



Invasive Insects Threatening Vegetable Production in The Midwest

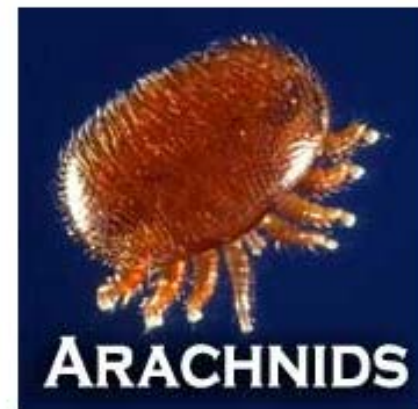
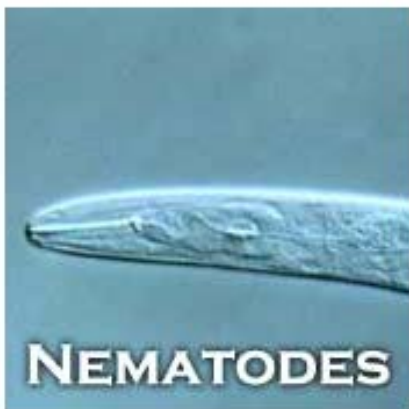
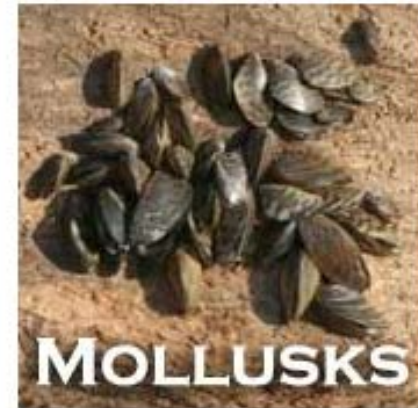


Jaime Piñero

State IPM Specialist
Lincoln University
Jefferson City, MO 65102

Tel: (573) 681-5522
pineroj@lincolnu.edu

Images of Invasive and Exotic Species



1. Brown Marmorated Stink Bug



2. Spotted Wing Drosophila



3. Asian Kudzu bug



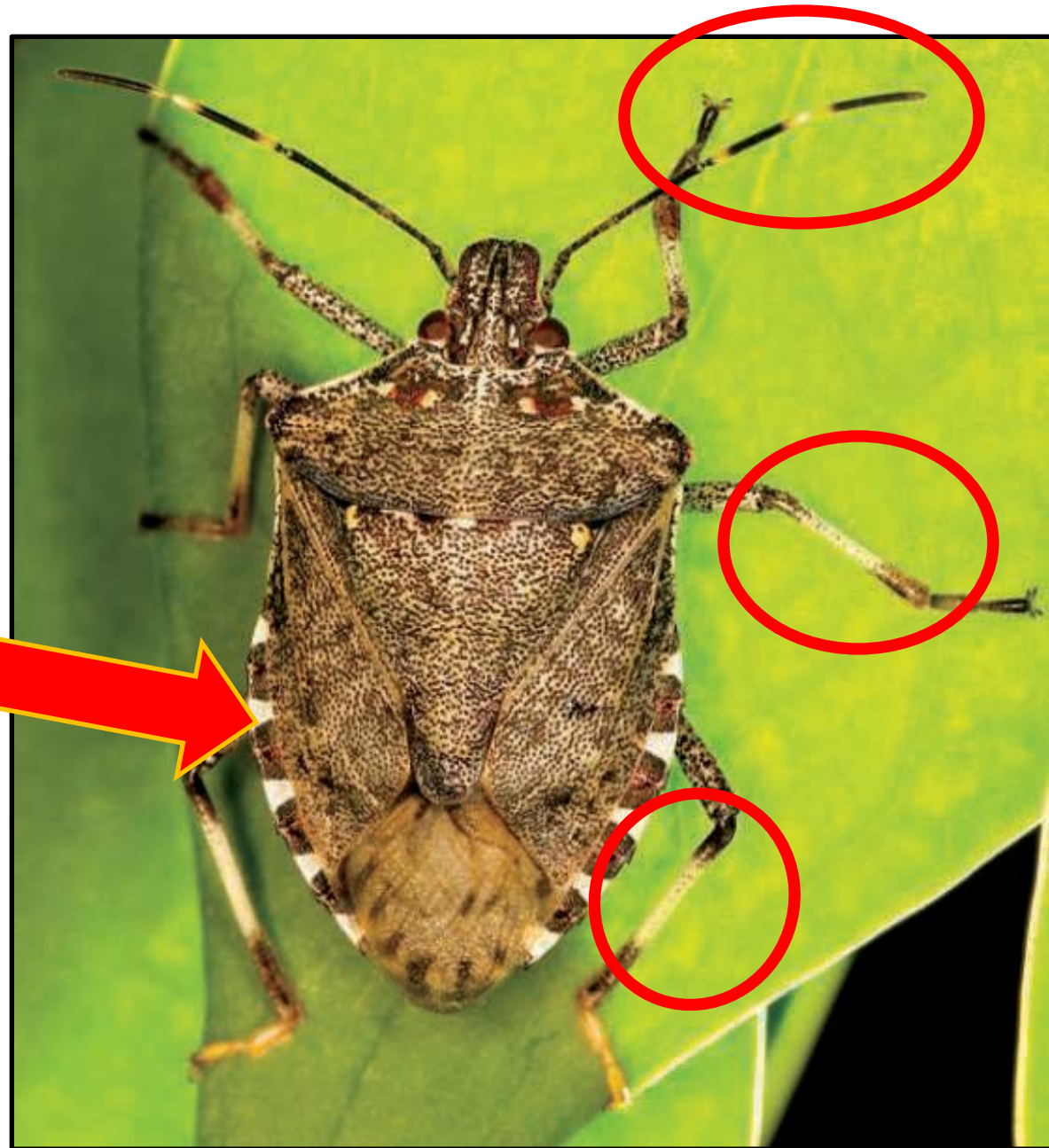
Brown Marmorated Stink Bug
(Halyomorpha halys)



BMSB Identification

ADULTS:

- White stripes on antennae and faint white bands on legs
- Outer edges of the abdomen alternating white and dark markings (“marmorated”)
- Underside is pale, sometimes with grey or black markings
- Emit a pungent odor when disturbed



Brown Marmorated Stink Bug = BMSB
Halyomorpha halys

BMSB Identification

Eggs

- Laid in clusters on undersides of leaves (~28 eggs per egg mass). Bright green when first deposited and then turn white



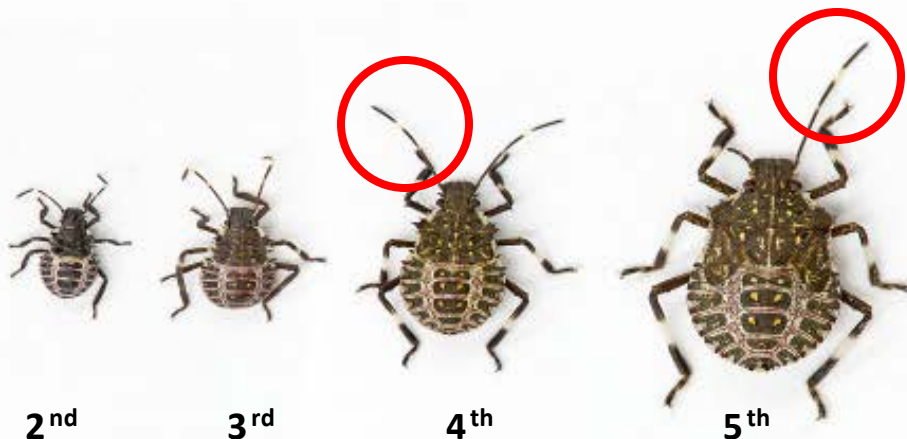
Egg Mass

Nymphs

- 5 nymphal instars
- First instars remain near hatched eggs
- 2nd-5th instars extremely mobile and called “tick-like”.



1st instar



Adult
Male



Adult
Female

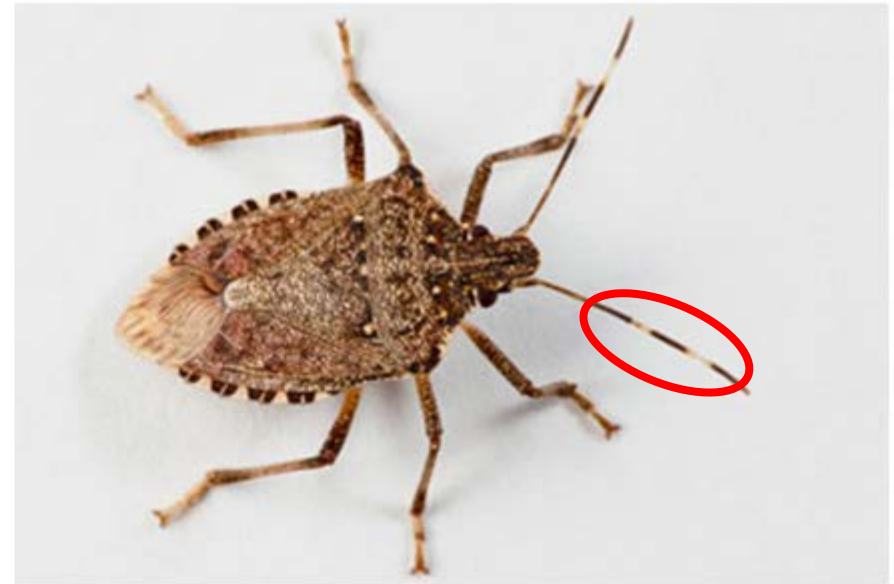
Look-Alike Insects

Brown Stink Bug



Brown stink bug, Euschistus servus, from above. Photo by Russ Ottens, University of Georgia, Bugwood.org

Brown Marmorated Stink Bug



BMSB adult male from above. Photo by W. Hershberger

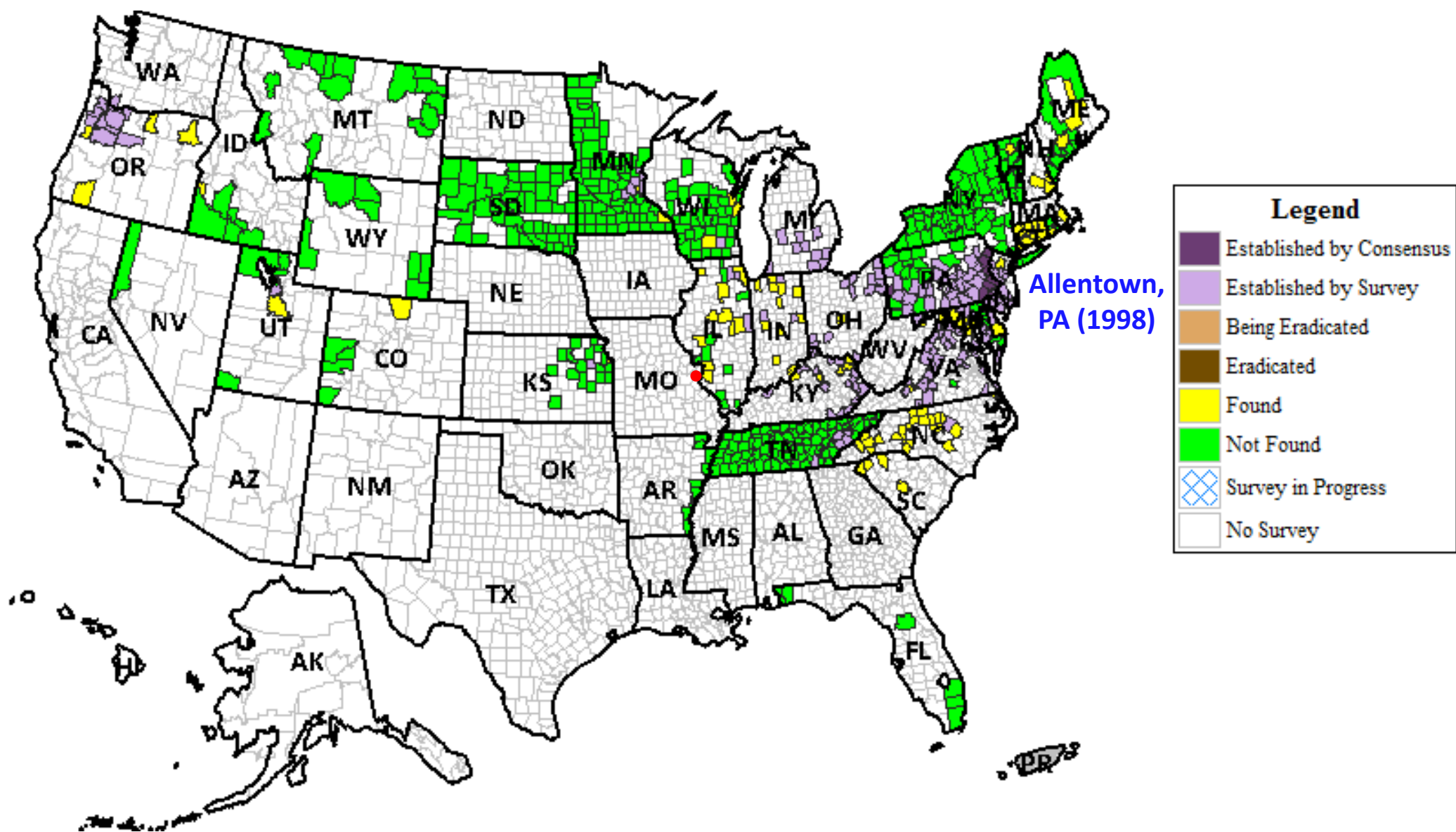


Brown stink bug, Euschistus servus, underside looks yellowish-green. Photo by Herb Pilcher, USDA-ARS, Bugwood.org



BMSB underside appears brown-grey. Photo by Susan Ellis, Bugwood.org

BMSB Distribution



BMSB Damage

BMSB is strongly associated with tree fruit



BMSB Damage

Damage to vegetables takes place later in the season

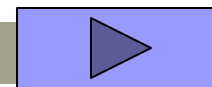


BMSB Damage

- Peppers, tomatoes, sweet corn, okra, and beans suffer the most damage from BMSB.
- Sweet corn appears to be a strongly preferred crop
- Very little injury in cruciferous and cucurbit vegetables



How to identify BMSB damage



3m20s

- On peppers and tomatoes, look for withish scarring on the surface.

Fig. 2. Damage to tomato and green pepper from Brown marmorated stink bug feeding.



Univ. Maryland Extension

- Internal damage appears as a white, spongy area beneath a BMSB feeding site



- In sweet corn, damaged kernels may collapse or appear dark brown once the ear is cooked



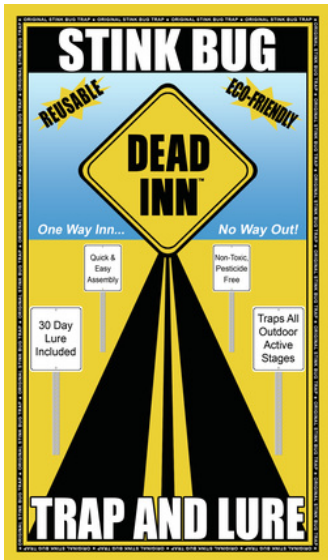
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BMSB Monitoring

In 2012 and 2013, researchers conducted trials of a pheromone known as “odor #10,” which reliably lured BMSB into traps in the field

Pheromone
lure inside
the trap top



AgBio, Inc., 9915 Raleigh St.
Westminster, CO 80031
P: 303.469.9221
F: 303.469.9598
agbio@agbio-inc.com

Things we should know about BMSB

Damage to vegetables takes place later in the season

- 1) Proximity to woods is a risk factor for ag crops. Proximity to soybeans has been a risk factor for MD nurseries
- 2) Like many tough-to-control pests, earlier life stages more susceptible to insecticides, especially true for organic options. Overwintering adults more susceptible than first generation adults

BMSB management options

➤ **ATTRACT-AND-KILL / TRAP CROPPING**

An attract-and-kill strategy for BMSB would involve luring large numbers of the insects to a specific area, and then treating that area.

➤ **BIOLOGICAL CONTROL**

Researchers are seeking to identify the natural enemies of BMSB, including a group of tiny parasitic wasps that attack BMSB eggs and a naturally occurring fungus that targets stink bugs.

➤ **CHEMICAL CONTROLS**

Researchers are working to identify insecticides that effectively control BMSB, so that growers can select materials based on their economic and environmental impacts.

Spotted Wing Drosophila
(Drosophila suzukii)



Spotted Wing Drosophila= SWD

- Introduced into California in late 2008, SWD has since spread throughout California, Oregon, and Washington
- Due to a separate introduction in 2009, SWD has also spread from Florida to Louisiana, North Carolina, and South Carolina, etc.
- Invaded Missouri in late June, 2013



Introduction

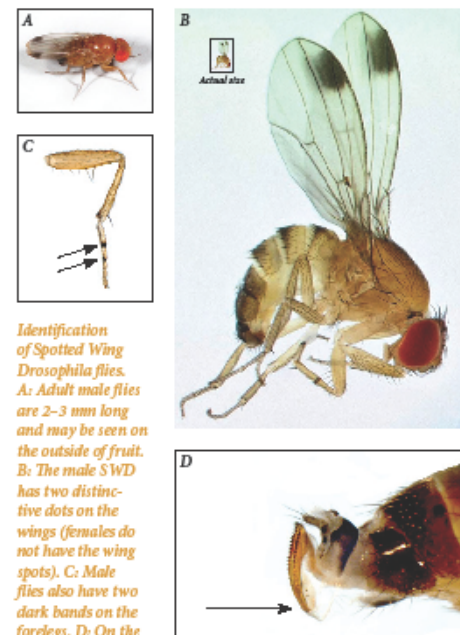
The Spotted Wing Drosophila (SWD), *Drosophila suzukii*, is a small vinegar fly with the potential to damage many fruit crops. In the North Central region, it was first detected in Michigan in late September 2010. Unlike most other vinegar flies that require damaged fruit to attack, SWD causes damage when the female flies cut a slit and lay eggs in healthy fruit. This insect is a pest of most berry crops, cherries, grapes and other tree fruits, with a preference for softer-fleshed fruit. Given the propensity for this insect to spread and its potential to infest fruit, it is important to learn about monitoring and management of SWD to minimize the risk of larvae developing in fruit and affecting fruit marketability.

Spotted Wing Drosophila was first discovered in the western United States in 2008 and moved quickly through the Pacific Northwest into Canada. In the spring of 2010, SWD was discovered in Florida on strawberries and detected later in the summer in The Carolinas. It has also been detected in Europe. Because the flies are only a few millimeters long and cannot fly very far, human-assisted transportation rather than natural dispersion is the most likely cause of the recent rapid spread.

Damage

Female SWD can cut into intact fruit using their serrated ovipositor to inject eggs under the skin. By being able to insert eggs into intact fruit, the larvae of SWD can be present during ripening, leading to a risk of detection in ripe fruit after harvest. During egg-laying, sour rot and fungal diseases can also be introduced, further affecting fruit quality. There is a greater risk of fruit contamination at harvest from SWD compared with native species that lay eggs only in already-damaged and rotting fruit.

The adult SWD lives for about two weeks, and can lay more than 300 eggs. This demonstrates their high potential for fruit infestation and distribution through a field if not controlled. Infested fruit do not show obvious symptoms of infestation at first, with only a small pin-prick visible from egg-laying. Within a few days, the fruit flesh

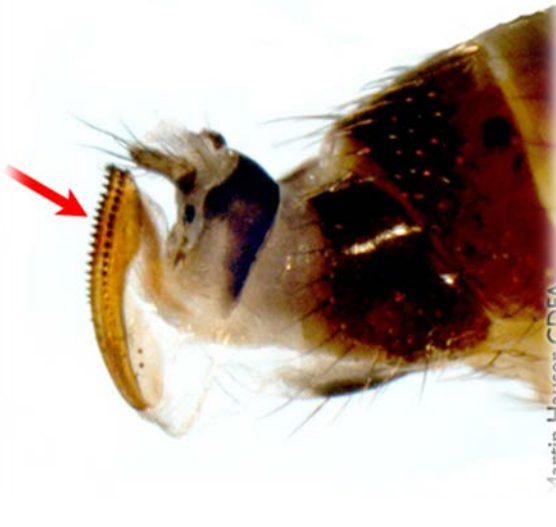


Significance

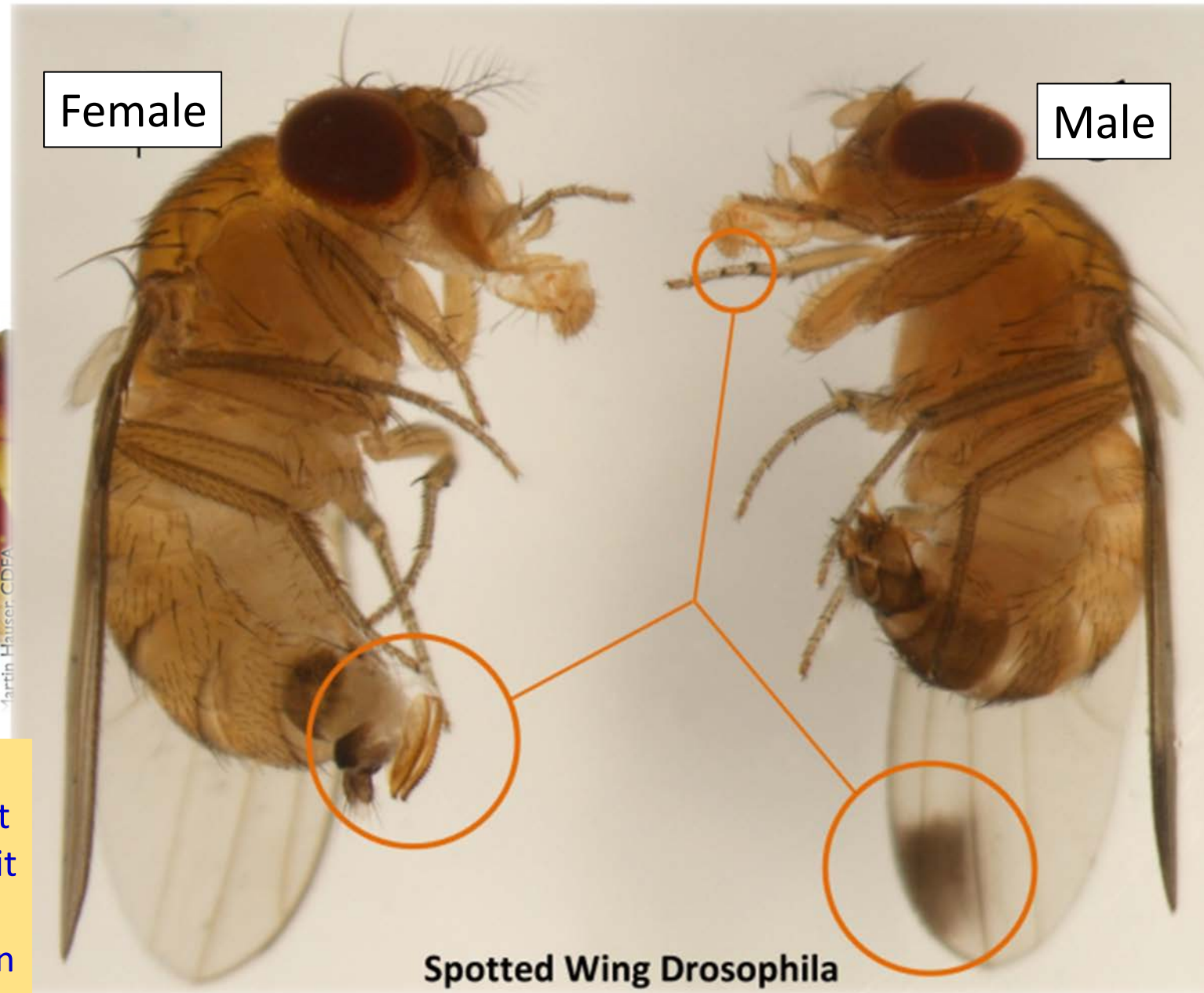


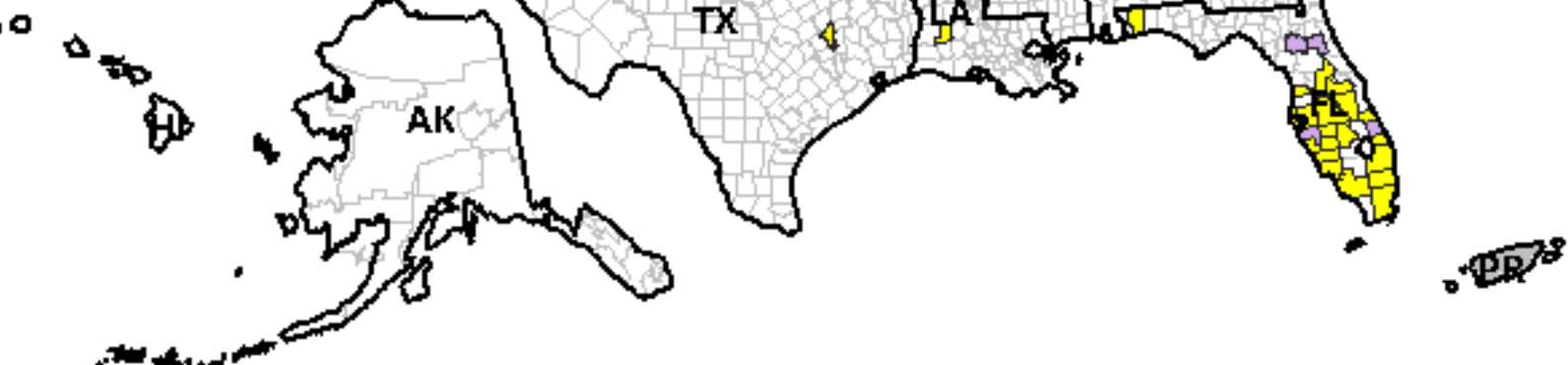
- ✓ Unlike other fruit flies, SWD attacks sound ripening fruit, also attacks some vegetables
- ✓ Once eggs laid in fruit, no longer able to control with pesticides
- ✓ Short lifecycle and overlapping generations make spray timing difficult
- ✓ Requires sprays near harvest time
- ✓ Requires multiple sprays which can lead to pesticide resistance

SWD Identification



Female SWD have serrated ovipositors that allow them to attack fruit earlier than other *Drosophila* species, often before the fruit ripens.

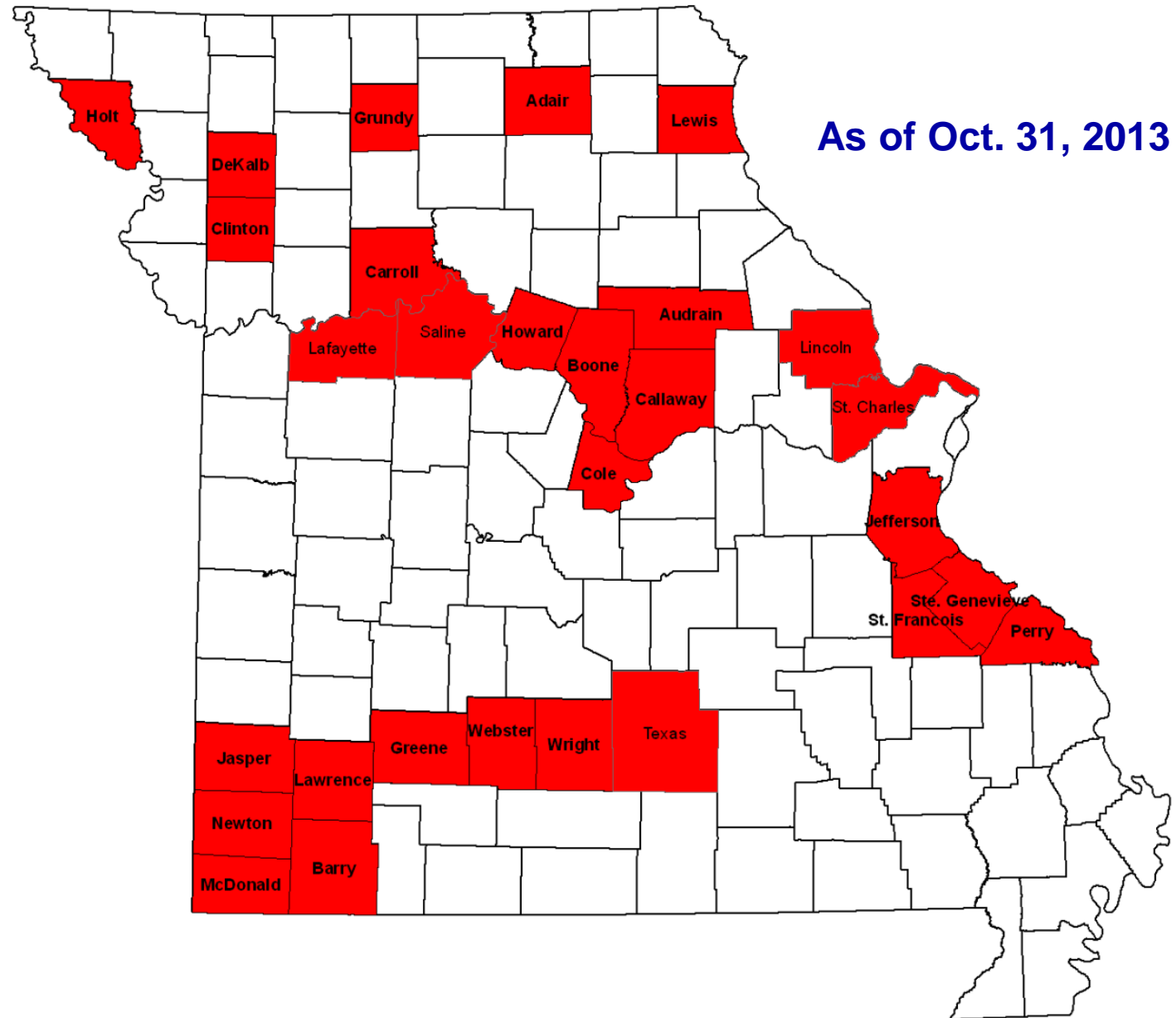




We have been invaded by SWD

Damage reported in:

- ✓ Blackberry
- ✓ Raspberry
- ✓ Elderberry
- ✓ Strawberry
- ✓ Blueberry



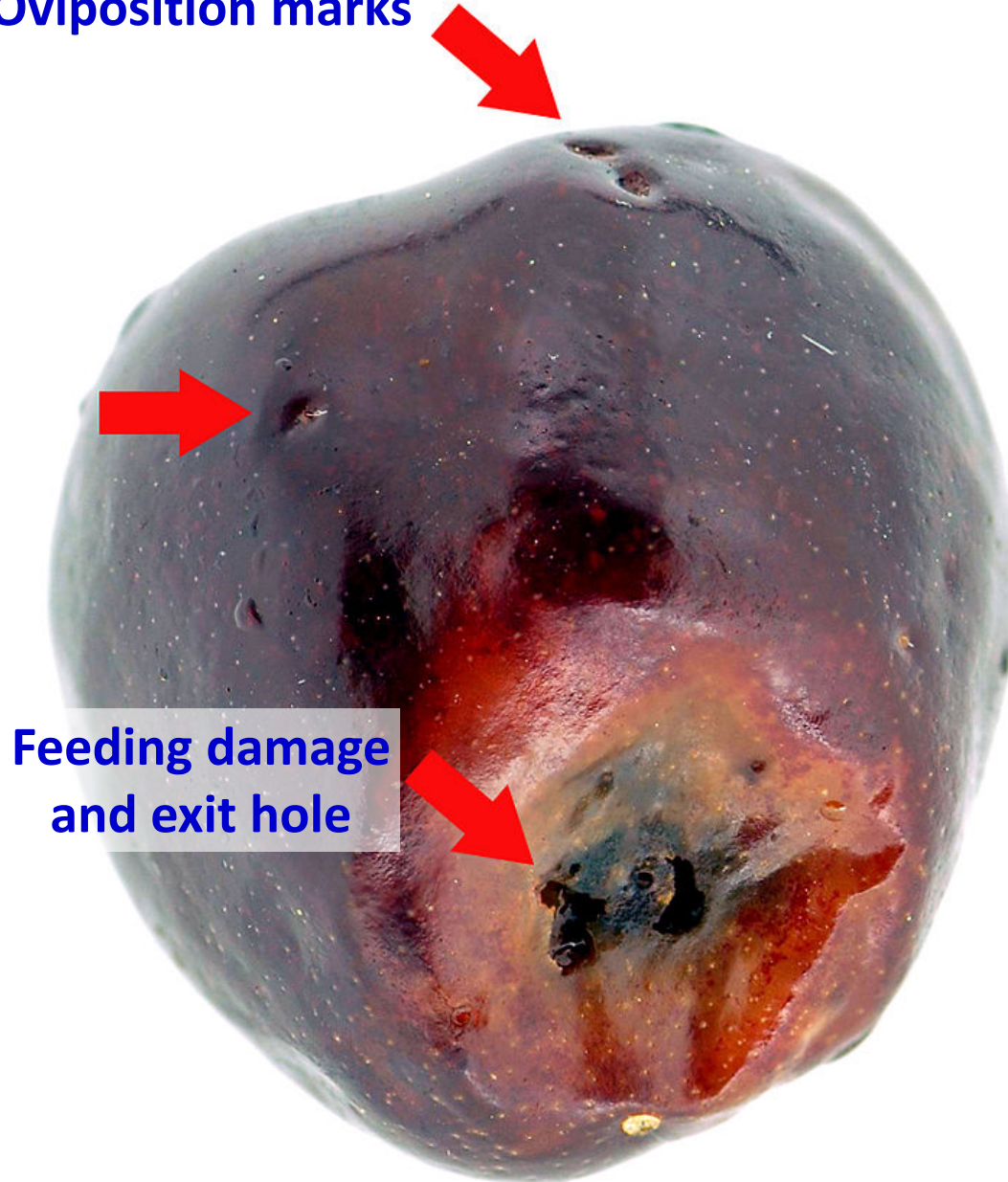
SWD Damage



Source: Washington State Univ.

SWD Damage

Oviposition marks



Feeding damage
and exit hole

Risk posed to vegetables

- ✓ Cherry and grape tomatoes, which tend to have more unharvested, overmature fruit represent higher risk
- ✓ Heirlooms, which are often marketed with cracks, are also higher risk than tomatoes with intact skin
- ✓ **Any tomato with cracks, regardless of inside or outside, is at higher risk for SWD**



<http://www.mofga.org/>

So, can SWD attack tomatoes?

Title of Project:

Preliminary assessment of Spotted Wing Drosophila (SWD), *Drosophila suzukii*, infestation risk to tomatoes

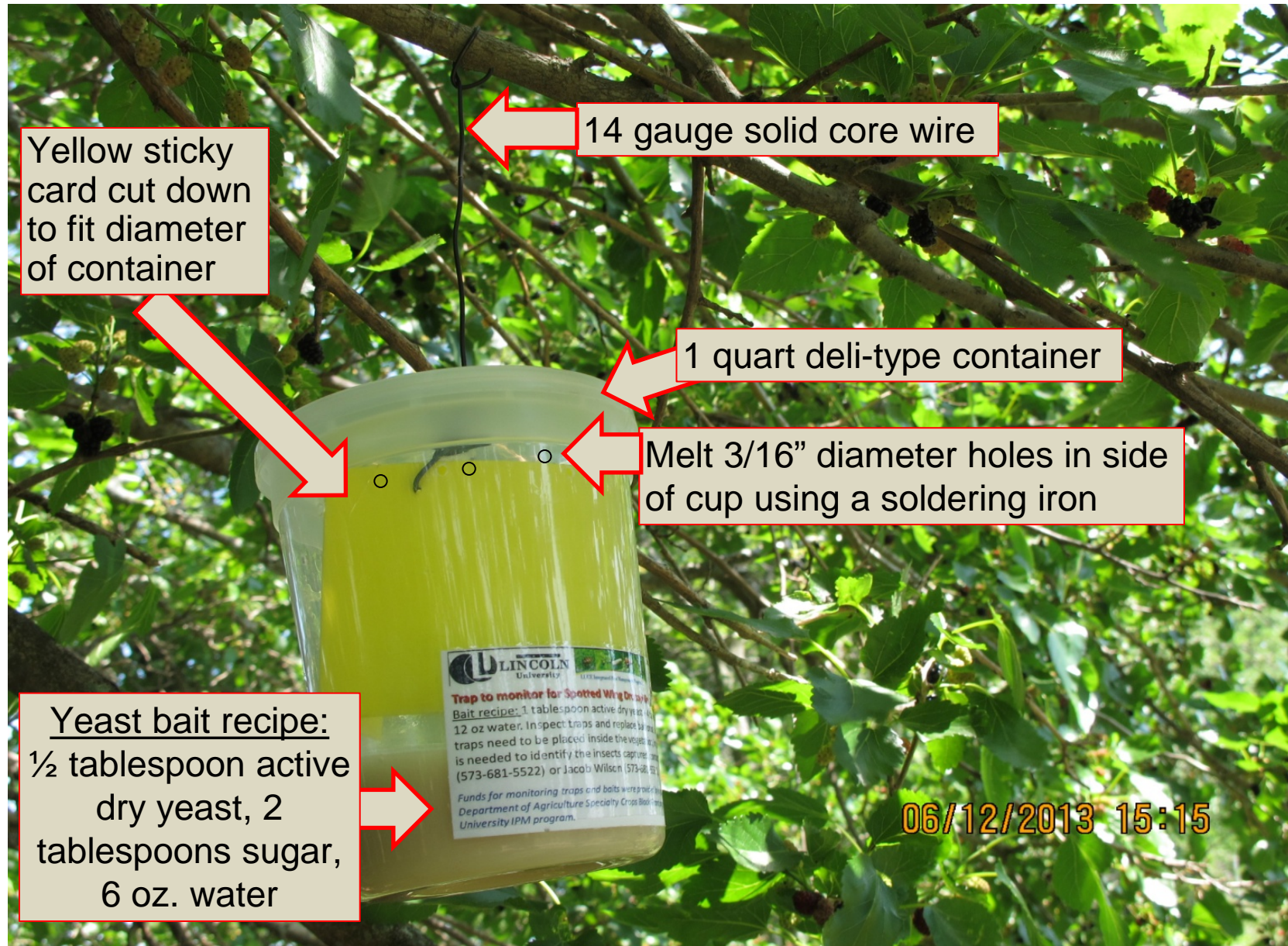
Project Leader:

Marion Zuefle, NYS IPM

Abstract:

Spotted Wing Drosophila (SWD), *Drosophila suzukii*, an invasive fruit fly from Japan, appeared in NY in 2011 and has become of major concern to small fruit growers. Unlike other fruit flies, it lays eggs in intact fruit prior to harvest. Current pesticide control measures target the adult but there is great risk of developing resistance; resistance has already been reported on the West Coast. Known hosts of SWD include soft skinned fruit like raspberries and blueberries. Even though the wild host range of SWD includes nightshades (*Solanum spp.*) no research had been conducted to evaluate the threat of SWD to tomatoes, *Solanum lycopersicum*. Preliminary surveys of field-collected tomatoes showed SWD can infest cracked or damaged fruit. A no-choice test was also conducted using intact tomatoes and results showed that SWD could lay and develop in intact fruit as well. Further research will be necessary to determine the extent to which SWD can use intact tomatoes as hosts in the field.

How to make a trap to monitor for SWD

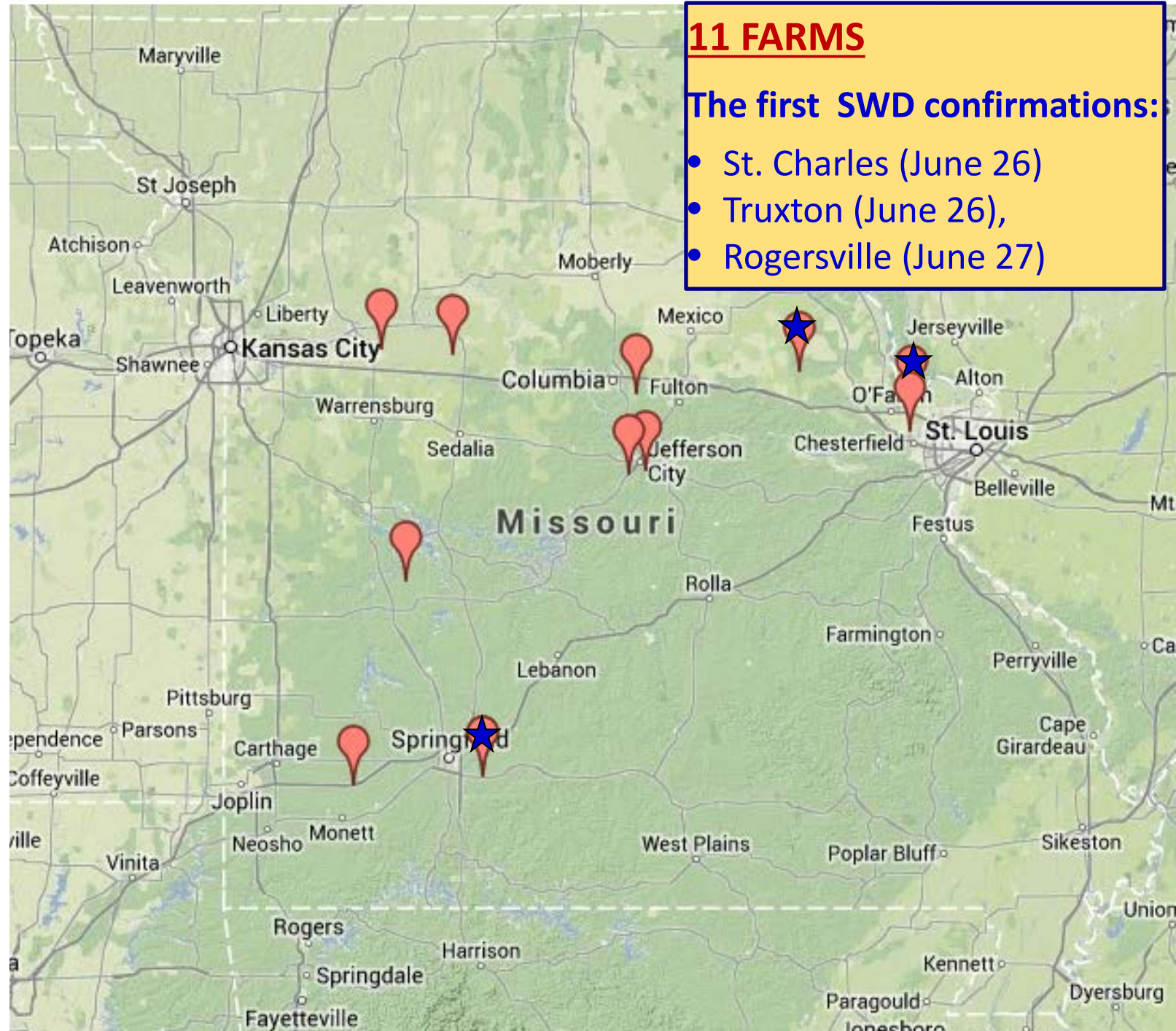


A monitoring system detected first SWD captures



Invasive Insect Pests
Threatening Specialty Crops
in Missouri: Monitoring,
Organic Management, and
Farmer's Education
(2013-2014)

12-25-B-1471



SWD Management Options

- ✓ IPM options to manage SWD include monitoring, cultural management such as canopy management, sanitation and exclusion, and, if needed, timely application of insecticide sprays
- ✓ This pest is new to Missouri so no research has been conducted within the state on most effective insecticide treatments to manage SWD
- ✓ Before you spray an insecticide, confirm that you have SWD in your area by hanging out monitoring traps or by inspecting fruit
- ✓ Sprays must be timed to kill adults before they lay eggs, as sprays will not control larvae already in the fruit



Additional Management Options for SWD

- ✓ If possible, locate tomatoes away from soft fruits such as blueberries or brambles
- ✓ Harvest tomatoes thoroughly and remove all ripe fruit regularly
- ✓ Manage irrigation water to reduce cracks
- ✓ Consider high tunnels / greenhouses to increase fruit quality
- ✓ If the market allows, shift to thicker skinned, less crack prone varieties

Contact Information for SWD

KANSAS



Dr. Raymond A. Cloyd

Extension Specialist, Horticultural Entomology / IPM

Phone: 785-532-4750

rcloyd@ksu.edu

IOWA:



Dr. Donald Lewis

Extension Entomologist

Phone: 515-294-1101

drlewis@iastate.edu

Dr. Laura Jesse

Plant and Insect Diagnostic Clinic

Phone: 515-294-0581

ljesse@iastate.edu

MISSOURI



Univ. Missouri Extension

Regional Specialists

<http://extension.missouri.edu>

Dr. Jaime Pinero

Lincoln University

State IPM Specialist

Phone: 573-681-5522

pineroj@lincolnu.edu

Dr. Bruce Barrett

Univ. of Missouri

Extension Entomologist

Phone: 573-882-3446

barrettb@missouri.edu

NEBRASKA



Dr. Bob Wright

Extension Entomologist

Phone: 402-472-2128

rwright2@unl.edu

Mr. Vaughn Hammond

Extension Educator

Phone: 402-873-3166

vaughn.hammond@unl.edu

SOUTH DAKOTA



Dr. Buyung Hadi

Urban Entomology Specialist

Phone: 605-688-5157

buyung.hadi@sdsu.edu



SPOTTED WING DROSOPHILA **CLINIC**



Midwest states have been invaded by Spotted Wing Drosophila (SWD), a small vinegar fly that has the ability to pierce the skin of healthy fruits and vegetables, and the maggots develop inside the fruits.

Information on SWD monitoring and management options available on Friday (Jan. 10) and Saturday (Jan, 11).

ROOM 211



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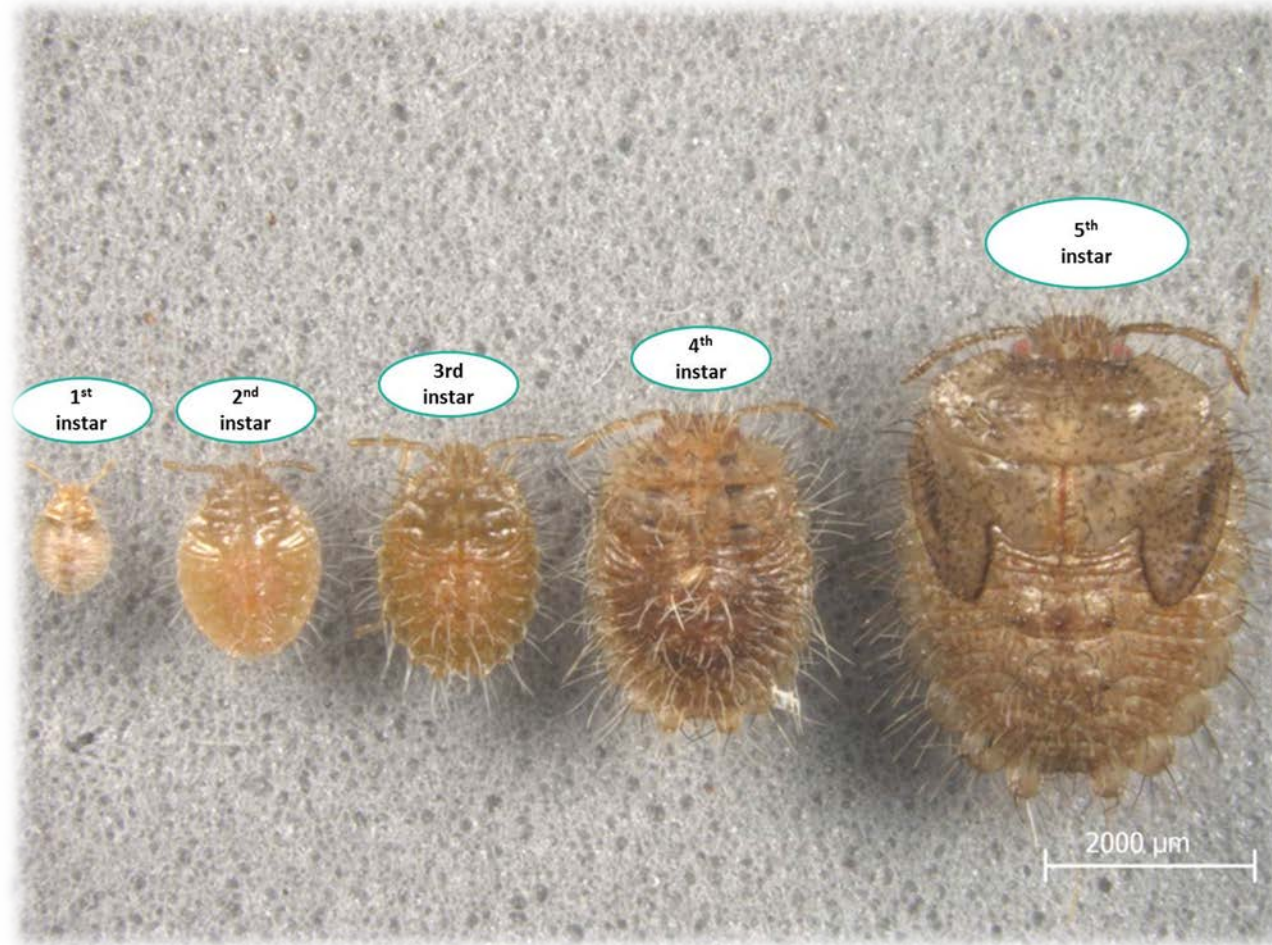
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Kudzu bug
(*Megacopta cribraria*)



Kudzu Bug Identification

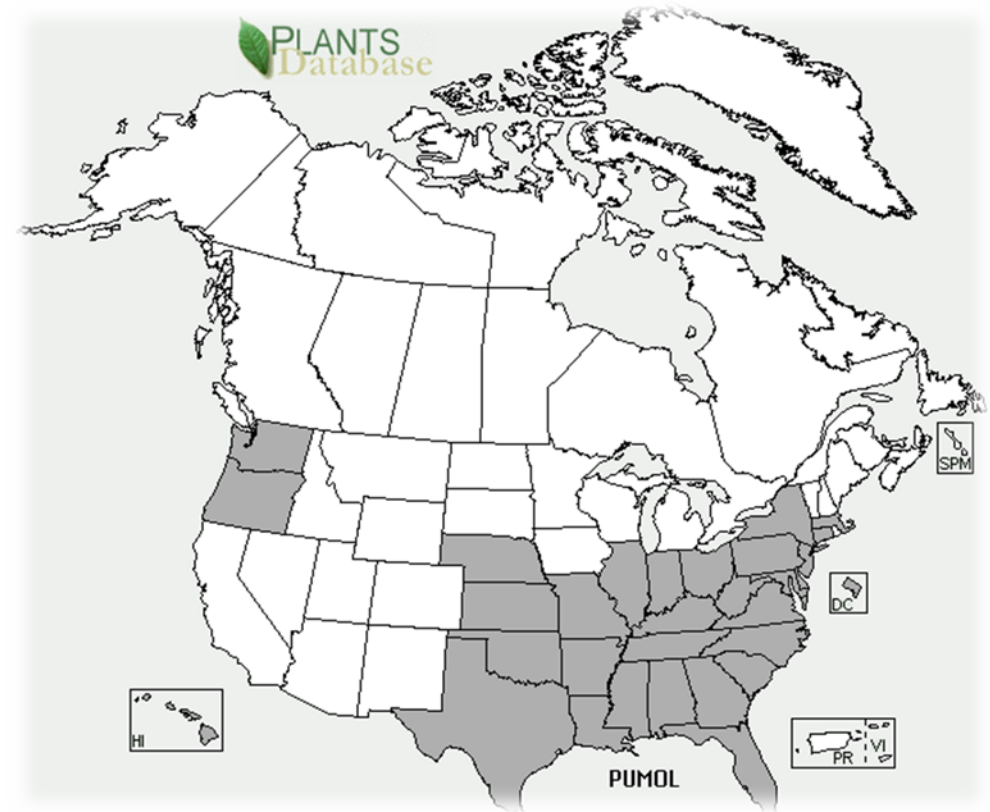
- ✓ A type of stink bug
- ✓ The size of the adult kudzu bug ranges from a sixth to a quarter inch (3.5 – 6 mm)
- ✓ Olive-green colored with brown speckles, and produce a mildly offensive odor when disturbed
- ✓ Five immature stages (nymphs)



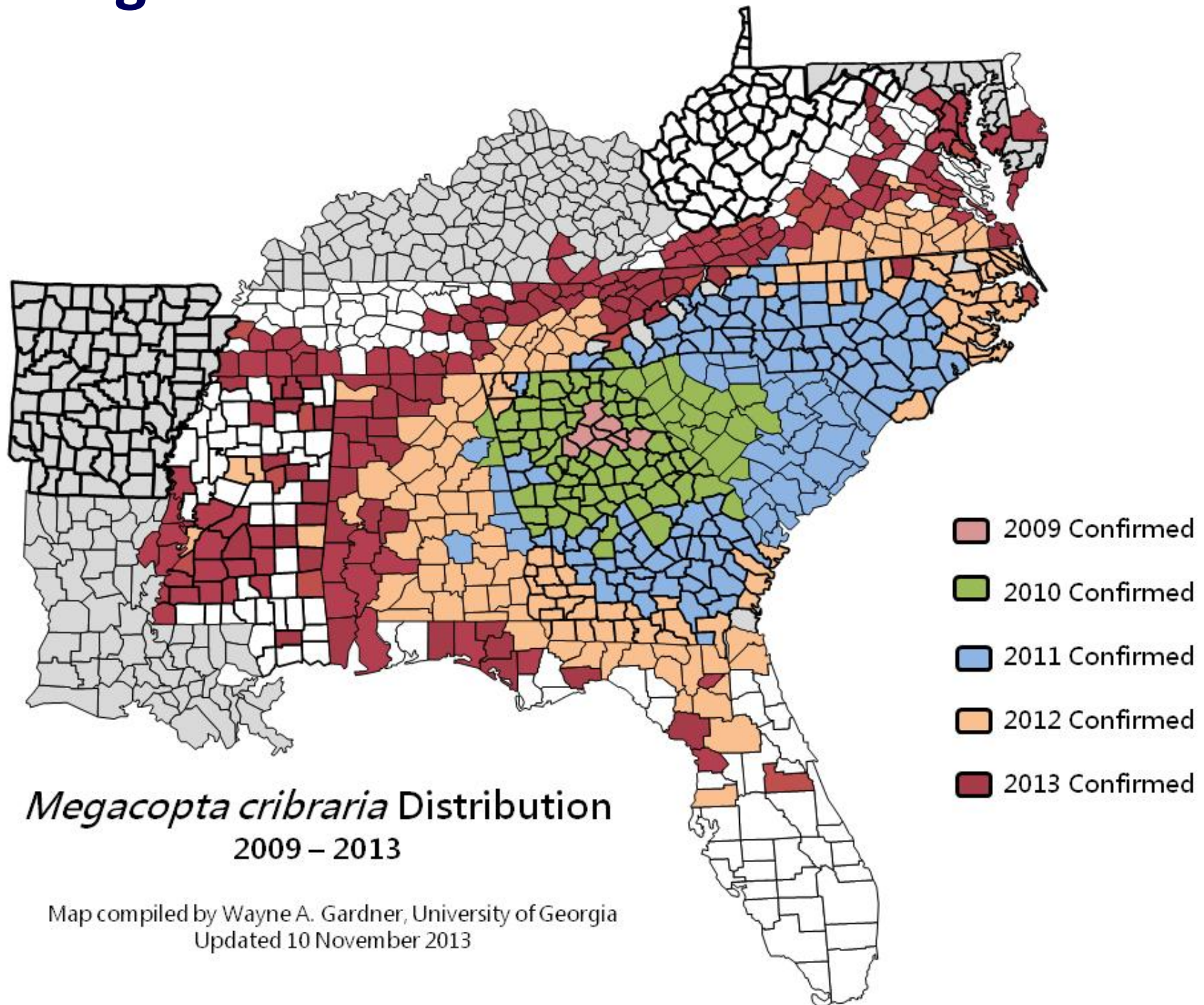
The Kudzu Bug invasion

- ✓ In October of 2009, it was first noticed in the US in 9 northeast Georgia counties as large aggregations of insects flying from patches of kudzu onto the outside walls of nearby houses and structures
- ✓ One year later, the **insect** was confirmed to be present in more than 60 north and central Georgia counties as well as limited distributions in North and South Carolina.

Kudzu plant: *Pueraria montana*,



Kudzu Bug Distribution

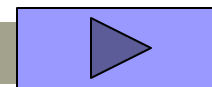


Kudzu Bug damage

- ✓ The kudzu bug sucks on the main stem and the leaf, which weakens and stresses the plant causing significant yield loss
- ✓ Yield loss in soybean can reach 75% if left uncontrolled
- ✓ Market farmers will primarily be concerned about kudzu bug damage on edamame and all types of beans



Kudzu bug monitoring and control



- ✓ Several randomly selected samples of 15 sweeps should be taken from interior areas of the field
- ✓ A preliminary threshold of one nymph per sweep (i.e., 15 nymphs per 15-sweep sample) is recommended
- ✓ **Control:** Insecticides only



Watch out for these pests



©Will Hershberger

- ✓ Tree fruit
- ✓ Vegetables
- ✓ Row crops (corn, soybean)
- ✓ Small fruits, grapes
- ✓ Ornamentals
- ✓ Hazelnuts
- ✓ Many more



- ✓ Tree fruits
- ✓ Small fruits
- ✓ Some vegetable fruits (tomatoes)
- ✓ Highest risk crops = Raspberries, blackberries, blueberries, cherries, strawberries, nectarines
- ✓ Lower risk crops = Grapes, pears, peaches



- ✓ Legumes (soybeans, edamame, and other bean species)



Thank You!
Questions?