Originally from Japan, Korea, China, highlands of southeast Asia and foothills of the Himalayas.
Fruits Affected by SWD

- Blueberries
- Raspberries
- Blackberries
- Boysenberries
- Strawberries
- Cherries
- Peaches
- Asian Pears
- Figs
- Grapes
- Nectarines
- Asian Plums
- Plumcots
- Elderberry
- Cold Hardy
- Kiwi
- Italian Prunes
- Persimmons
SWD LIFE CYCLE

Eggs laid in healthy fruit

Adults 20-30+ days

3 larval instars

Pupae

Gerdeman
Spotted Wing Drosophila Adults

**Females**
- Ovipositor easily observed in traps
- Lack wing spots

**Males**
- Wing spots near bottom outside edge
- First legs have 2 rows of sex combs.
Why is SWD so destructive?

Non *suzukii* ovipositor

*D. suzukii* ovipositor highly adapted for cutting.
Spotted Wing Drosophila Egg Deposition

Gerdeman

Gerdeman
Spotted Wing Drosophila Life Cycle

**Eggs**
- Laid in maturing fruit
- Hatches in 12-72 hours
- 350+ eggs/female
**Eggs**
- Laid in maturing fruit
- Hatch in 12-72 hours
- 350+ eggs/female

Respiratory filaments can be seen with a 10X hand lens and even the naked eye with training and sharp eyesight.
Larvae

• 3 instars
• 5-7 days
• 3\textsuperscript{rd} instar - wandering
Spotted Wing Drosophila Life Cycle

Pupae

• 3\textsuperscript{rd} instar larval cuticle hardens to form puparium

• 4-15 days
Beginning on 9/7/2011 we ran a weekly series of no-choice field cage studies where we exposed **cvs. ‘Reisling, Merlot, and Concord’** to SWD. Eggs and larva were detected on the caged fruit at dates near harvest, but no adults were detected indicating that SWD did not complete a generation in Washington grapes.

These results are nearly identical to 2010.
Concord Harvest Date October 31

<table>
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<th>Date</th>
<th>Brix</th>
<th>TA/I</th>
<th>pH</th>
<th>Eggs</th>
<th>Larva</th>
<th>Pupae</th>
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<td>3.54</td>
<td>0</td>
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</table>

1/ Date shown indicates when fruit in cages were exposed to SWD. Cages were collected 7 days later and fruit was left on the lab bench to permit adult emergence
Overview remarks from entomologist, Doug Walsh, WSU, Prosser, WA.

1. Grapes are not a preferred host and grapes need to be way overripe before they get attacked by SWD.
2. Westside grape grower’s viticultural challenge is just getting the grapes ripe.
3. Simple fact that we do not hear about any California coastal vineyards getting hit by SWD leads one to conclude that wine grapes are not a preferred host.
SWD population trends in blueberry and red raspberry at the WSU NWREC for 2010 and 2011.
Summary Insights on SWD Management, 2011

• Monitor ACV traps closely as small fruit approach ripening/increased fruit ripening volatile/odor cues for SWD females.

• Critical **treatment threshold** is first presence of SWD in traps or fruits (reproductive capacity, eggs in fruit, migration).

• Difficult to clean-up SWD if the first contact, cover applications is late (e.g. 1-3 days).

• A rescue cover application by helicopter or chemigation can effectively knockdown immigrating adult SWD at first fruit ripening.

• With the exception of the neonicotinoids, all of the commercially registered insecticides are effective contact/stomach poison chemistries.
• Good coverage of the foliage and fruit is key for effective contact activity to prevent egg laying in maturing fruit (gallonage/ac, pressure and speed).

• Rotate MOA insecticides to delay onset of tolerance and cross-resistance.

• Apply full labeled rate of each insecticide and consider PHIs and REIs of each when formulating your pest management program.

• Use enough monitoring traps along perimeter and within-in field to calibrate each application for immigrating flies from outside the crop. These observations will provide growers with insights about the protective residual of each insecticides.

• This knowledge about field residual is critical to SWD management for not leaving fruit unprotected between rotations.
Distribution and Host Range of the BMSB

- Brown marmorated stink bug (BMSB), *Halyomorpha halys*, invasive insect native to Japan, Korea, Taiwan and China.

- BMSB officially identified in 2001, Allentown, PA, established throughout the mid-Atlantic region and officially detected in 30 states.


- Within Asia, 300 host plant recorded. US surveys identified apple, plum, peach, pear, cherry, raspberry, blueberry, grape, pecan, bell pepper, tomato, pole/bush beans, cucumber, sweet/field corn, soybean ornamental trees and shrubs (maple, dogwood, crabapple, hawthorne, elm, sycamore, serviceberry and magnolia.)
Brown Marmorated Stink Bug – Native Range

Japan, Korea, Taiwan and China
Brown Marmorated Stink Bug – North America

2001, Allentown PA
Report New Infestations

Collect the sample!
Check your ID resources or drop off at your local extension office
All new records will be reported to WSDA
Only known to occur in Clark and Skamania counties in Washington State.
Brown Marmorated Stink Bug

*Halyomorpha halys* (Hemiptera: Pentatomidae)
Biology

• Overwinter as adults, emerge in spring and begin mating two weeks later. 1-6 generation/year. Between 200-500 egg/female.

• Eggs are laid in egg masses/clusters containing 25-30 eggs on the underside of leaves.

• Life stages: egg, 5 instar nymphs (wingless versions of the adult) and adult (male & female).

• Called stink bugs because they produce a disagreeable odor from specialized body glands when disturbed.

• Piercing-sucking mouthparts, slender beak-like structure.
Life stages - mid-April to October, WV
Brown Marmorated Stink Bug - Life Cycle

- 200-500 egg/female
- Eggs laid in clusters of 25-30
- 1-2 generations per year ??
- Up to 6 in warm climates
Brown Marmorated Stink Bug - Life Cycle

Winter aggregations
BMSB feeding damage
Brown Marmorated Stink Bug – Damage
Brown Marmorated Stink Bug – Hosts

**Paulownia tomentosa**

*Royal Princess or Empress Tree*
Brown Marmorated Stink Bug - Pest Status

Severe damage in Mid-Atlantic states in 2009-2010. $37 million in damages to apple growers in MD, PA, and WV. 20%-100% crop loss.
USDA/ARS AFRS, Leskey 2010

- Pyrethroid Brigade, carbamate Lannate, organochlorine Thiodan, OPs Lorsban, Malathion, Cygon and Supracide showed good activity as direct contact on dried insecticide residues.

- Many newer “reduced-risk” insecticides proved far less efficacious under laboratory conditions.

- All registered neonicotinoids, Agri-Mek, Beleaf, Avaunt, Movento, Cyazypyr are not effective.

- Biological control: egg and adult parasitoids attacked BMSB at less than 5%. China, *Trissolcus* species caused 50-80% egg parasitism and adapted to BMSB. Years away from being implemented.
Chemical Management

• No system to effectively/reliably monitor BMSB in any cropping system.

• Newly established invasive pest, insecticides are needed to manage BMSB on specialty crops in the short term.

• Newer reduced-risk and OP-replacement insecticides are generally NOT effective against BMSB.

• 2010, no field-based management recommendations.

• Pyrethroids proved problematic because many recovered after initial knock-down; >33% moribund BMSB recovered after direct exposure to cyfluthrin.

• Commercial orchards, 80% recovery rate for insecticide exposure reported.
Prototype BMSB Monitoring Traps
Acknowledgments:
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Washington State Red Raspberry Commission
Washington State Strawberry Commission
Northwest Agriculture Research Foundation
Washington State Commission on Pesticide Registration

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