

SPOTTED WING DROSOPHILA

Integrated Pest Management for Home Gardeners and Landscape Professionals

Spotted wing drosophila (SWD), *Drosophila suzukii*, is a fruit fly first found in 2008 damaging fruit in many California counties. It infests ripening cherries throughout the state and ripening raspberry, blackberry, blueberry, and strawberry crops, especially in coastal areas. It also has been observed occasionally attacking other soft-flesh fruit such as plums, plumcots, nectarines, and figs when conditions are right.

IDENTIFICATION AND LIFE CYCLE

Adults and maggots closely resemble the common vinegar fly, *D. melanogaster*, and other *Drosophila* species that attack primarily rotting or fermenting fruit. Spotted wing drosophila, however, readily attacks undamaged fruit. See *Identifying Drosophila suzukii* in References for help with distinguishing this pest from other flies. The online version of this publication also includes a link to an SWD identification card.

Adults are small flies about $\frac{1}{16}$ to $\frac{1}{8}$ inch long with red eyes and a pale brown thorax and abdomen with black stripes on the abdomen (Fig. 1). The most distinguishable trait of SWD males is a black spot towards the tip of each wing (Fig. 2). The females do not have spots on wings but have a very prominent, sawlike ovipositor for laying eggs in fruit (Fig. 3).

Larvae are tiny, white cylindrical maggots a little longer than $\frac{1}{8}$ inch when full grown (Fig. 4). One to several larvae can be found feeding within a single fruit. After maturing, the larvae partially or completely exit the fruit to pupate (Fig. 5).

Spotted wing drosophila may be mistaken for other adult flies and maggots. Look closely by comparing



Figure 1. Adult male spotted wing drosophila.



Figure 2. Close-up of the wing of a male spotted wing drosophila.



Figure 3. The spotted wing drosophila's ovipositor is large and serrated.

anatomical features of the maggots and wing patterns of adult flies. For instance, adult Western cherry fruit flies, *Rhagoletis indifferens*, in another family of flies called Tephritids, are much longer at $\frac{3}{16}$ inch than SWD adults and have a dark banding pattern on their wings. This fruit fly, which is a quarantine pest, occurs in Washington, Oregon, and other states but has not established in California. If



Figure 4. Spotted wing drosophila larva on damaged cherry.

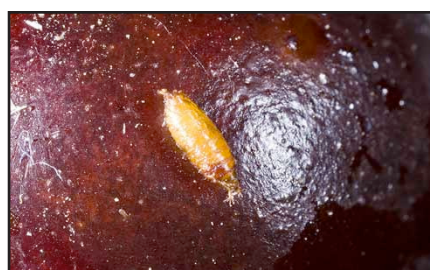


Figure 5. Spotted wing drosophila pupating on the surface of a cherry.

you suspect you have a Western cherry fruit fly, take specimens to your local agricultural commissioners' office.

Research studies to define the biology and life cycle of SWD in California are still underway; however, like other vinegar flies, it appears to have a short life cycle of one to several weeks depending on temperature and can have as many as 10 generations per year. This rapid developmental rate allows it to quickly develop large populations and inflict severe damage to a crop.

In its native Japan and in coastal California the adult flies can be captured throughout much of the year. In California's inland valleys the adult flies are most active during spring and fall when highs are between 60° and 80°F, especially when conditions

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are humid and food is available. In laboratory studies at constant temperatures, they are most active at 68°F; activity becomes reduced at temperatures above 86°F.

DAMAGE

Unlike other vinegar flies that occur in California, spotted wing drosophila attacks healthy ripening fruit as well as damaged or split fruit. The female will penetrate the skin of soft-skinned fruit with her large ovipositor and lay eggs just under the skin, creating a small puncture, or “sting,” on the fruit surface (Fig. 6). Each sting contains 1 to 3 eggs, and a female can oviposit on many fruit. Multiple larvae within a single fruit are quite possible, because many females might visit the same fruit to oviposit. Once fruit integrity is compromised by SWD’s activities, common vinegar flies also might oviposit in the damaged fruit.

Eggs hatch and maggots develop and feed inside the fruit, causing the flesh to turn brown and soft with sunken areas that can exude fluid on the surface of smooth-skinned fruit such as cherries and blueberries. Damage can provide an entry site for infection by secondary fungal and bacterial pathogens, but this is not always the case (Fig. 7).

MANAGEMENT

Spotted wing drosophila flies and their damage often are not noticed in backyard fruit crops until fruit is being harvested. Sprays at this time will not protect the crop, because maggots already are in the fruit.

If a small percentage of fruit is infested, you can salvage some of the crop by harvesting the crop immediately and sorting and removing fruit with stings on the surface. Place infested fruit in a sturdy, sealed plastic bag and dispose of it in the trash. A combination of preventive and cultural practices, discussed below in Cultural Control, might be useful for reducing problems on fruit trees and berries. If using insecticides, it is important to monitor

for fly abundance before fruit begins to color to be sure treatments are made before they have attacked the fruit.

Varietal Susceptibility

Some cherry varieties might be more susceptible to SWD than others, but more research is required. Among the berries, raspberries appear to be the most susceptible; blackberries and strawberries also are susceptible in coastal climates under very moist conditions when fruit is not harvested frequently. Blueberries also are quite attractive to SWD in moist, coastal environments but less so where moisture is lacking and temperatures are high. All blueberry varieties appear to be susceptible.

Cultural Control

Sanitation. Eliminating any fruit that has fallen on the ground and any infested fruit remaining on plants in the garden can reduce populations of flies that might infest next year’s crops or later-ripening varieties. Infested fruit can be placed in a durable plastic bag, sealed, and placed in the trash. Composting or burying is not a reliable way to destroy eggs and larvae in fruit. Solarizing fruit under clear plastic in the sunshine has been quite successful in killing flies in fruit in preliminary studies performed in Oregon.

Netting. Fine netting over whole plants or canes can be useful to keep flies from attacking fruit on blueberries and other small fruit and possibly on branches on small cherry trees. However the netting must be applied before fruit begins to ripen so that flies will not be caught inside the net. Netting must be secured so flies cannot enter, and the mesh size should be very small, such as 0.98 mm mesh used for screening out no-see-um flies.

Early Harvest. Early harvest of fruit can be important in reducing exposure of fruit to the pest. Begin harvest as early as you can and continue to remove fruit as soon as they ripen.

Trapping. Trapping, as discussed below in Monitoring for SWD, has

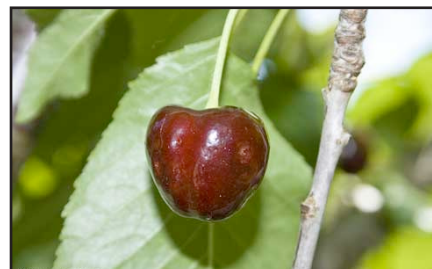


Figure 6. Tiny punctures on this cherry are SWD oviposition scars.



Figure 7. Secondary damage caused by mold on a SWD-damaged cherry.

not been shown to effectively reduce populations of SWD in backyard trees. Trapping is important, however, for monitoring for the pest.

Monitoring for SWD

It is very important to monitor for SWD activity in your susceptible fruit trees and berries. You can use traps to monitor for flies, but it is also important to observe cherry or blueberry fruit regularly as it begins to ripen. In some cases, this will allow you to harvest before problems are serious. Monitoring also will help you time insecticide applications for greatest effect.

Start checking cherry or blueberry fruit for damage (i.e., prematurely rotting fruit or punctures created when the female lays eggs in fruit) as soon as fruit begins to develop any pink color. SWD stings are tiny, so a magnifying glass will help you see them. You can gently squeeze the fruit to see if juice leaks from the small punctures; this can indicate presence of the pest. Break open suspect fruit to see if small, white larvae are inside. If you find infected fruit you should either harvest all the fruit immediately or spray to prevent the damage from increasing before

harvest. The infestation level can increase quite rapidly if fruit are left untreated or unharvested. Remove and destroy infested fruit as you monitor. Stings are not readily visible on raspberries, blackberries, and strawberries, so it is difficult to detect an early infestation by monitoring the fruit for damage.

You also can use traps to detect and monitor SWD adults. Commercial fruit fly traps are available or you can make traps out of 1-quart plastic yogurt (or similar) containers that have a lid (Fig. 8). Drill 10 to 16 holes that are $\frac{3}{16}$ -inch in diameter around the upper side of the container for fly entry. Bait the trap with 1 to 2 inches of **pure** apple cider vinegar; avoid flavored apple cider vinegars. Add a drop of unscented liquid dishwashing soap to break the surface tension so the flies will drown. Hang the trap in the shade in your cherry tree or near your berries in early May or well before fruit begins to ripen.

Check the trap weekly for small flies with dark spots at the tip of their wings floating in the fluid. These are male spotted wing drosophila and will confirm that you have the pest. Put fresh apple cider vinegar and a drop of soap in each week.

Chemical Control

Because this pest is so new to California, there has been limited research on treatments to manage spotted wing drosophila. Before you spray, confirm that you have SWD in your area by hanging out traps or checking fruit. Sprays must be timed to kill adults before they lay eggs, as sprays will not control larvae already in the fruit. Always read product labels to make sure pesticides are

registered for use on the fruit or berry you are treating.

If monitoring indicates a need to spray, the application should be made as soon as the fruit just begins to turn from yellow to pink. This should be about 2 to 3 weeks before cherry or berry harvest. A second application may be needed 7 to 10 days later. In the case of indeterminate fruiting berries such as raspberries or strawberries, sprays might need to be repeated to keep populations low during summer and fall. You can use monitoring traps to help you decide if and when additional sprays might be needed. Be sure to wait the interval specified on the pesticide label before harvesting fruit.

The insecticide spinosad (e.g., Monterey Garden Insect Spray) is effective and has the least negative environmental effects of currently available products. Some spinosad products are sold to be applied with a hose-end sprayer, but a compressed-air sprayer will give more reliable coverage.

The organophosphate insecticide malathion also will control spotted wing drosophila, but malathion is very toxic to bees and natural enemies of other pests in the garden so care must be taken to keep the application on the target plant and avoid drift and runoff. Improper application also can result in injury to cherry trees. Because of the potential negative impact of malathion in the garden, use it only where you are certain you will have a spotted wing drosophila infestation, either because you had a problem last year or from trapping and positively identifying insects this season as SWD.



Figure 8. Spotted wing drosophila bait trap.

REFERENCES

- Dreves, A. J., and G. A. Langellotto-Rhodaback. 2011. *Protecting Garden Fruits from Spotted Wing Drosophila (Drosophila suzukii)*. Corvallis: Ore. State Univ. Ext. Serv. EM 9026. Available online, <http://extension.oregonstate.edu/catalog/>. Accessed August 2011.
- Vlach, J. 2010. *Identifying Drosophila suzukii*. Salem: Ore. Dept. of Agric. Available online, www.oregon.gov/ODA/PLANT/docs/pdf/ippm_d_suzukii_id_guide10.pdf.
- Walton, V., J. Lee, D. Buck, P. Shearer, E. Parent, T. Whitney, and A. J. Dreves. 2010. *Recognize Fruit Damage from Spotted Wing Drosophila*. Corvallis: Ore. State Univ. Ext. Serv. EM 9021. Also available online, <http://extension.oregonstate.edu/catalog/>.

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For more information, contact the University of California Cooperative Extension office in your county. See your telephone directory for addresses and phone numbers, or visit <http://ucanr.org/ce.cfm>.

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WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original, labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down the sink or toilet. Either use the pesticide according to the label, or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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