Spotted wing drosophila and brown marmorated stink bug - the biggest challenges to berry growers

Douglas G. Pfeiffer
Dept. of Entomology
Virginia Tech, Blacksburg

Brown Marmorated Stink Bug

- *Halyomorpha halys* (Stål)

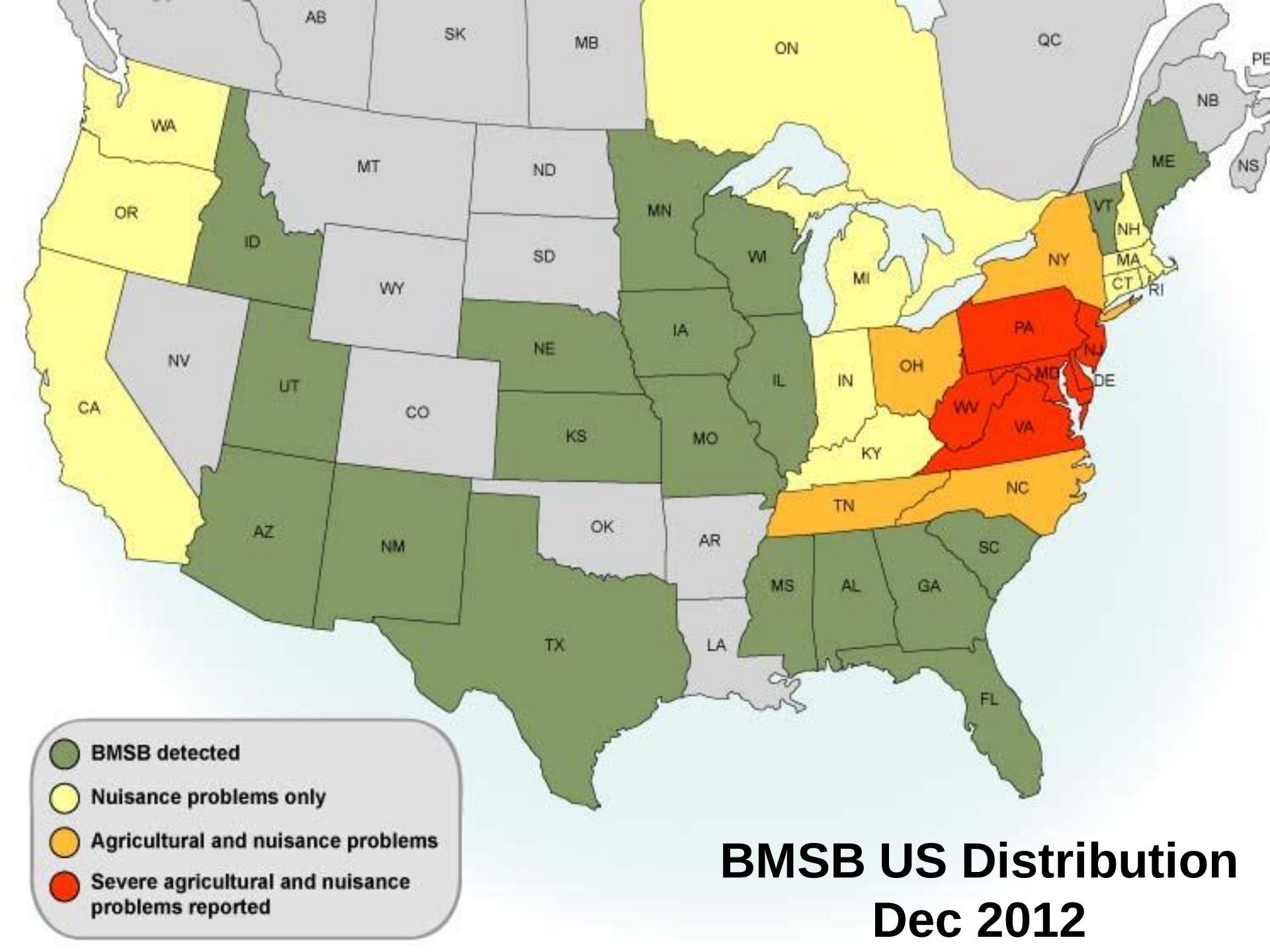
Brown Marmorated Stink Bug

- Native to China, Japan, Korea
- Introduced around Allentown PA in 1996
- Found in Virginia 2004
- Now found in 39 states
- One gen PA, NJ, 2 generations for us (4-6 in subtropical parts of China)
- In fall, seek shelter in houses
- Why the big stink?

BMSB Host Range

- Highly polyphagous, >300 hosts
- Fruit crops
  - Orchard – apple, pear, peach, hazelnut
  - Small fruits – caneberries, blueberries
  - Wine grapes
- Field crops
  - Soybean
  - Cotton
- Vegetable crops
  - Tomatoes
  - Peppers
- Ornamental crops

Brown Marmorated Stink Bug



BMSB US Distribution Dec 2012

Brown Marmorated Stink Bug

- *Halyomorpha halys* (Stål)

Stink Bug Eggs

Podisus

Halyomorpha

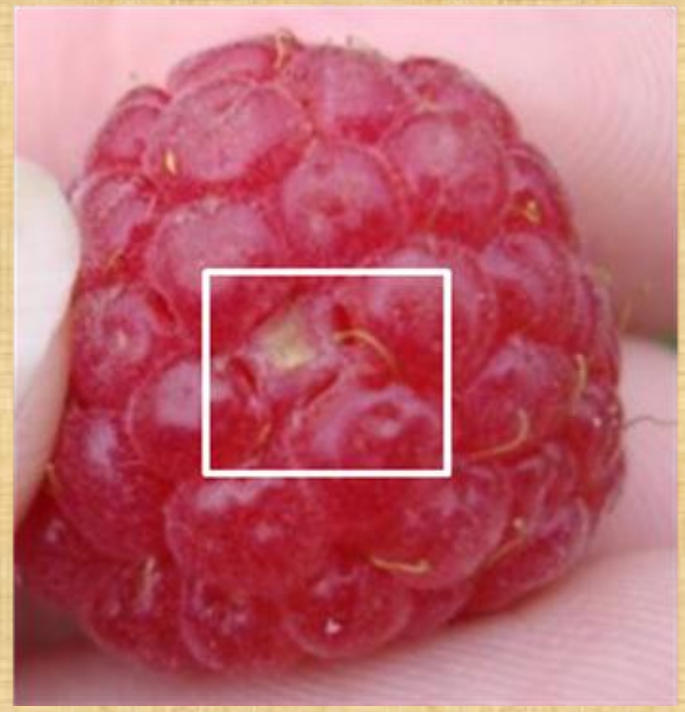
Brown marmorated stink bug, *Halyomorpha halys*

- **Impact in caneberries?**
- **50% loss of berries reported by a Virginia grower**
- **Prospects for early season populations in 2013?**

Insertion of stylets -

Stink Bug Injury

- Injury to berries



Invasive drosophilids in Virginia Small Fruits

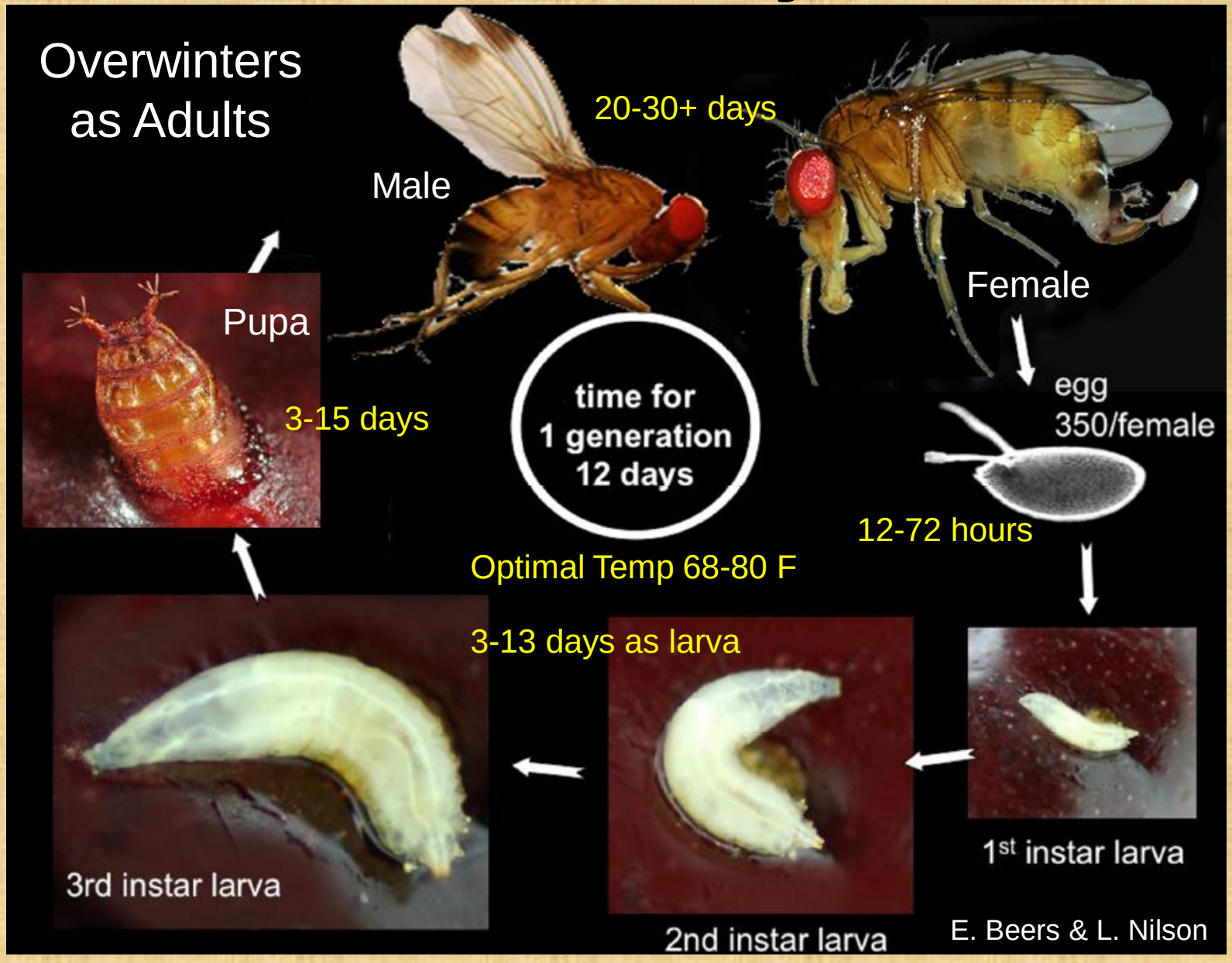
- **Background and identification of SWD**
- Movement and establishment
- Hosts
- Trapping
- New kid on the block
- Management

Drosophila suzukii

- Most *Drosophila* spp. attack rotting fruit

- *Drosophila suzukii* (spotted wing drosophila) differs in **attacking ripe and ripening fruit**

SWD Life Cycle



SWD Identification: Male

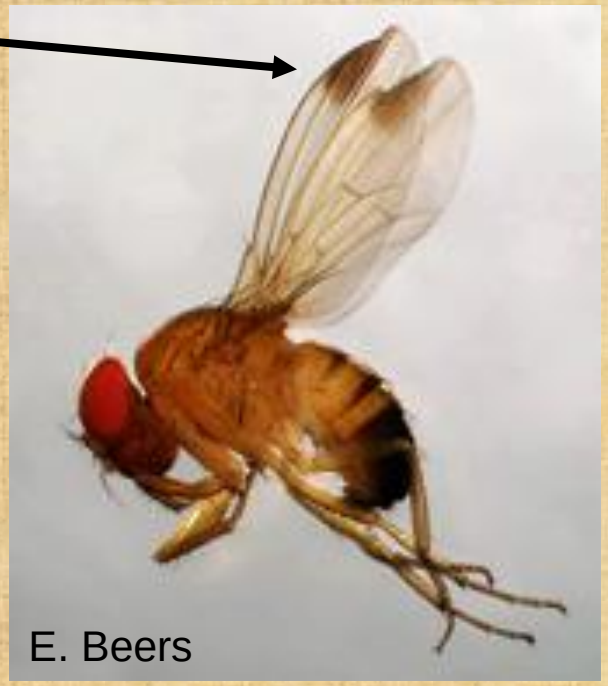
M. Hauser

G. Dill

Dark spot on leading edge of wing

2 dark stripes on tarsi of front legs

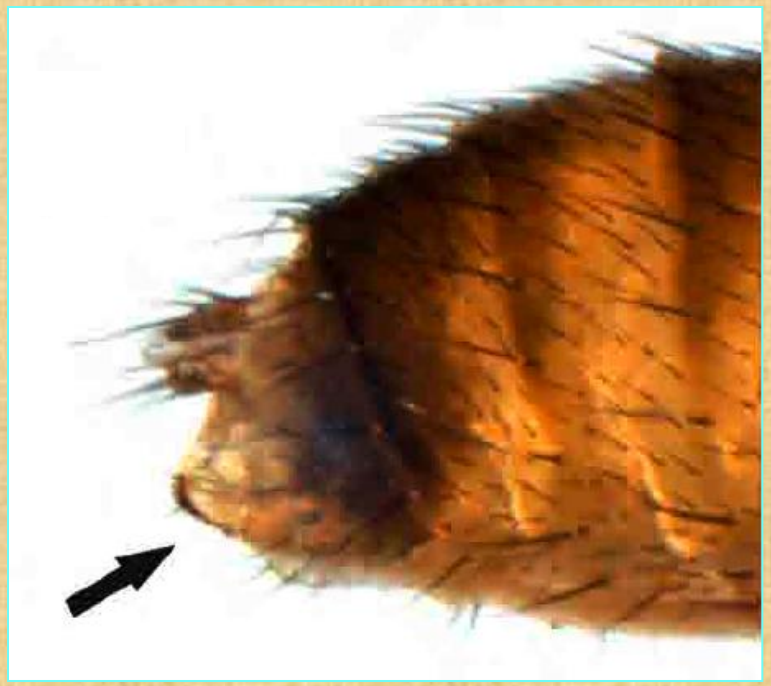
M. Hauser



E. Beers

SWD Identification: Female

Other *Drosophila*



Blunt ovipositor cannot pierce skin of healthy fruit

Female: No spot on wing

SWD
D. suzukii

Saw-like, serrated ovipositor with two even rows of teeth

Invasive drosophilids in Virginia Vineyards

- Background and identification of SWD
- **Movement and establishment**
- Hosts
- Trapping
- New kid on the block
- Management

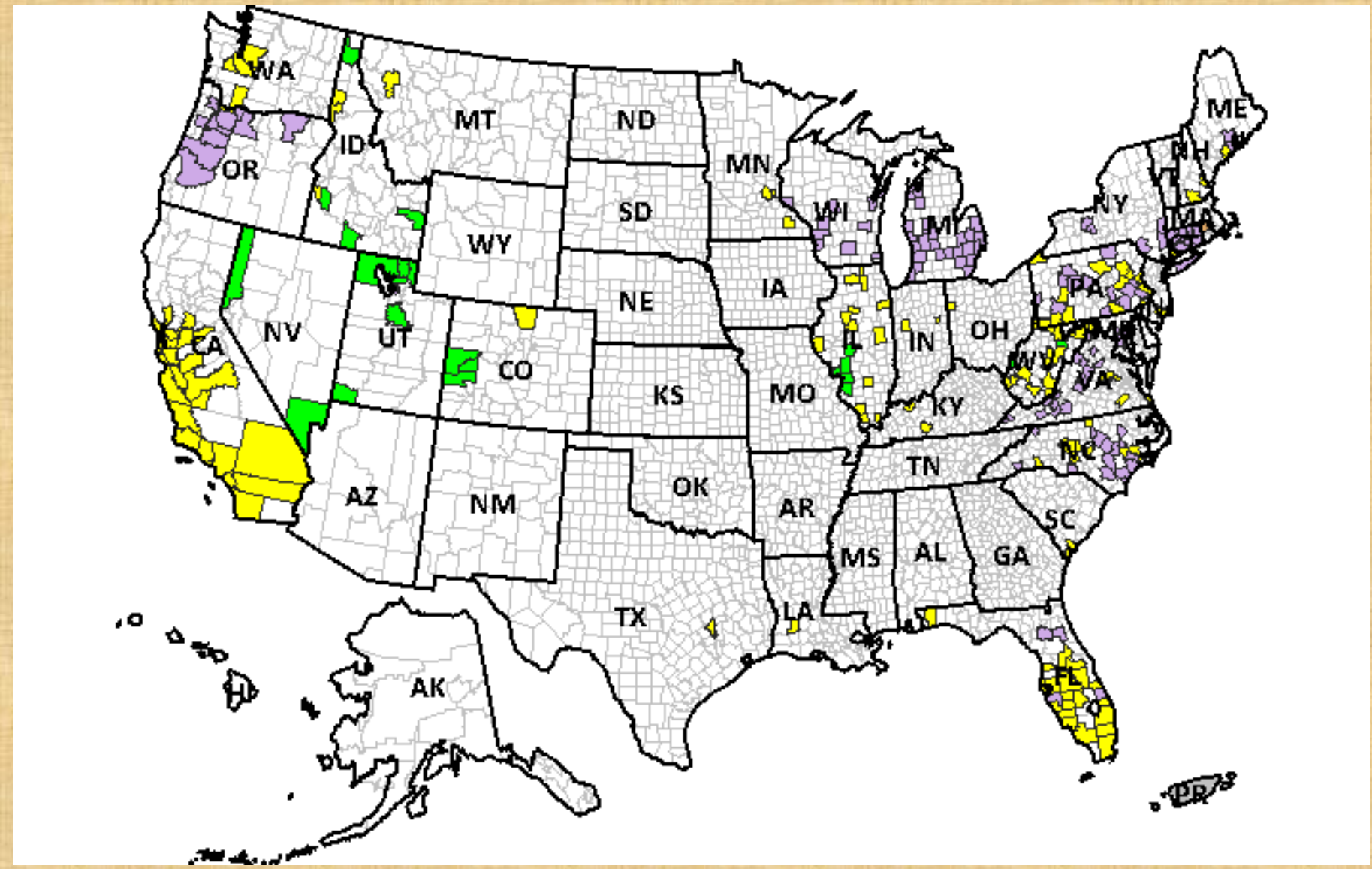
Dispersal history

- Introduced into California 2008
  - Strawberries, caneberries
- In 2009:
  - California (strawberries, caneberries)
  - Oregon (blueberries)
  - Washington (strawberries)
  - British Columbia (berries, grapes, cherries)

Dispersal in Southeast

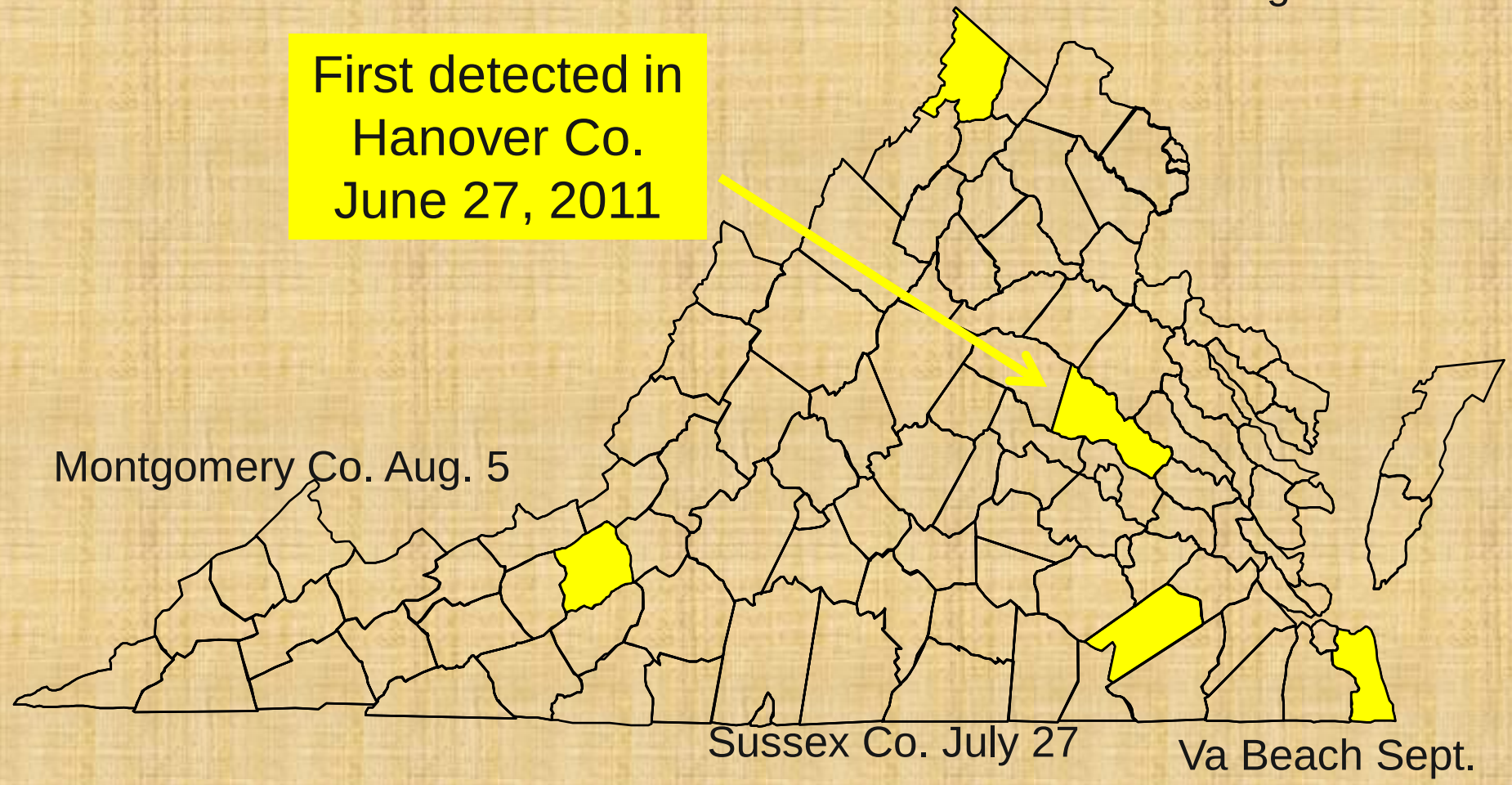
- Found in Florida, Late 2009
- In 2010 and 2011, trapping program in South Carolina, North Carolina and Virginia (Burrack, Pfeiffer and Smith (SRSFC)

Jan. 2013: SWD Distribution in U. S.

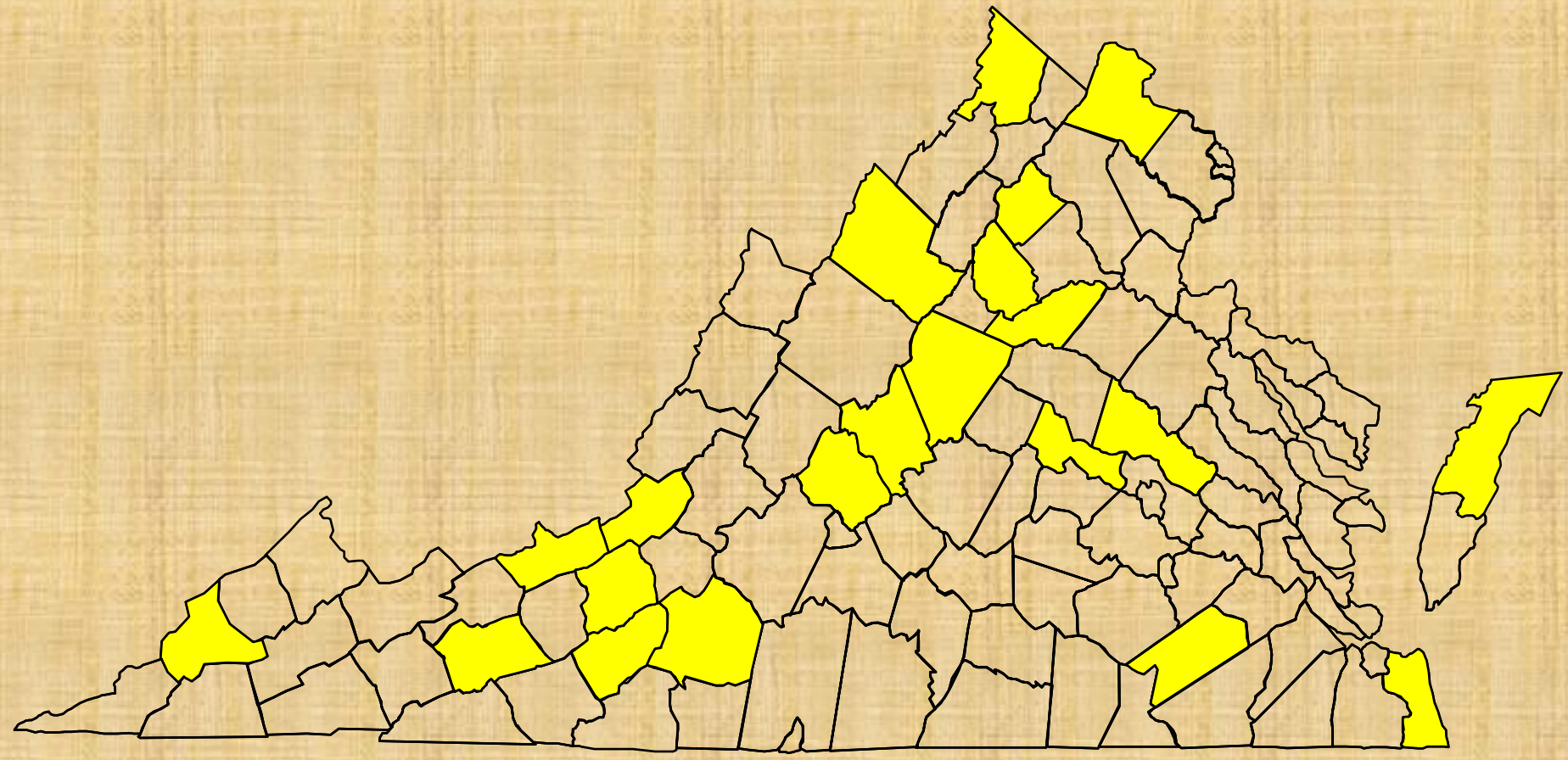


National Agricultural Pest Information System (NAPIS). Purdue University. "Survey Status of Spotted Wing Drosophila - *Drosophila suzukii* (2009 to present)." Published: 01/24/2012.

SWD in Virginia – 2011



Spotted wing drosophila, *Drosophila suzukii* (Matsumura), in Virginia – October 2012



Invasive drosophilids in Virginia Vineyards

- Background and identification of SWD
- Movement and establishment
- **Hosts**
- Trapping
- New kid on the block
- Management

SWD Host List – Risk?

- Raspberries, blackberries, strawberries blueberries
- Cherries, grapes
- Nectarines, peaches, plums
- Apple, pear
- Tomatoes?

SWD-infested raspberry

SWD Host List – Non-crop hosts

- Wild blackberries
- Pokeweed
- Dogwood
- Persimmon
- Rose hips
- Porcelain berry

SWD Eggs in Fruit

SWD Larvae in Fruit

Cherry

Strawberry

Damage is difficult to see until larvae are almost mature

Invasive drosophilids in Virginia Vineyards

- Background and identification of SWD
- Movement and establishment
- Hosts
- **Trapping**
- New kid on the block
- Management

Trapping for SWD

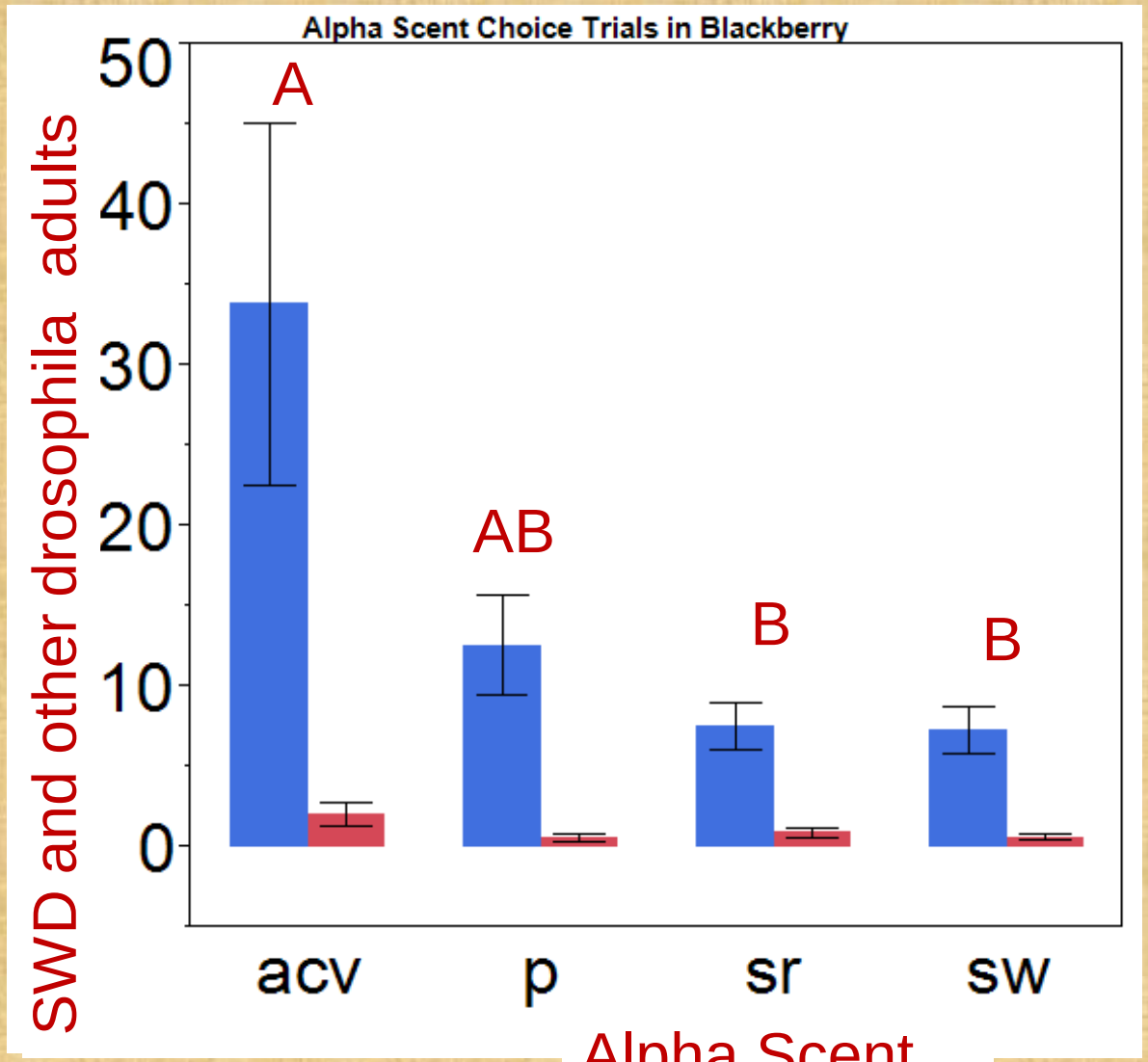
Apple cider vinegar

Burrack: SWD monitoring network

Novel Attractant

- Montgomery Co. berry farm
- Blackberry, raspberry and blueberry
- Alpha Scents; plum, sweet cherry, sour cherry
- Standard ACV
- Control of Low-tox antifreeze
- Three reps in each berry plot
- Randomized each week
- Monitored weekly
- 1 August – 15 Sept (Blackberry)
- 15 Sept – 15 Oct (Raspberry)

Preliminary Results



*SWD adults in blue
*Other drosophila adults in red

Trapping Summary

- SWD was found at every site where traps were placed
- ACV probably not best monitoring, trap counts low
- Little to no SWD trapping numbers in vineyards, yet fruit infested
- Fruit scent of plum likely more attractive to SWD than sweet and sour cherry
- Numerically very different from ACV
- Fruit scents need to be more potent and/or longer lived

Invasive drosophilids in Virginia Vineyards

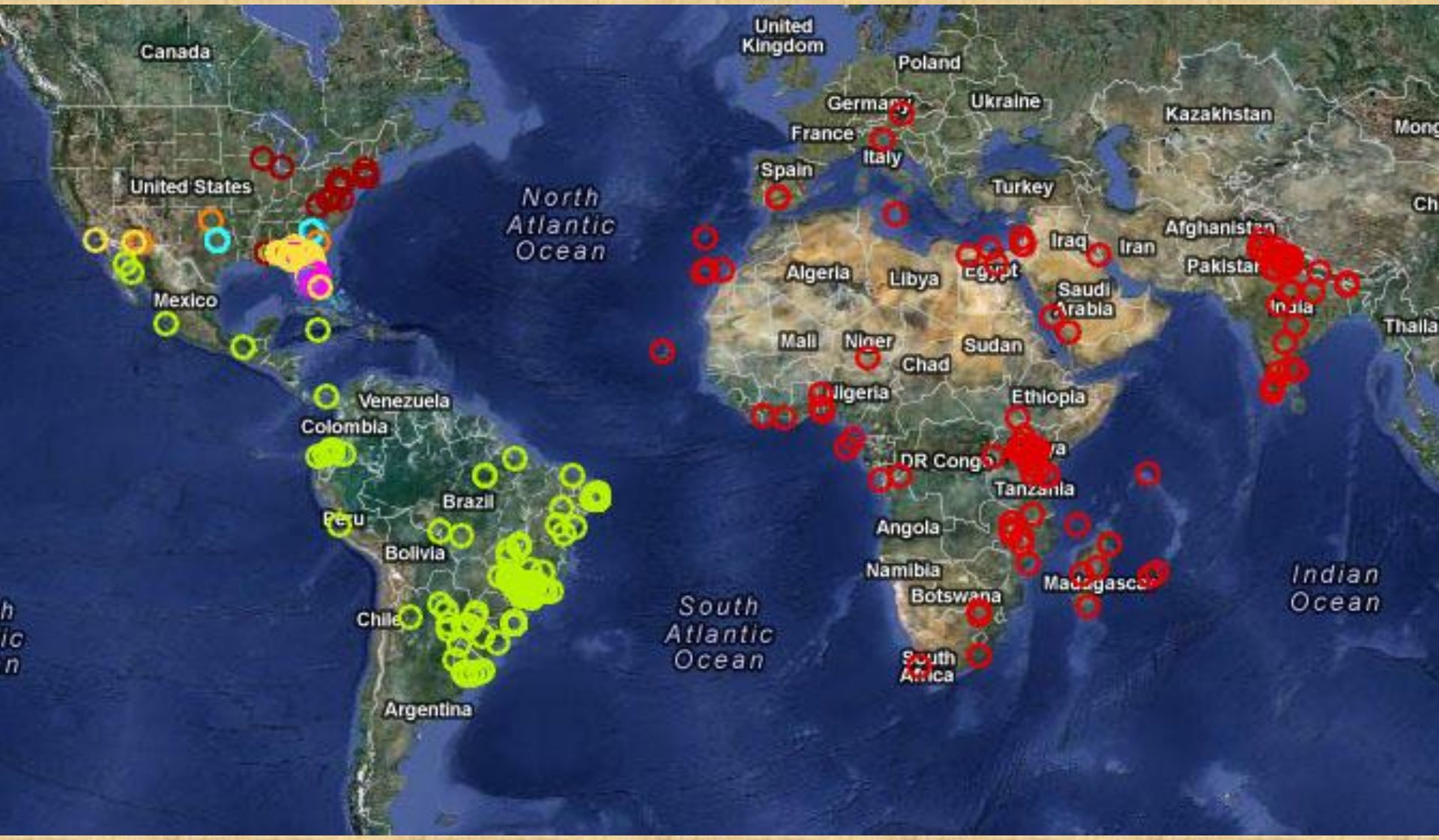
- Background and identification of SWD
- Movement and establishment
- Hosts
- Trapping
- **New kid on the block**
- Management

Albemarle County

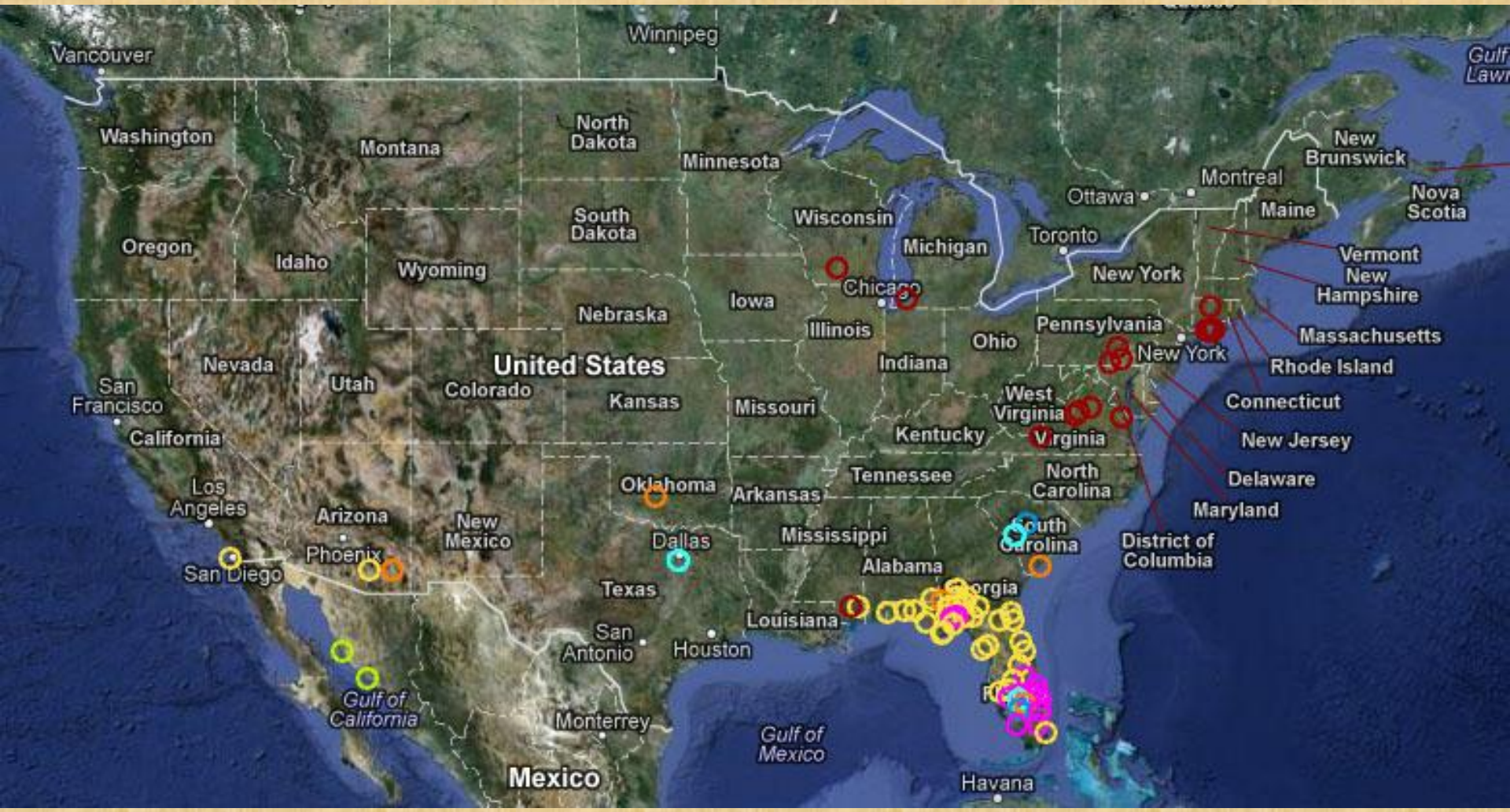
Zaprionus indianus Gupta, African fig fly

Zaprionus indianus Gupta, African fig fly

AFF World Distribution

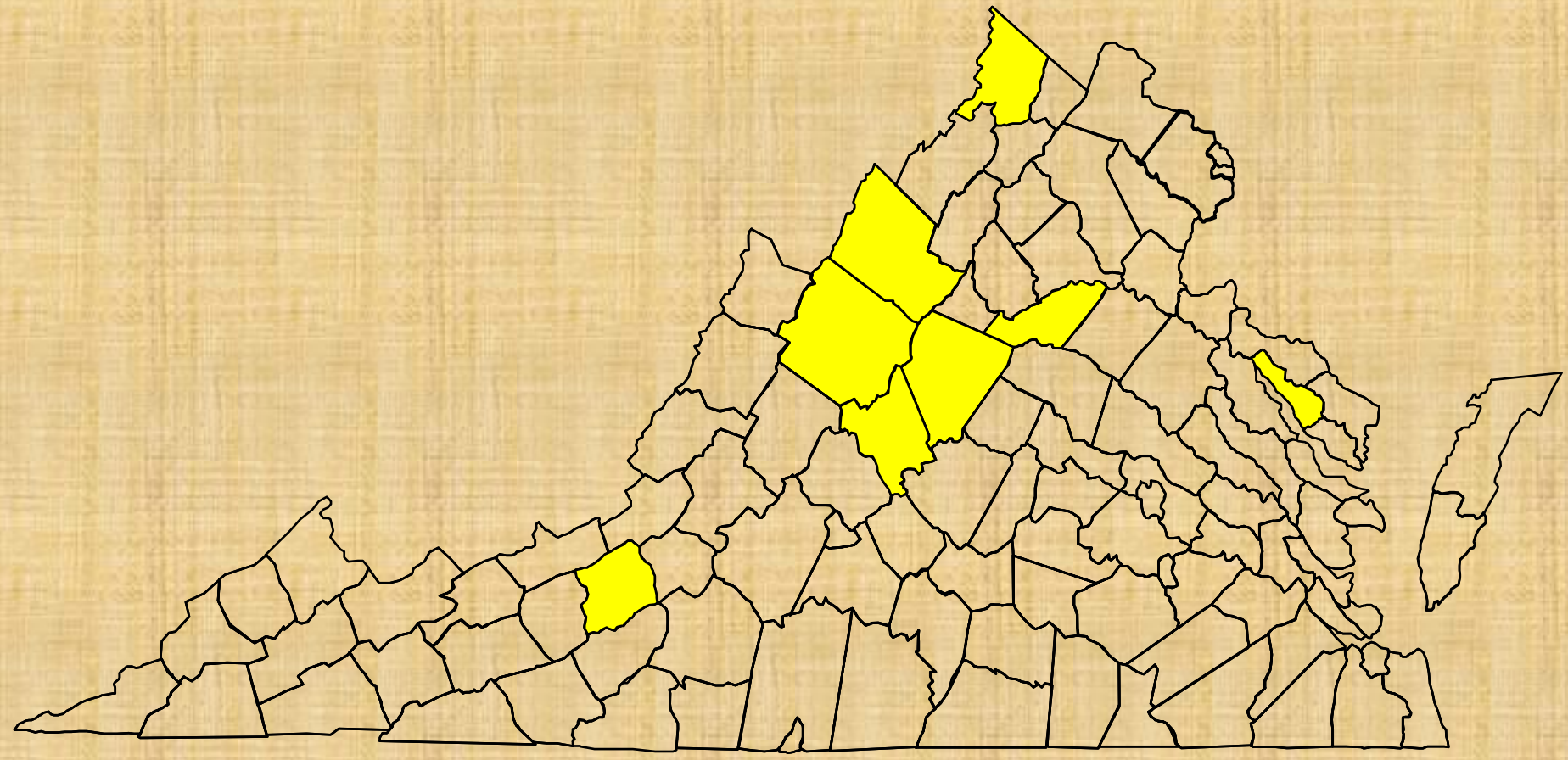


AFF US Distribution



2005 2006 2007 2008 2009 2012

African fig fly, *Zaprionus indianus* Gupta,
in Virginia – November 2012



Incidence in wine grapes

- Weak ovipositor
- Sometimes high incidence in grape berries
  - In some Virginia clusters, 90% of emerging drosphilids were AFF
  - Sweep net samples in Pennsylvania vineyards
- How do they get into grapes?

Incidence in wine grapes

- Perhaps follow SWD injury?
- Biological control example in giant reed
  - *Arundo donax* takes over wetlands
  - *Lasioptera donacis* can kill reeds by mining in stalk
  - Oviposits in hole made by another insect

Competition stuey of Gilpin et al. (1986)

- Paired rearing comparisons of 28 drosophilid species, at two temps, two media
- 1 *Zaprionus*, 27 *Drosophila* spp.

Gilpin et al. (1986)

- In thick food, carried out at 19° C, it was ranked 12 out of 28 in competitiveness
- In thick medium at 25° C, it was ranked 8
- But in thin food, it was ranked 5 at 25° C, and ranked 3 at 19° C.

Gilpin et al. (1986)

- Crowd out other larvae
- Liquify substrate, drowning other larvae

Invasive drosophilids in Virginia Vineyards

- Background and identification of SWD
- Movement and establishment
- Hosts
- Suitability of grapes
- Trapping
- New kid on the block
- **Management**

SWD Management
Cultural Control

- Harvest fruit promptly to eliminate breeding sites
- Destroy nearby overripe or rotten fruit

http://www.virginiafruit.ento.vt.edu/SWD.html

SWD Management
Chemical Control

- Need materials with short PHI
- Need materials of various MOA
- Need to rotate in a spray program!

- In high risk crops, need to spray weekly or more often

- Need local research on efficacy

SWD Management
Chemical Control

Organophosphates:

Malathion effective in West; regional differences?

Imidan effective but long REI (14 d) in grape (watch for developments here with new formulation)

SWD Management
Chemical Control

Crop:	Imidan	Malathion 8E	Malathion 8F
Caneberry	--	--	1-4 pts
Strawberry	--	1.5–2 pts	1.5-2 pts
Sw Cherry	--	--	--
Grape	1.33-2.12	1–1.8 pts	2-2.5 pts
Blueberry	1-1.33 lb	--	1.5-2.5 pts
Peach	2.12-4.25	--	5-9 pts
Nectarine	2.12-4.25	--	2.5-9 pts
Apple	2.12-5 lb	--	--
Pear	2.12-5.75 lb	--	--

SWD Management
Chemical Control

Crop:	Imidan	Malathion 8E	Malathion 8F
Caneberry	--	--	1-4 pts
Strawberry	--	1.5–2 pts	1.5-2 pts
Sw Cherry	**--**	--	--
Grape	1.33-2.12	1–1.8 pts	2-2.5 pts
Blueberry	1-1.33 lb	--	1.5-2.5 pts
Peach	2.12-4.25	--	5-9 pts
Nectarine	2.12-4.25	--	2.5-9 pts
Apple	2.12-5 lb	--	--
Pear	2.12-5.75 lb	--	--

SWD Management
Chemical Control

Crop:	Imidan	Malathion 8E	Malathion 8F
Caneberry	--	--	1-4 pts
Strawberry	--	1.5–2 pts	1.5-2 pts
Sw Cherry	--	--	--
Grape	1.33-2.12	**1–1.8 pts**	**2-2.5 pts**
Blueberry	1-1.33 lb	--	1.5-2.5 pts
Peach	2.12-4.25	--	5-9 pts
Nectarine	2.12-4.25	--	2.5-9 pts
Apple	2.12-5 lb	--	--
Pear	2.12-5.75 lb	--	--

SWD Management
Chemical Control

Spinosyns:

Entrust (spinosad) effective but relatively short lived

Delegate (spinetoram) very effective

SWD Management
Chemical Control

Crop:	Bifenthrin	Danitol	Mustang	Baythroid
Caneberry	**3 d**	**3 d**		
Strawberry	**0 d**	**2 d**		
Sw Cherry		3 d	14 d	7 d
Grape	**30 d**	**21 d**	**1 d**	**3 d**
Blueberry	**1 d**	**3 d**		
Peach		3 d	14 d	7 d
Nectarine		3 d	14 d	7 d
Apple		14 d	14 d	7 d
Pear	14 d	14 d	14 d	7 d

SWD Management
Chemical Control – Commercial Vineyards

Critical to use insecticides that have short PHI
PHI's of 0-3 days are generally acceptable
From 2013 Pest Management Guide to
Horticultural and Forest Crops:
http://pubs.ext.vt.edu/456/456-017/456-017.html

Fourth Cover: mid-August or 10 days after third cover spray

Entrust	spinosad	1.25-2.5 oz	7 d PHI
Delegate	spinetoram	3-5 oz	7 d PHI
Malathion	malathion	2.5 pt	3 d PHI
Mustang Max	zeta-cypermethrin	2-4 fl oz	1 d PHI
Pyganic	pyrethrins	64 fl oz	0 d PHI
Azera	pyrethrins/azadirachtin	1–2 pt	0 d PHI

SWD Management
Chemical Control – Commercial Vineyards

Critical to use insecticides that have short PHI
PHI's of 0-3 days are generally acceptable
From 2013 Pest Management Guide to
Horticultural and Forest Crops:
http://pubs.ext.vt.edu/456/456-017/456-017.html

Fourth Cover: mid-August or 10 days after third cover spray

Entrust	spinosad	1.25-2.5 oz	7 d PHI
Delegate	spinetoram	3-5 oz	7 d PHI
Malathion	malathion	2.5 pt	3 d PHI
Mustang Max	zeta-cypermethrin	2-4 fl oz	1 d PHI
Pyganic	pyrethrins	64 fl oz	0 d PHI
Azera	pyrethrins/azadirachtin	1–2 pt	0 d PHI

SWD Management
Chemical Control – Commercial Vineyards

Critical to use insecticides that have short PHI
PHI's of 0-3 days are generally acceptable
From 2013 Pest Management Guide to
Horticultural and Forest Crops:
http://pubs.ext.vt.edu/456/456-017/456-017.html

Fourth Cover: mid-August or 10 days after third cover spray

Entrust	spinosad	1.25-2.5 oz	7 d PHI
Delegate	spinetoram	3-5 oz	7 d PHI
Malathion	malathion	2.5 pt	3 d PHI
Mustang Max	zeta-cypermethrin	2-4 fl oz	1 d PHI
Pyganic	pyrethrins	64 fl oz	0 d PHI
Azera	pyrethrins/azadirachtin	1–2 pt	0 d PHI

Future Work

- Chemical control including new chemistry
  - Need for rotating MOA
  - Need for less disruptive materials
- Improved trapping
- Varietal differences
- Landscape effects
- Biological control
- Ecological interactions between SWD and AFF

A Request …

To aid in proposal development, please send grower experiences on SWD to:

dgpfeiff@vt.edu

Also for access to Berry Scholar site!

Questions?