

An Update on Spotted-wing Drosophila and its Management

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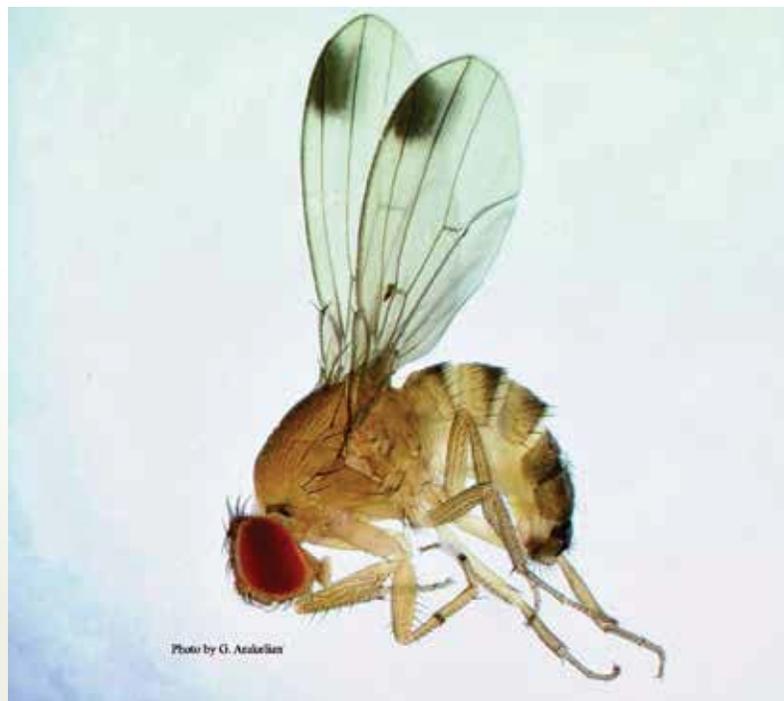
Spotted-wing drosophila (SWD), *Drosophila suzukii* is a polyphagous pest and infests several small fruit in California and other states. SWD belongs to the group of flies that is generally known as vinegar flies or lesser fruit flies. It was initially known as cherry fruit fly in 1930s and is now referred to as spotted-wing drosophila. SWD can be distinguished from other *Drosophila* spp. based on the following traits:

- Females have a hard and dark (sclerotized) ovipositor with prominent serrations or saw-teeth that enable the fly to lay eggs in intact ripening fruit.
- Antennae has a branched bristle-like part called arista.
- Males have a distinctive dark spot at the tip of each wing, hence the name.
- Males also have two dark bands (combs) of 3-6 teeth on each front leg.

Origin and distribution: It is traditionally known to be a pest in Asia, but it is now reported in the Neotropics, North America, and Europe. In the US, it has been reported in Hawaii, Washington, Oregon, California, Utah, Minnesota, Michigan, Missouri, Louisiana, West Virginia, Pennsylvania, North Carolina, South Carolina, and Florida.

Host range: They generally infest thin-skinned fruit and prefer temperate climate. Host range includes apple, blackberry, blueberry, cherry, dogwood, grape, mulberry, peach, persimmons, plum, raspberry, and strawberry. Non-crop hosts that support SWD populations include barberry, brambles (wild raspberry and blackberry), buckthorn, cotoneaster, currant, dogwood, elderberry, fig, honeysuckle, laurel, mulberry, nightshade, oleaster, orange jasmine, pin cherry, pokeweed, purple flowering raspberry, spicebush, sweet box, and yew.

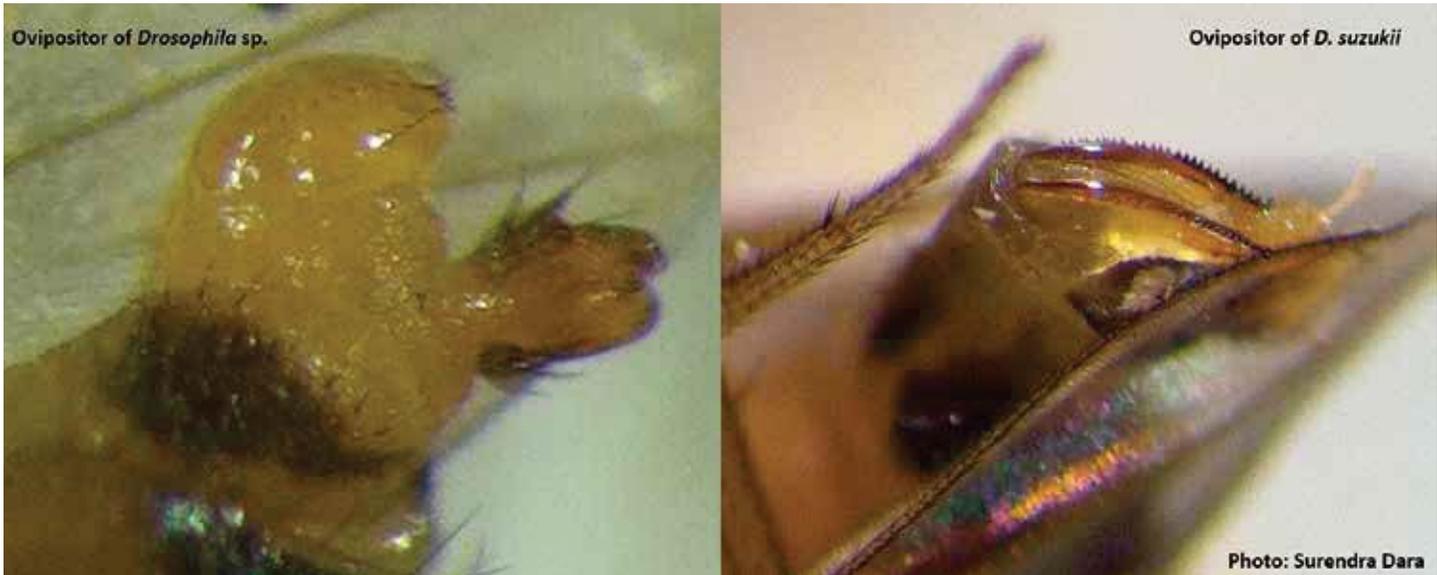
Biology: SWD prefers 68-86 °F and overwinters as adults. Various sources suggested 5-13 generations per year. There can be 10 generations per year in California. Eggs are translucent to milky-white. Females lay an average of 384 eggs at 7-16 per day and there can be 1-3 eggs per oviposition site. Multiple females may deposit eggs in the same fruit. Eggs hatch in 2-72 hours and larval stage lasts for 3-13 days. Larvae are milky-white with a legless body tapering towards the anterior end (towards the head). Mouthparts are dark and sclerotized. Pupation takes place inside the fruit or in the soil and lasts for 3-15 days. Pupae are reddish brown and have



Male spotted-wing drosophila adult. Photo by Gevork Arakelian, Los Angeles County Ag Commissioner's Office



Distinctive combs on the front legs of male spotted-wing drosophila. Photo by Gevork Arakelian.



Sclerotized ovipositor of SWD (right) compared to the normal ovipositor of a vinegar fly (left).

two spiracles (breathing tubes) at the anterior end. Adults are small (2-3 mm) flies. Life cycle takes anywhere from 21-25 days at 59 °F to 7 days at 82 °F. Female can start laying eggs within 1 day after their emergence and can lay up to 600 eggs in its lifetime. Based on the degree day (DD) calculations, egg, larval, and pupal stages require 20.3, 118.1, and 200 DD.

Damage: Other fruit flies usually infest overripe and fallen fruit, but SWD infests fresh fruit because of its powerful ovipositor, which can rupture harder fruit tissue. Adults feed on fallen fruit but lay their eggs under the skin of intact fruit. Softening and collapse of the tissue results from larval feeding inside the fruit. Oviposition holes can be seen on the fruit with close observation. In addition to the direct damage, SWD makes the infested fruit vulnerable to other pests and diseases. Monitoring SWD is very important to avoid harvesting and marketing infested berries.

Monitoring: Use traps made with apple cider vinegar or yeast-sugar solutions for early detection of SWD. There are numerous studies using a variety of containers and attractants showing varying results. Commercially available traps and lures can also be used for monitoring.

Management: A variety of organic and conventional management options are available. Efficacy of the options varied among different studies and decisions should be made based on local conditions.

- **Cultural** – Discard fallen and unmarketable fruit in the field to prevent SWD infestation. Remove wild hosts in the vicinity that might harbor SWD populations.
- **Biological** – Studies with predators such as rove beetle (*Dalotia coriaria*) and insidious flower bug (*Orius insidiosus*) did not demonstrate their potential for field use. Natural parasitism can cause very high mortality in some *Drosophila* spp. and researchers are searching for suitable parasitoids (parasitic wasps) for SWD.

- **Botanical** – Pyrethrins and azadirachtin products were not found to be effective in some studies.

- **Chemical** – Research indicates that organophosphates, pyrethroids, and spinosyns are among the chemicals that can be used against SWD. Remember to rotate chemicals among different mode of action groups to reduce the risk of resistance development.

- **Physical** – Fine mesh netting can be effective in excluding SWD.

- **Microbial** – Commercial formulations of entomopathogenic fungi (*Beauveria bassiana*, *Isaria fumosorosea*, *Metarhizium brunneum*) and bacteria (*Chromobacterium subtsugae* and *Burkholderia rinojensis*)-based products against adults, and entomopathogenic nematodes (*Heterorhabditis* spp. and *Steinernema* spp.) against pupae that form outside the fruit are some of the available options. However, a naturally occurring fungus, *Entomophthora muscae*, caused epizootics in SWD populations on fig. Cool and moist weather coupled with high host populations usually favor epizootics by entomophthoralean fungi, a group different from hypocrealean fungi (*B. bassiana*, *I. fumosorosea*, *M. brunneum* and others). Entomophthoralean fungi are difficult to culture on artificial media and do not have the potential for augmentative release. However, artificial introduction in areas where climatic conditions are favorable for *E. muscae* infections could complement IPM practices. ■

References

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Additional resources:

- Biology and management of SWD:
<http://cesantabarbara.ucanr.edu/files/262206.pdf>
- *Drosophila* distribution:
<http://pest.ceris.purdue.edu/map.php?code=IOAPUA>
- SWD factsheets:
http://www.ipm.msu.edu/invasive_species/spotted-wing_drosophila/factsheets

SWD female with an egg being deposited. Photo: Elizabeth Beers (Washington State University) and Whitney Cranshaw (Colorado State University).



SWD larvae on raspberry. Photo: Elizabeth Beers (Washington State University) and Whitney Cranshaw (Colorado State University).



SWD pupa on cherry. Photo: Elizabeth Beers (Washington State University) and Whitney Cranshaw (Colorado State University).