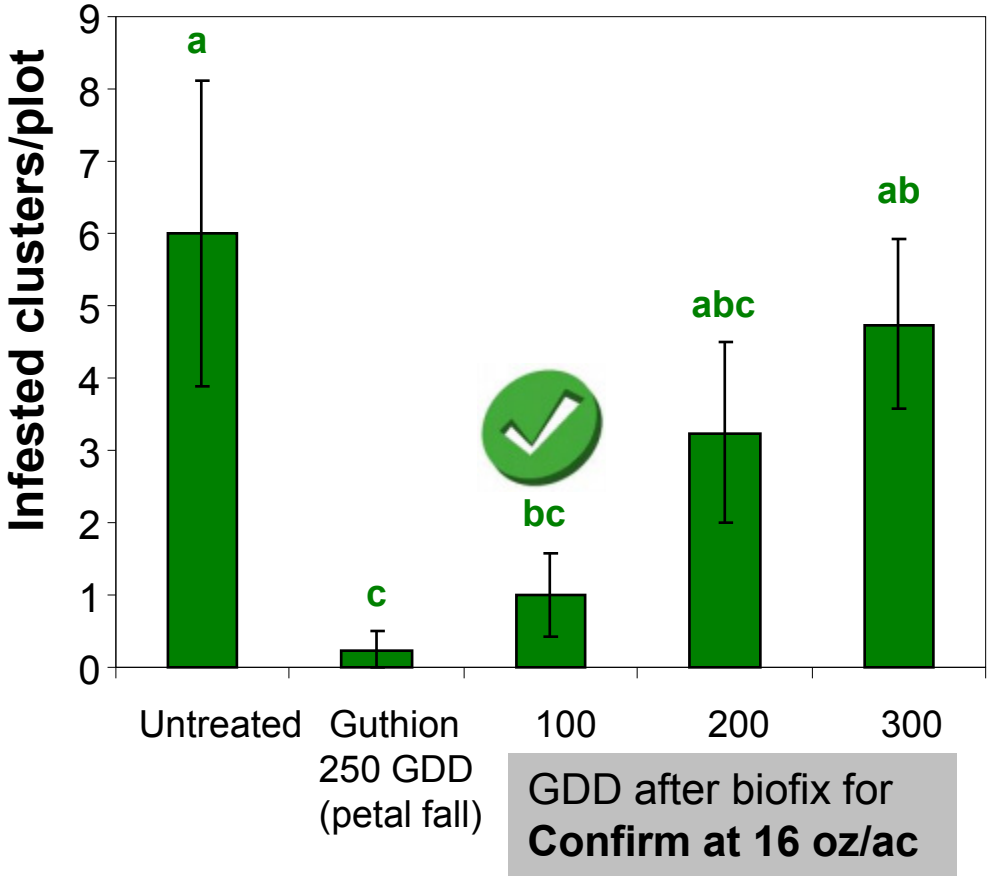
For selective insecticide, correct timing improves control

Comparison of different timings of growth regulator Confirm to the broad-spectrum Guthion. All treatments reapplied 14 days later.



Tracking degree days on your farm

DIY: max-min thermometer

$$\frac{(\text{Max}+\text{Min})}{2} - 50 = \text{daily DD accumulation}$$

Weather monitor:

MSU Online Information:

Fruit CAT Alert

Blueberry IPM Update

Enviroweather

www.enviroweather.msu.edu

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Using the cranberry fruitworm model

www.enviroweather.msu.edu

Free online service to access weather information from around Michigan

Weather forecasts, frost warnings

Pest development models for blueberry
- cranberry fruitworm
- blueberry maggot
- oblique-banded leafroller

2009		Temperature (F)			Degree Days Base 50 F		Biofix Date (date immediately before first sustained moth captures)																
Day	Date	Max	Min	Avg	Today	Since 3/1	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Wed	5/13	70	55	63	12.7	299.1	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thu	5/14	71	48	60	9.9	309	23	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fri	5/15	68	47	58	8	317	31	18	8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sat	5/16	62	38	50	3.7	320.7	34	22	12	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sun	5/17	60	34	47	2.9	323.6	37	24	15	7	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mon	5/18	69	32	51	6.2	329.8	43	31	21	13	9	6	--	--	--	--	--	--	--	--	--	--	--	--	--
Tues	5/19	80	47	63	13.7	343.5	57	44	34	26	23	20	14	--	--	--	--	--	--	--	--	--	--	--	--
Wed	5/20	86	54	70	20.2	363.7	77	65	55	47	43	40	34	20	--	--	--	--	--	--	--	--	--	--	--
Thu	5/21	84	57	71	20.6	384.3	**98**	**85**	75	67	64	61	64	41	21	--	--	--	--	--	--	--	--	--	--
Fri	5/22	72	52	62	12.4	396.7	**110**	**98**	**88**	80	76	73	67	53	33	12	--	--	--	--	--	--	--	--	--
Sat	5/23	83	52	67	17.4	414.1	**128**	**115**	**105**	**97**	**93**	**90**	84	71	50	30	17	--	--	--	--	--	--	--	--
Sun	5/24	80	60	70	20	434.1	**148**	**135**	**125**	**117**	**113**	**110**	**104**	**91**	70	50	37	20	--	--	--	--	--	--	--
Mon	5/25	76	56	66	16.1	450.2	**164**	**151**	**141**	**133**	**130**	**127**	**120**	**107**	**86**	66	54	36	16	--	--	--	--	--	--
Tues	5/26	84	58	71	21.4	471.6	**185**	**172**	**163**	**155**	**151**	**148**	**142**	**128**	**108**	**87**	75	58	38	21	--	--	--	--	--
Wed	5/27	80	64	72	21.8	493.4	**207**	**194**	**184**	**176**	**173**	**170**	**164**	**150**	**130**	**109**	**97**	79	59	43	22	--	--	--	--
Thu	5/28	64	48	56	6.5	499.9	**214**	**201**	**191**	**183**	**179**	**176**	**170**	**156**	**136**	**116**	**103**	**86**	66	50	28	6	--	--	--
Fri	5/29	68	46	57	7.8	507.7	**221**	**209**	**199**	**191**	**187**	**184**	**178**	**164**	**144**	**123**	**111**	**94**	74	58	36	14	8	--	--
Sat	5/30	77	46	61	12	519.7	**233**	**221**	**211**	**203**	**199**	**196**	**190**	**176**	**156**	**135**	**123**	**106**	**86**	70	48	26	20	12	--
Sun	5/31	70	41	56	7.7	527.4	**241**	**228**	**218**	**210**	**207**	**204**	**198**	**184**	**164**	**143**	**131**	**113**	**93**	77	56	34	28	20	8
Mon	6/1	80	49	64	14.4	541.8	**255**	**243**	**233**	**225**	**221**	**218**	**212**	**198**	**178**	**158**	**145**	**128**	**108**	**92**	70	48	42	34	22
Tues	6/2	69	52	61	10.6	552.4	**266**	**253**	**243**	**235**	**232**	**229**	**223**	**209**	**189**	**168**	**156**	**138**	**118**	**102**	81	59	53	46	33
Wed	6/3	68	45	56	7.4	559.8	**273**	**261**	**251**	**243**	**239**	**236**	**230**	**216**	**196**	**176**	**163**	**146**	**126**	**110**	**88**	66	60	52	40
Thu	6/4	73	42	58	9.4	569.2	**283**	**270**	**260**	**252**	**248**	**246**	**239**	**226**	**206**	**185**	**172**	**155**	**135**	**119**	**98**	76	69	62	50
Fri	6/5	77	40	58	10.7	579.9	**294**	**281**	**271**	**263**	**259**	**256**	**250**	**236**	**216**	**196**	**183**	**166**	**146**	**130**	**108**	**87**	80	72	60
Sat	6/6	75	50	63	12.7	592.6	**306**	**293**	**284**	**276**	**272**	**269**	**263**	**249**	**229**	**208**	**196**	**178**	**158**	**142**	**121**	**99**	**93**	85	73
Sun	6/7	77	60	69	18.8	611.4	**325**	**312**	**302**	**294**	**291**	**288**	**282**	**268**	**248**	**227**	**215**	**197**	**177**	**161**	**140**	**118**	**112**	**104**	**92**

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Fruitworm control, 2006

Treatment	Timing	% clusters infested 7/7/06
Untreated		21.5 a
Guthion 50WP, 1.5 lb	A,B,C	1.5 b
Assail 30SG, 5 oz	A,B,C	1.5 b
Avaunt 30 WG, 6 oz	A,B,C	0.5 b
Delegate 25 WG, 4.5 oz	A,B,C	1 b

Treatment timing: A = 6/7 (Petal Fall), B = 6/21, C = 7/6

Fruitworm control trial, 2009

Trial at TNRC Rubel planting

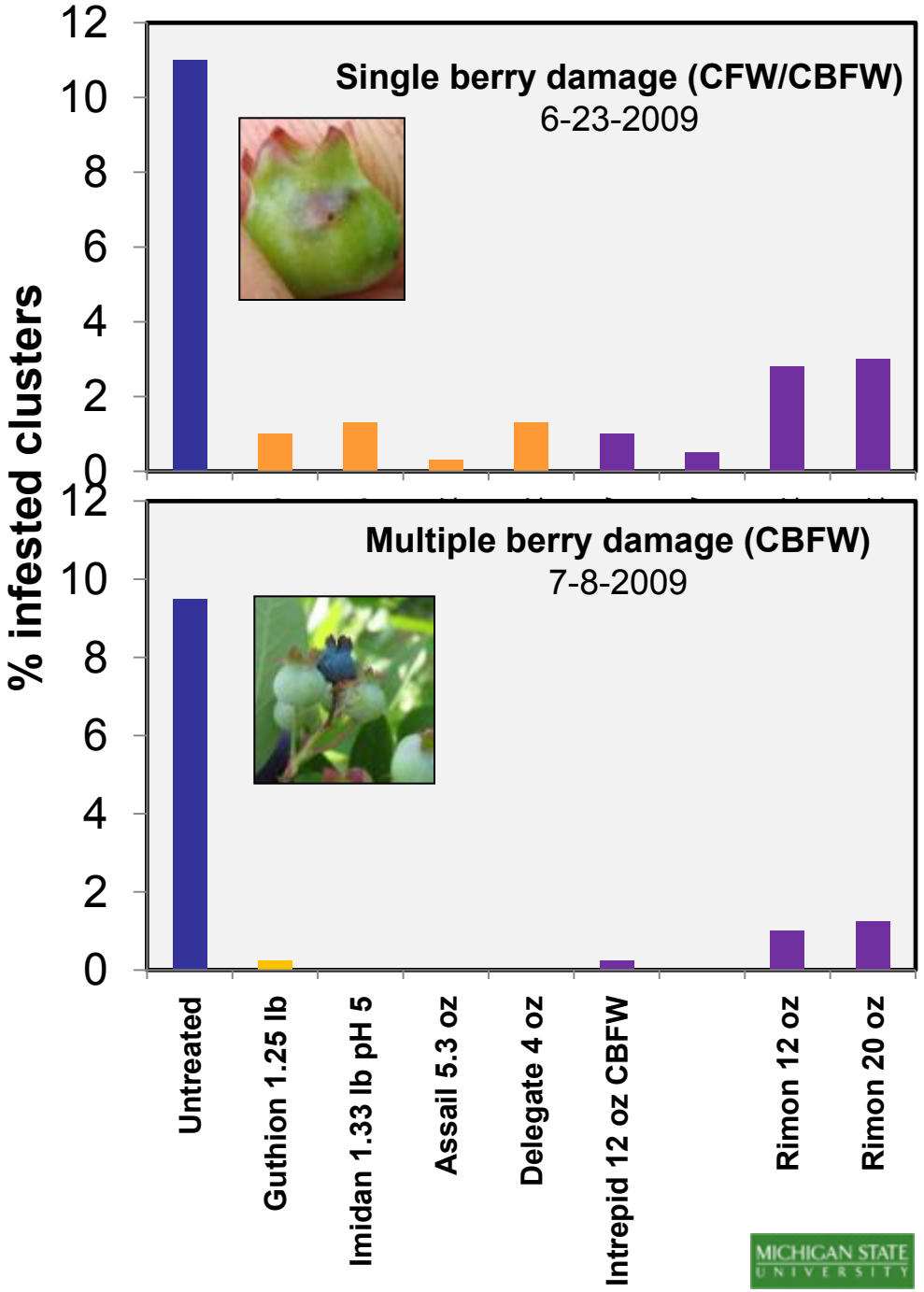
Treatments applied at:

Std timing: 6-5 (PF), 6-19, 7-3

Model timing: 5-27 (85 GDD), 6-10, 6-24

All insecticide treatments were active against CFW and CBFW

Broad-spectrum and reduced-risk insecticides performed very well against fruitworms



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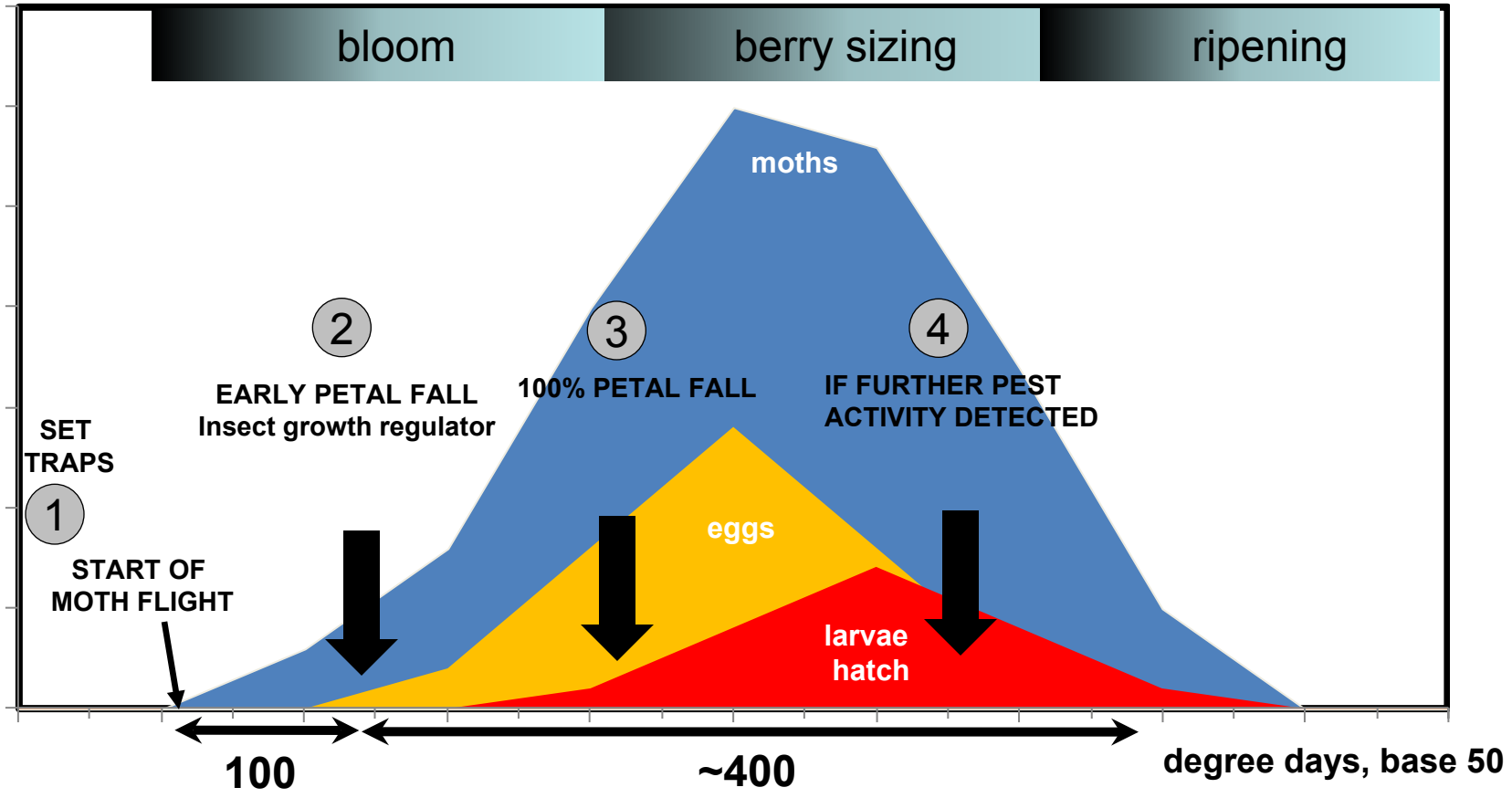
Cranberry fruitworm program in blueberry



1. Set traps at early bloom and check twice a week. Set biofix as the date of the trap check preceding sustained catch.
2. First egglaying starts around 85 GDD after biofix (base 50 °F). Intrepid at this timing reduces infestation during bloom.
3. Apply a second spray with excellent activity and long residual at 100% petal fall, once bees are removed. **This is a key spray!!**
4. *If* cranberry fruitworm is still active 7-14 days later, consider a follow-up spray to protect berries against hatching larvae. May overlap with the need for aphid or maggot control.

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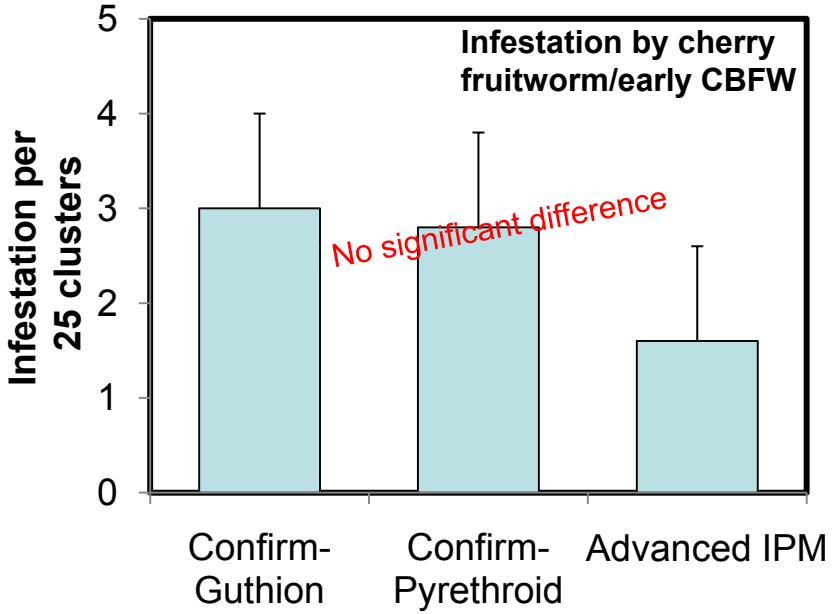
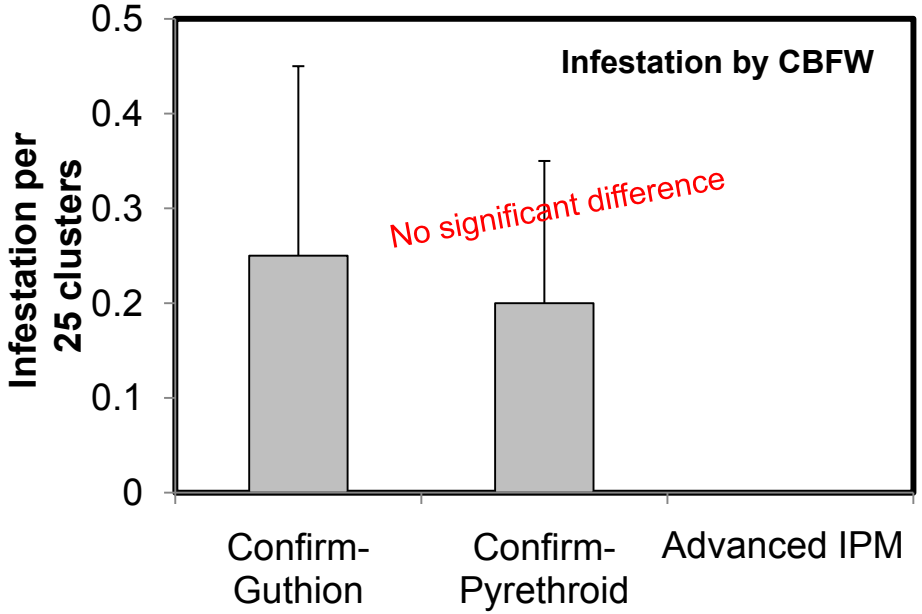
On-farm program comparison, 2009

Timing	Confirm-Guthion	Confirm-Pyrethroid	Advanced IPM
Bloom	Confirm 16 oz	Confirm 16 oz	Intrepid 8 oz 85 GDD
Petal fall	Guthion 1.25 lb	Asana 9.6 oz	Intrepid 8 oz 10-14 d later
7-10 days later	Guthion 1.25 lb	Asana 9.6 oz or Mustang Max 4 oz	Assail 5.3 oz 7-10 days later





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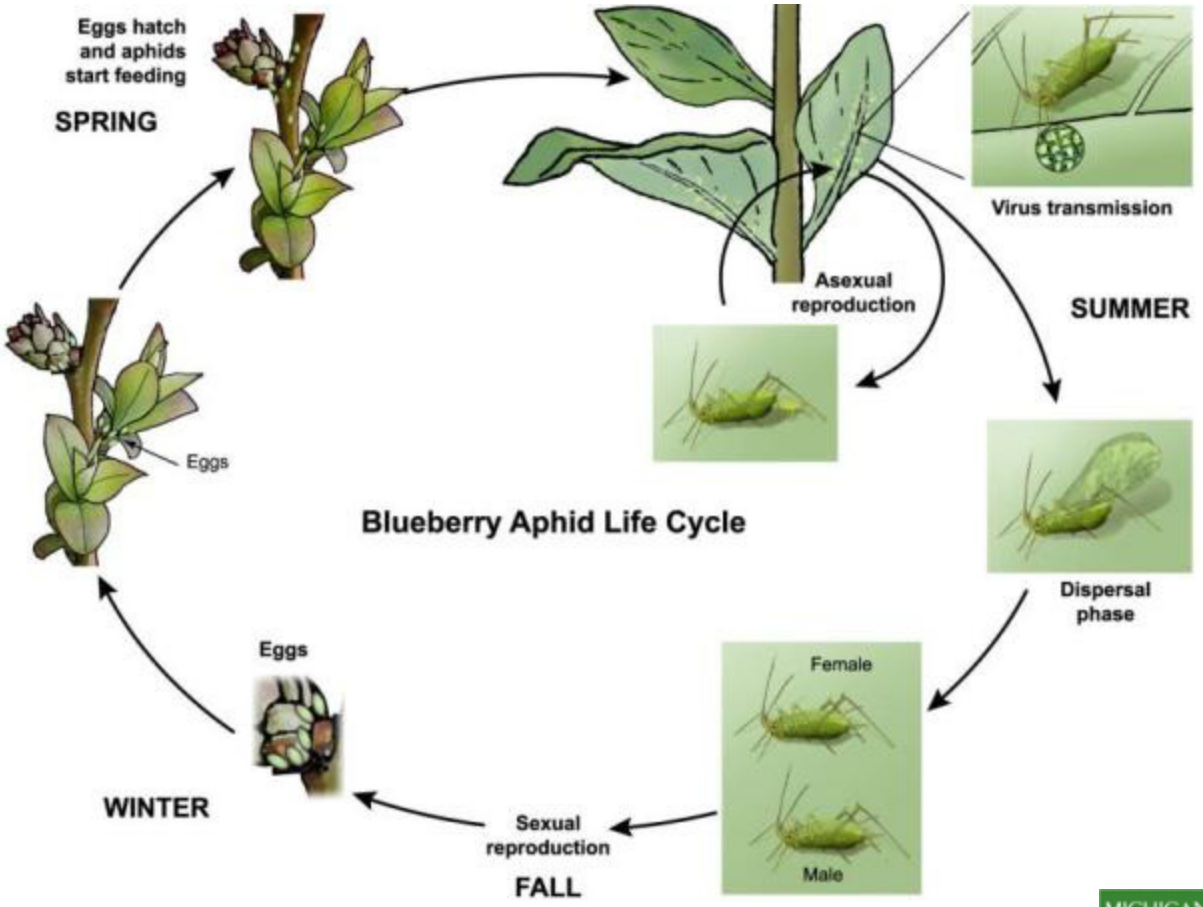
Blueberry aphid

Aphids transmit viruses – shoestring virus in Michigan.

Natural enemies suppress populations.

Control is most important in shoestring susceptible cultivars.



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Aphid control for virus control

- If an aphid-vectored virus detected, aphid control prevents further spread.

- Many broad spectrum insecticides will provide short-term control of aphids. Lannate is the most effective of these.

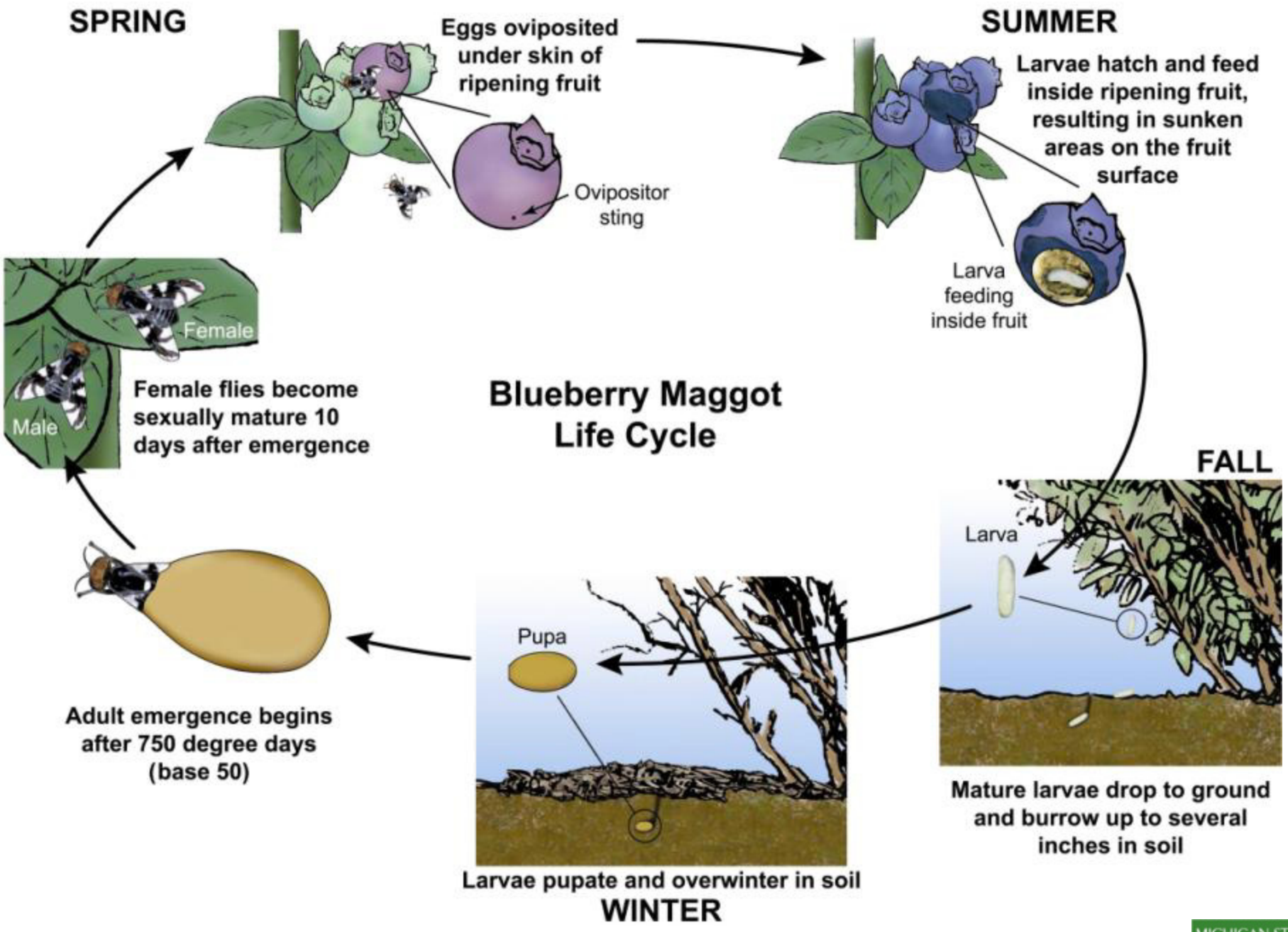
- Neonicotinoids (e.g. Provado, Assail, Actara) are systemic. They move into the leaves and stems, protecting the residue and directing it into the aphid.

- The neonicotinoid class is highly effective against aphids and may control other pests active at the same time.

Ratings of registered neonicotinoids for control of blueberry insect pests

Insecticide	REI (h)	PHI (d)	Aphids	CBFW	BBM	JB	
Actara 3-4 oz	12	3	****	*	**	**	foliar
Assail 2.5-3.5 oz	12	1	****	***	****	**	
Provado 3-4 oz	12	3	****	*	***	**	
Admire (soil) 16 oz	12	7	****			**** grubs	soil
Platinum (soil) 5-12 oz	12	75	****			**** grubs	

- For all foliar aphid sprays, be sure to cover the whole bush, including the lower branches.



Monitoring for Blueberry Maggot Adults

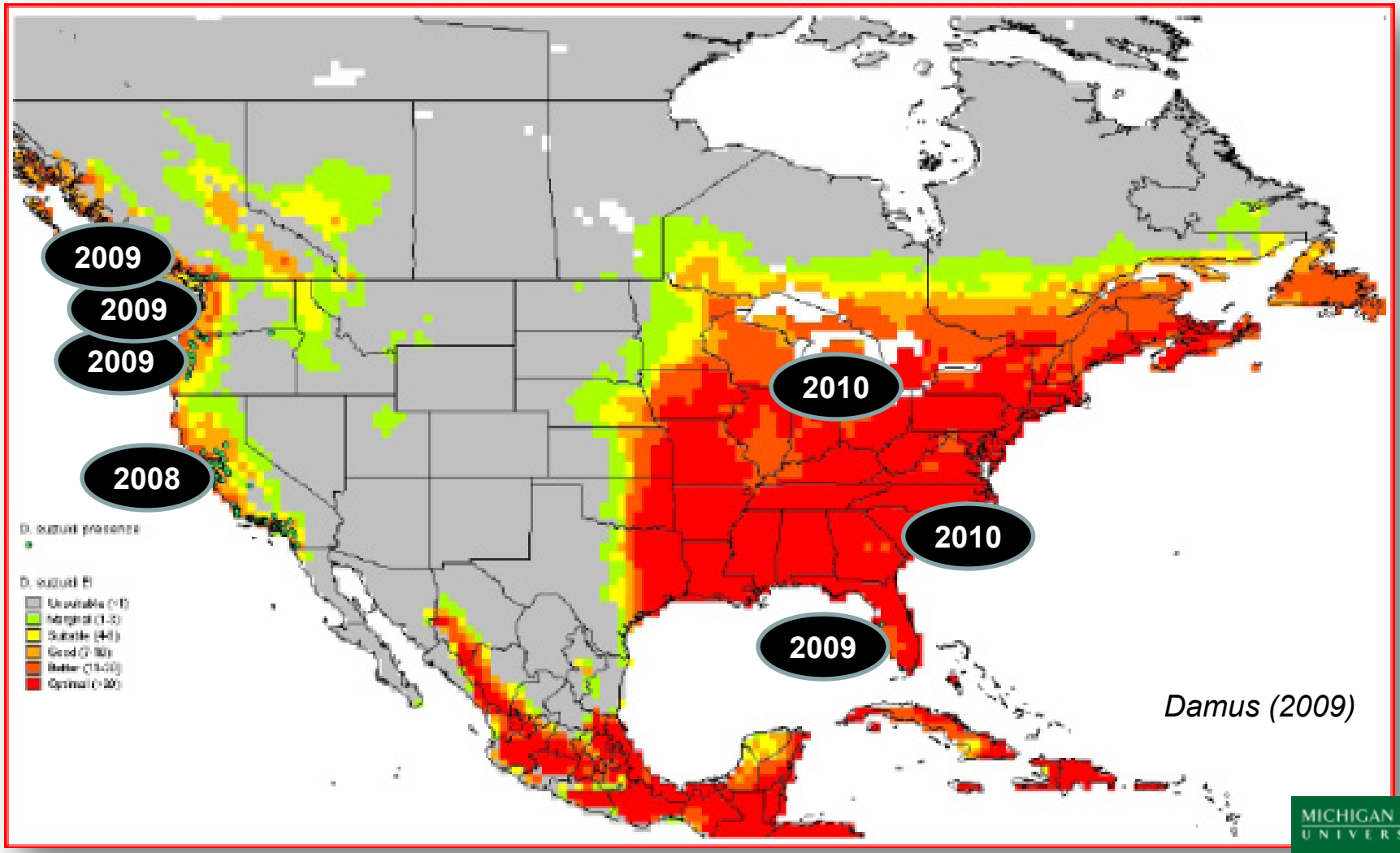
- Adult emergence is best monitored using yellow boards
  - Place in perimeter rows
  - Bait with ammonium acetate
  - Check weekly
  - Can also use green sphere, but not very economical

Blueberry Maggot Adult Identification

- Blueberry Maggot adults are about 5 mm in length. Most characteristic is the wing banding with an ‘M’ pattern (three lines that join together).

Where can SWD survive in N. America?

- Native to East Asia, where it is a pest on fruit.
- Information on climate in Asia used to **predict** distribution in the Americas.



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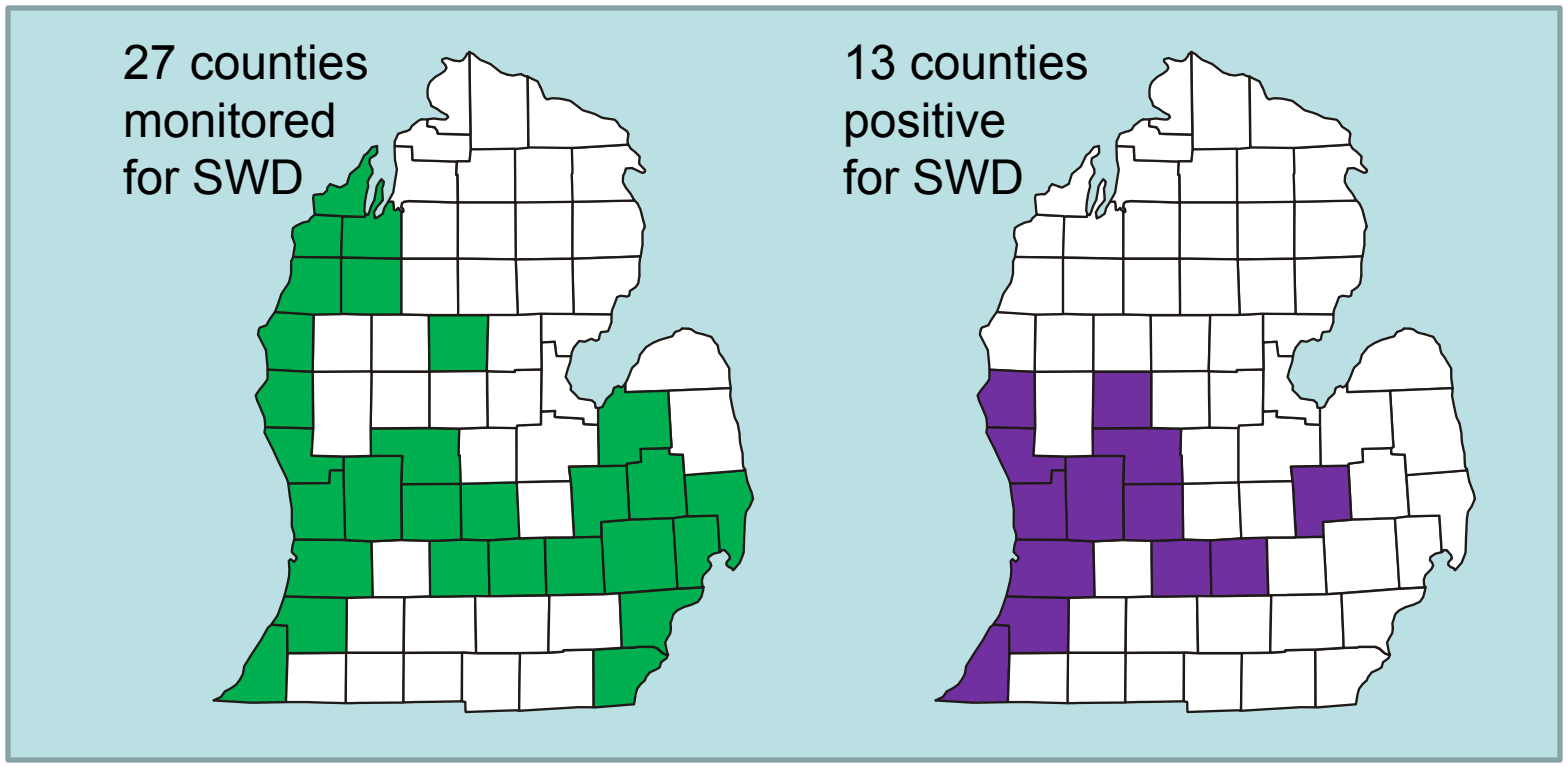
2010 Monitoring for SWD in Michigan

Over 300 traps deployed in spring, more in late September.

Detections in blueberry, raspberry, grape, cherry, rest areas, backyards.

Highest activity of SWD was late-season, well into November.

13 counties positive for SWD as of Nov 20, 2010.



Fruit affected by SWD

Highest risk

Strawberries

Raspberries

Cherries

Nectarines

Blueberries

Blackberries

Moderate risk

Peaches

Grapes

Pears

Apples

Tomato

Alternate hosts

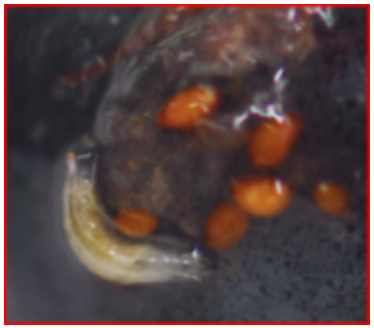
Wild plants with berries, such as…

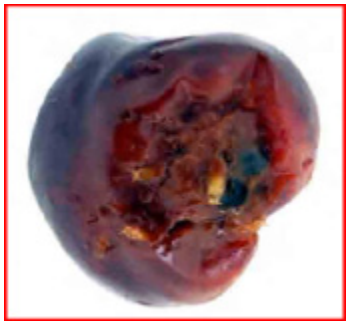
Snowberry

Elderberry

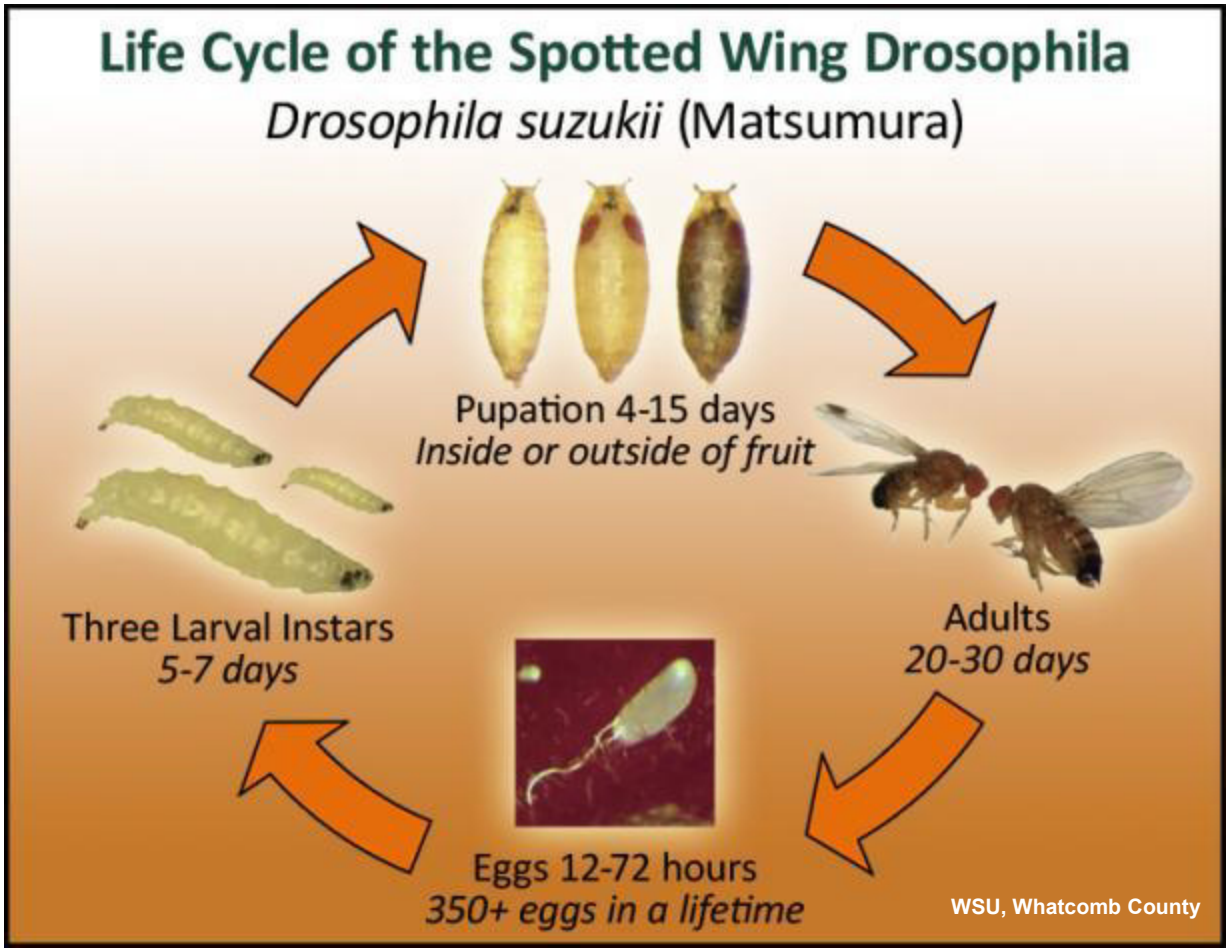
Pokeweed

Dogwood





Biology of SWD



- Optimal development at 65-70°F, **~12 day** generation time.
- Adult flies live for 3-6 weeks, and females can lay over 300 eggs.
- Female fly lays eggs into ripening fruit.
- Limited by high heat in summer and by winter cold. But, SWD populations are found in cold regions of Japan.

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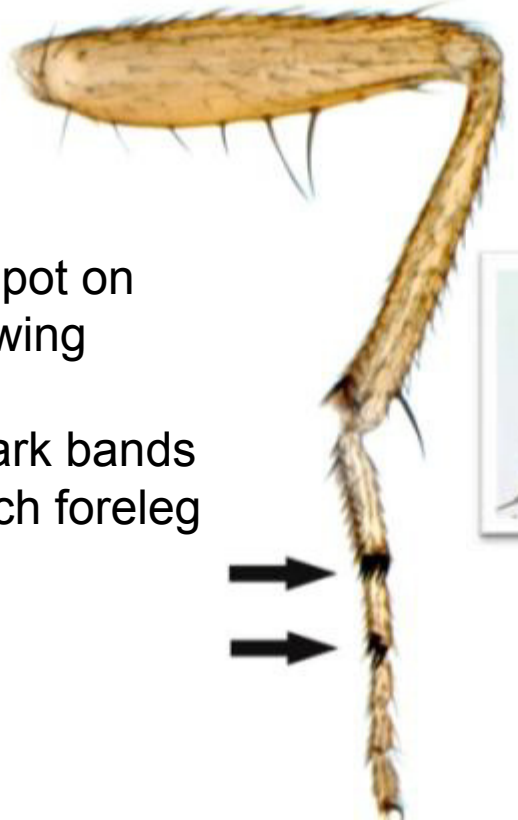
Male and female SWD

MALE

M. Hauser, UC



dark spot on each wing

two dark bands on each foreleg

FEMALE

two rows of serrations on ovipositor

no dark spots on wings

M. Hauser, UC

Click HERE for a detailed key for identifying SWD

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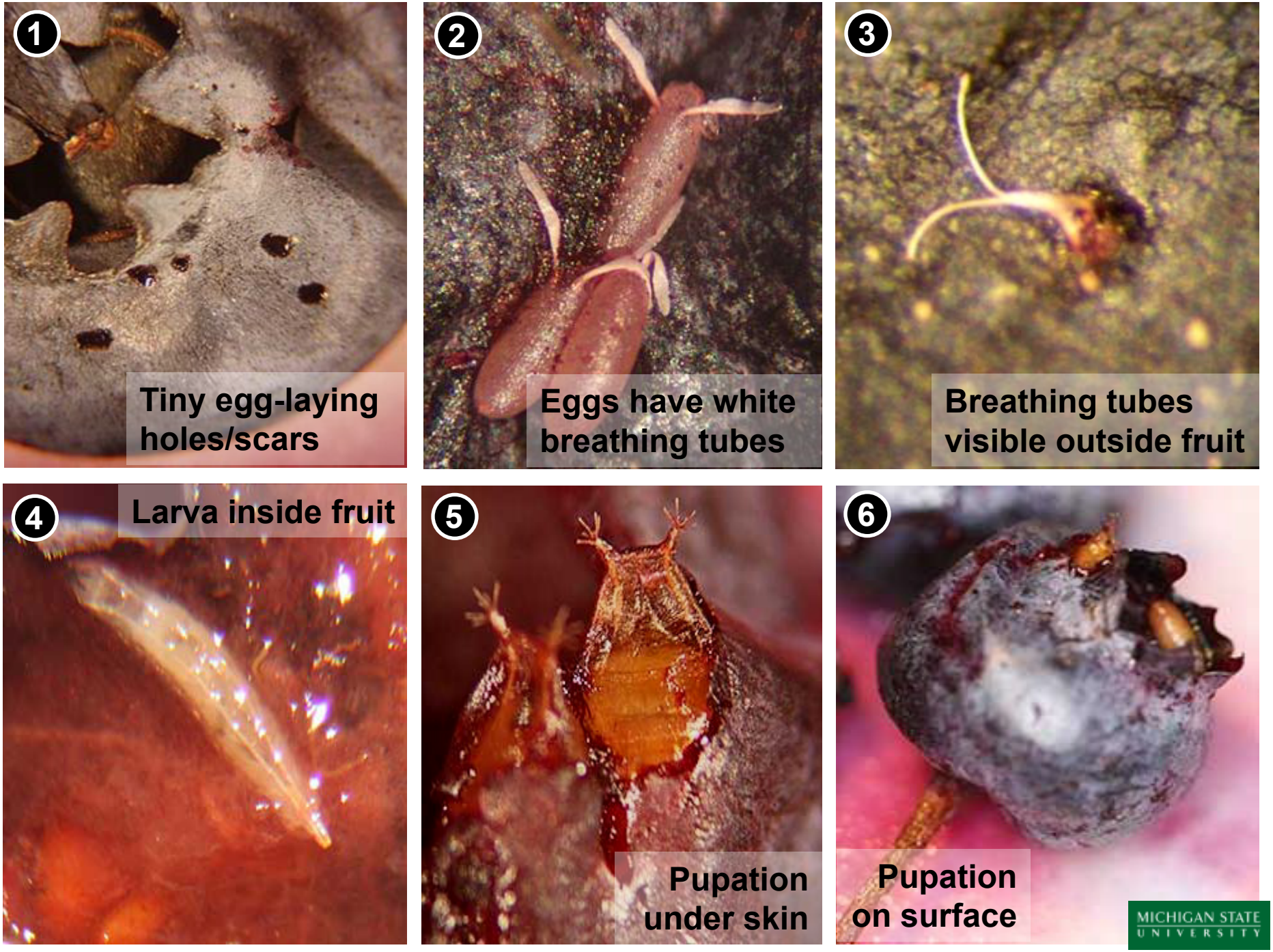
1
Tiny egg-laying holes/scars
2
Eggs have white breathing tubes
3
Breathing tubes visible outside fruit
4
Larva inside fruit
5
Pupation under skin
6
Pupation on surface
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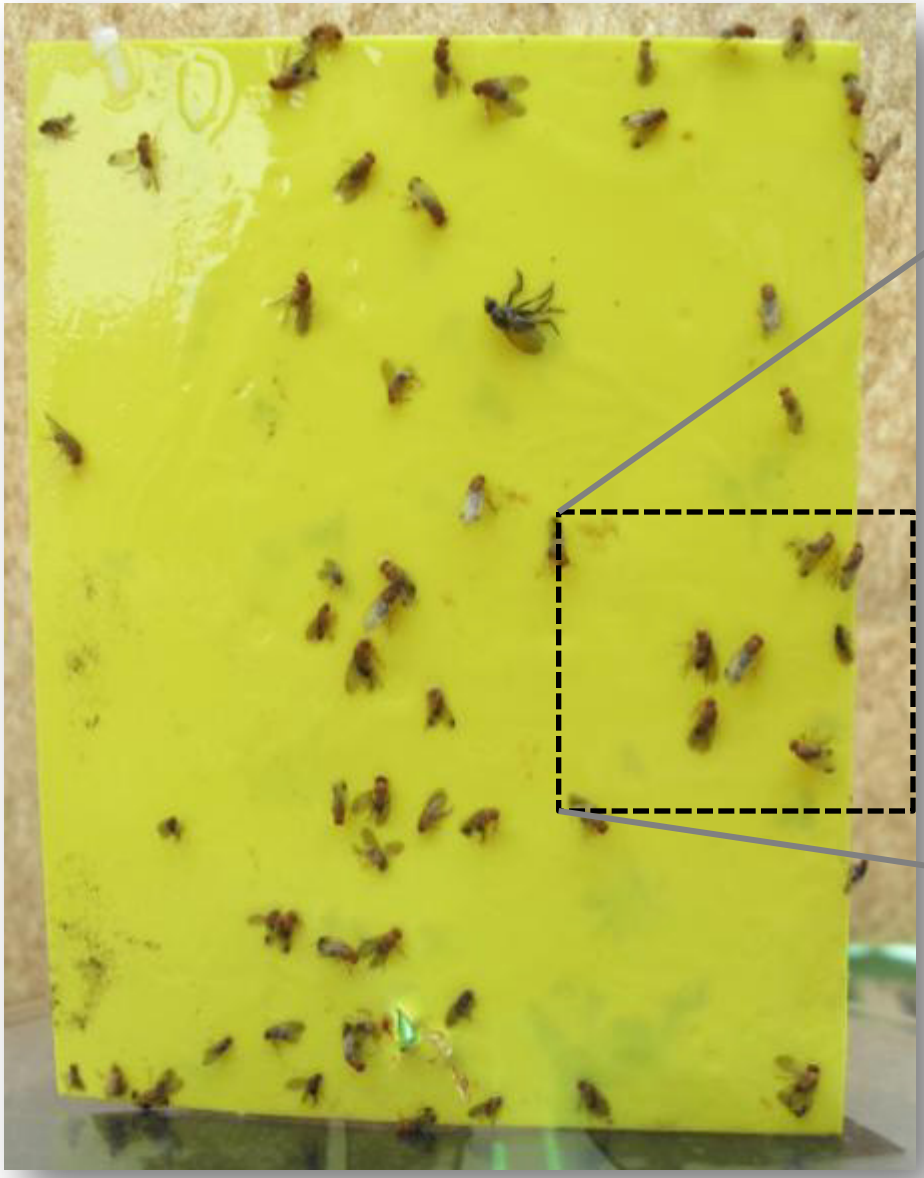
Monitoring SWD

Approx. $1/trap for materials and construction.

- Plastic cup with side holes, apple cider vinegar bait.
- Use small yellow sticky trap to capture flies. Or, use only vinegar with a drop of unscented soap.
- Hang in fruit canopy near fruit and in the shade.
- Change vinegar weekly, and dispose away from trap.
- Best detection potential expected as fruit ripens.
- Check weekly, and record catches.

Spotting SWD males on traps



Checking fruit for SWD

To see eggs on berry surface

Look for pits in fruit surface or egg tubes

Use a 30x hand lens, also available with LED light for better viewing

To check berries for SWD larvae

Start as fruit begins coloring

Sample 1-2 lbs, ripest suspect fruit

Place in a shallow pan

Pour solution over: 1 Tbsp salt in 1 cup water

Look for mature larvae

Eggs and smallest larvae difficult to detect

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IPM for SWD

Current information is primarily from experiences in western US. We will learn a lot in 2011 about pest impact, timing, overwintering survival, and control.

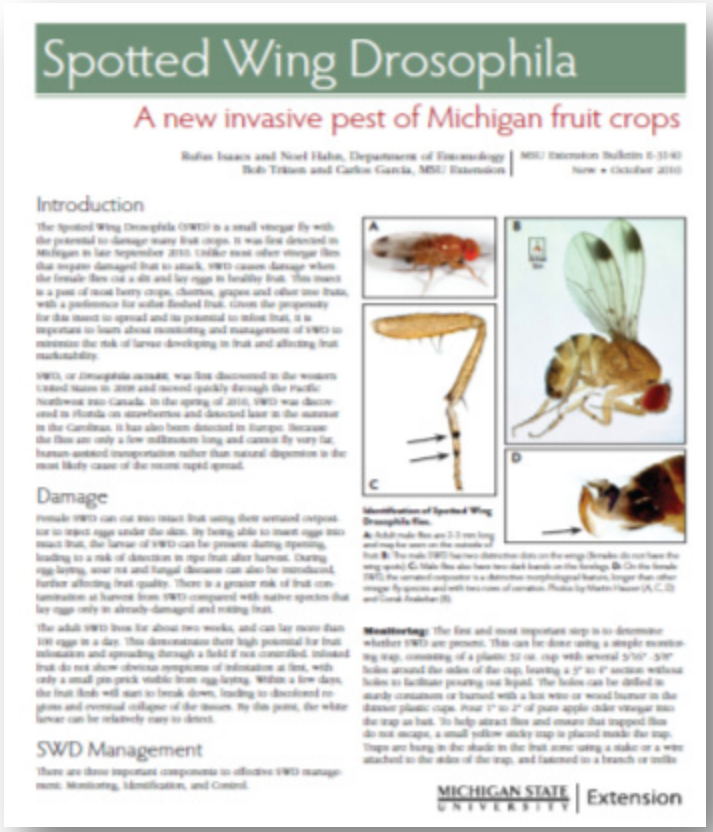
- Midwest growers should be prepared to monitor and manage SWD in 2011.
- Flies were trapped in vineyards only after late September in 2010.
- Grape infestation has generally been lower than other crops, and only after fruit ripen.

IPM for SWD

- If SWD is detected, current IPM programs will require adjustment.
- If flies are detected, SWD is sensitive to OPs (e.g. Imidan) and pyrethroids (e.g. Mustang Max).
- Entrust and Pyganic are the most effective organic insecticides. Shorten interval (5 days) to maintain control.
- Stay informed through workshops, newsletters, websites.

Stay informed…

www.ipm.msu.edu/SWD.htm



Publication E-3140
Tambien en Español (E-3140SP)

Meeting announcements, including hands-on workshops

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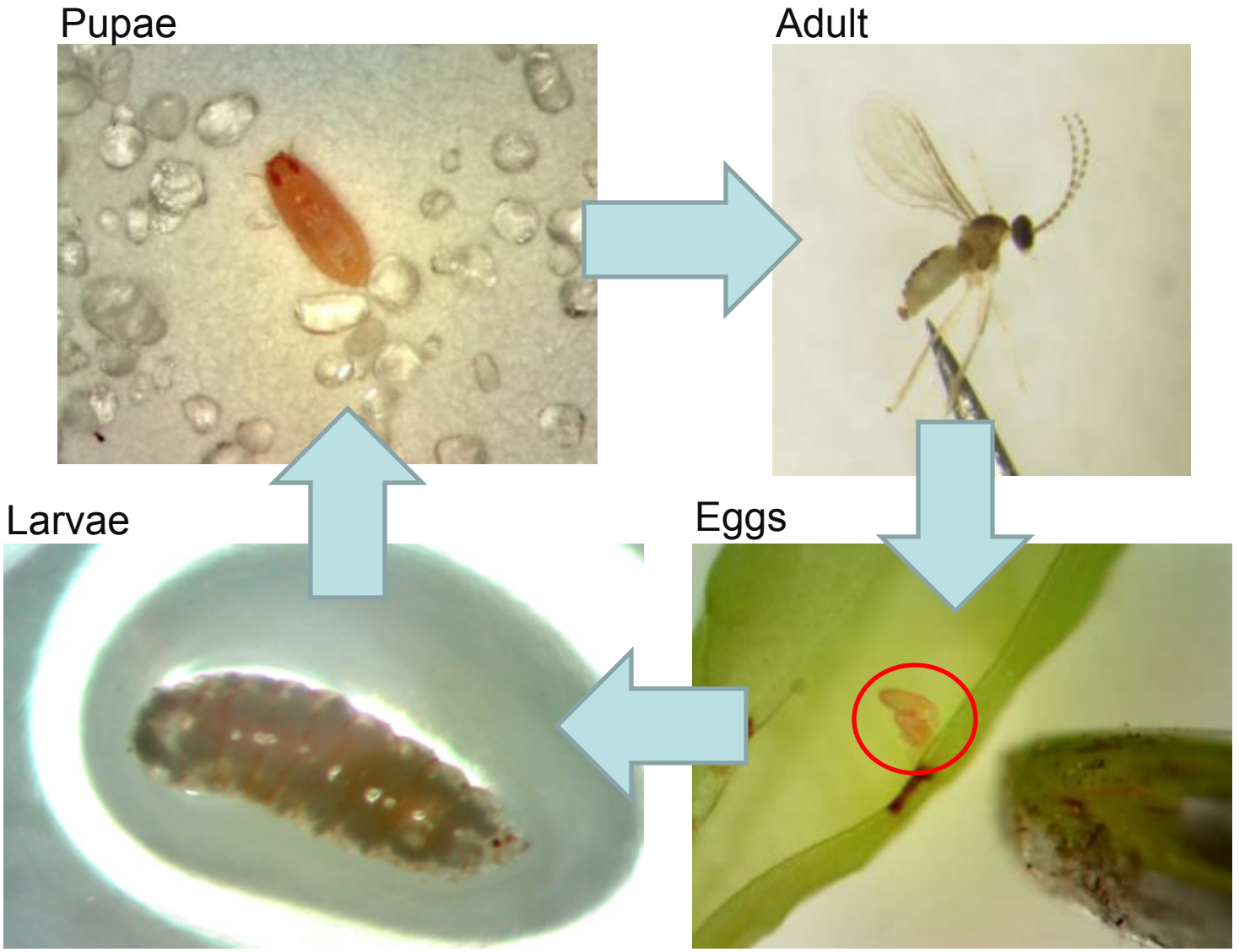
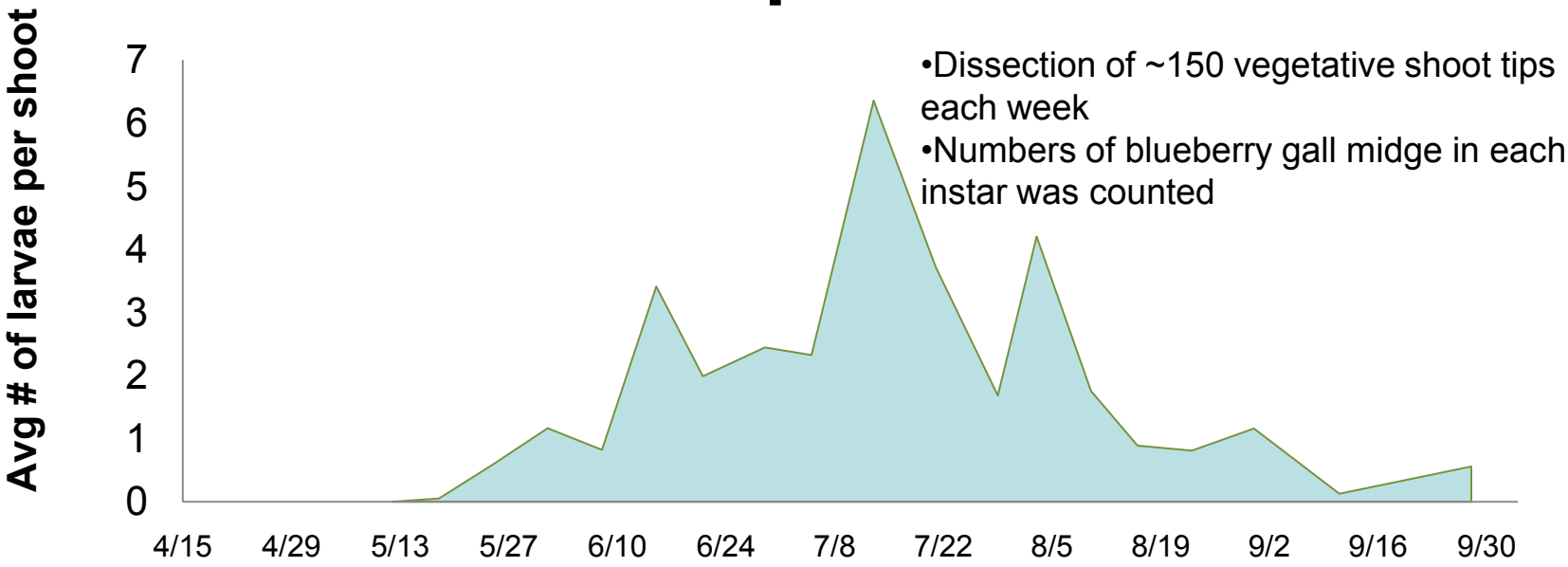
Blueberry gall midge

Dasineura oxycoccana

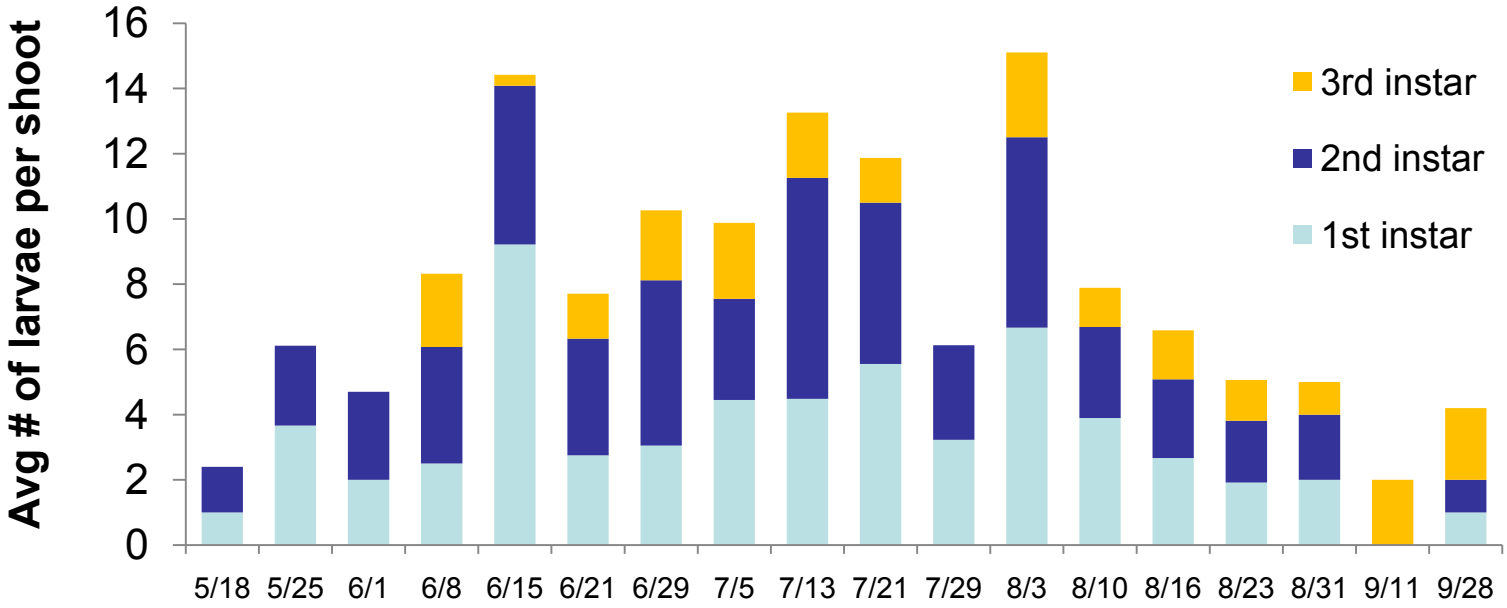
Blueberry gall midge life cycle



Shoot tip dissections



- Dissection of ~150 vegetative shoot tips each week
- Numbers of blueberry gall midge in each instar was counted



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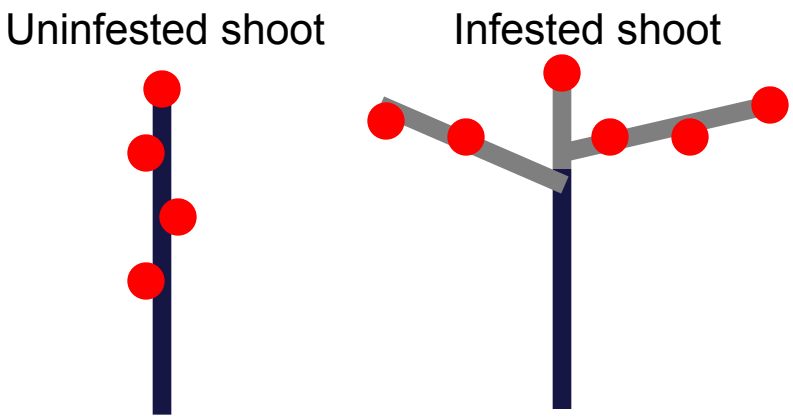
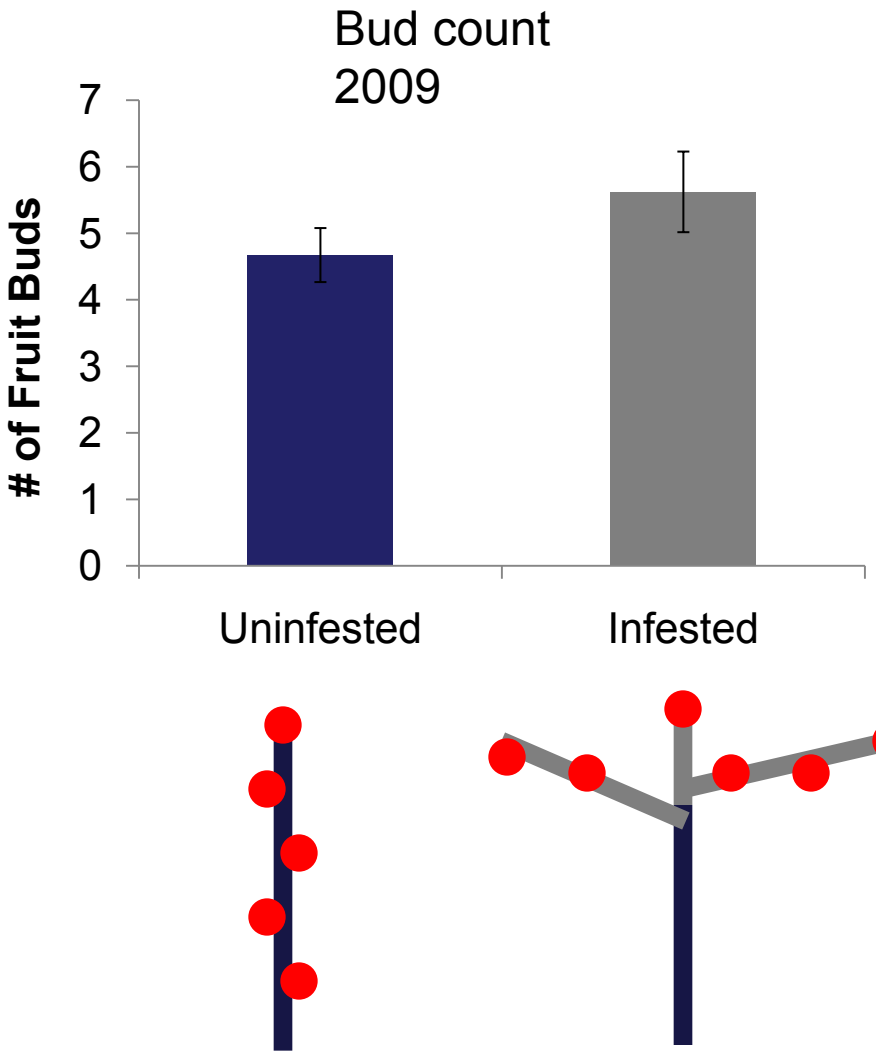
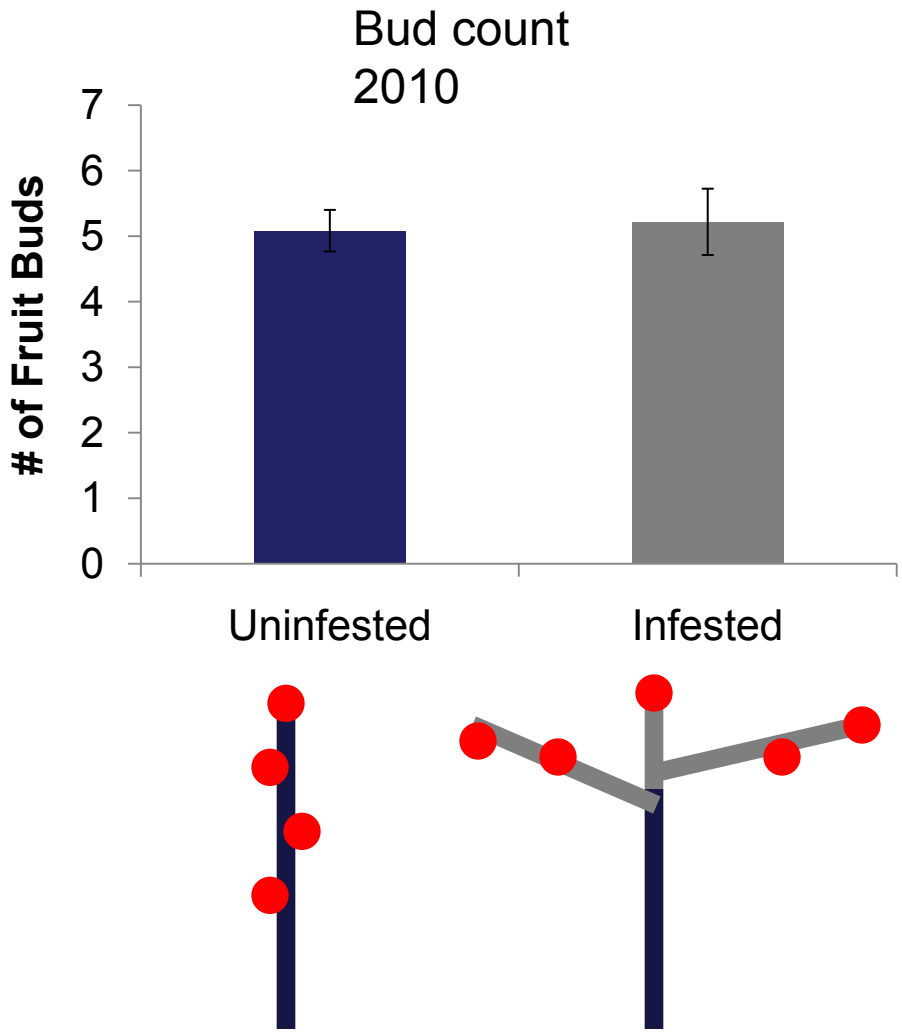
Economic impact of blueberry gall midge?

- Four farms, 20 uninfested shoots and 20 infested, branched shoots per farm
- Fruit buds counted on each uninfested shoot and each branch of infested shoots

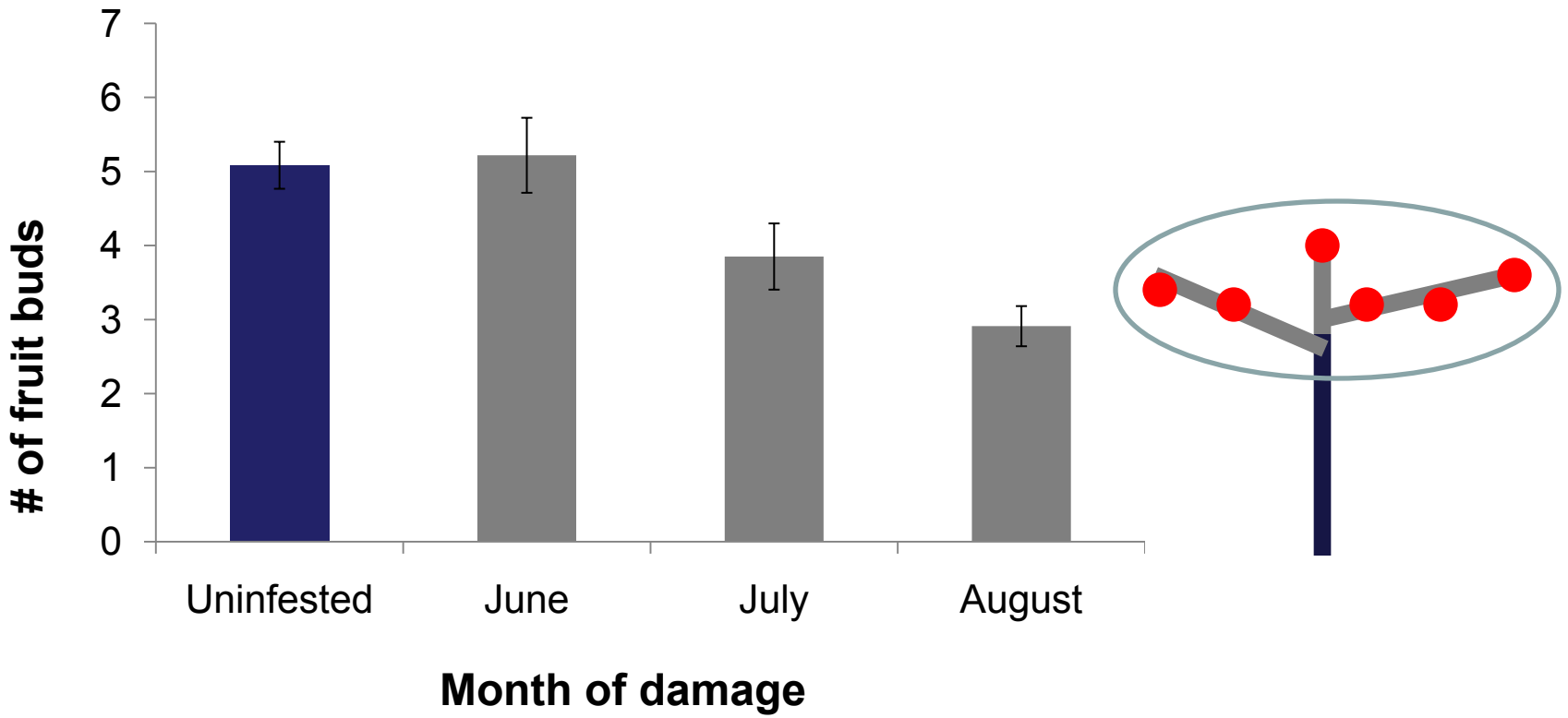


Economic impact of blueberry gall midge?





Does timing of damage affect bud formation?



Blueberry gall midge summary

- Blueberry gall midge is widespread and active throughout the summer
  - Emergence traps were the first to detect BGM in the field
  - Shoot dissections were effective but time consuming
- Parasitoids are present, although in low numbers
- There is no overall difference in the number of fruit buds on uninfested and infested shoots. But, bud production is lower on shoots infested in later part of the season.

Blueberry Bud Mite

Acalitus vaccinii Keifer - from Eriophyid family of mites

White body, 1/128 inch long. Spherical eggs.

Sporadic pest. More important in southeast US

Spend fall and winter under bud scales

Leads to mis-formed flowers and fruit, poor yield

Typically few mites per bud, but can be >50

Cultivars vary in sensitivity (Rubel is v. sensitive)

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Summary

Use monitoring and degree day models to optimize spray timings

Integrate new insecticide tools where they fit best

- Intrepid for fruitworms and tussock moth during bloom
- Assail, Avaunt, Asana, Mustang, or Delegate for fruitworms post bloom
- Assail or Provado for aphids and blueberry maggot post bloom
- Provado or Mustang for Japanese beetle

Be on the lookout for SWD this season

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MSU Extension information is online

www.blueberries.msu.edu

ipmnews.msu.edu/fruit/

Email to: jenki132@msu.edu to subscribe

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THE BLUEBERRY PEOPLE

Project GREEEN

USDA CSREES

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