

Spotted Wing Drosophila (SWD)
(Drosophila suzukii)

Species of vinegar fly, new to this area. Native to Southeast Asia. Detected in California in late 2008; spread rapidly up the coast. By summer of 2009 it was found as far north as British Columbia. As an OSU press release of 3/12/10 stated, “Damage from the fly was rapid and intense.” Last year California lost about one-third of the cherry crop. Growers in Oregon’s Willamette Valley lost up to 20 percent of their blueberries and raspberries and up to 80 percent of their late-season peaches.

SWD is related to the common vinegar fly that swarms around fruit left on your counter.

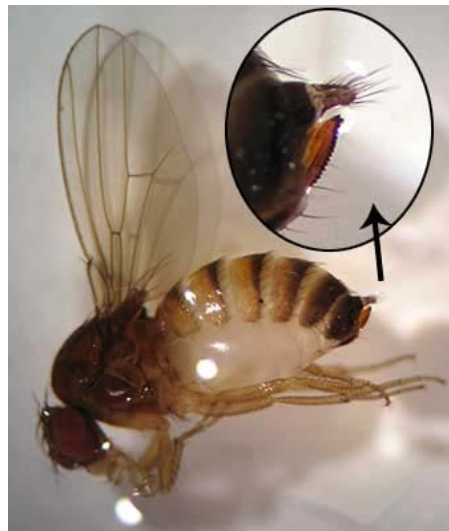
One crucial difference – the common vinegar fly lays eggs only on fruit that is overripe or starting to rot. *Suzukii* attacks fruit ripening in the field, which makes it a major threat to commercial fruit production and to home-grown fruit. The female has a saw-like ovipositor and deposits eggs under the skin of the fruit.

- Prefers ripe fruit, but will oviposit in “ripening” fruit. In cherries, for example, when they start to change color the fruit is vulnerable. Researchers don’t yet know exactly the point at which other fruits become susceptible.
- Favorite host fruits: blueberries, domestic and wild blackberries (both Himalayan and Evergreen), raspberries, cherries, strawberries, peaches.
- Have also been found in apples, grapes and wine grapes, figs, boysenberries, elderberry, Italian prunes, cold hardy kiwis, Asian pears, plums, plumcots, nectarines, and persimmon. They have been found to attack tomatoes in the laboratory but might not be as attracted to tomatoes in the field because their sense of smell is finely attuned to detect sugars. In apples and Asian pears it is usually fruit still on the tree in late season that the flies attack.
- Candidates for attack include any thin-skinned sweet fruit with skin soft enough for the female to puncture with her ovipositor.

DESCRIPTION:



Male *Drosophila suzukii*



Female *Drosophila suzukii* and enlarged view of the serrated ovipositor.

Adults: 1/8 inch long or less, yellow-brown body with prominent red eyes and clear wings. The size is indicated by this picture of male and female flies on a raspberry.



- **Males have a black/grey spot on the end of each wing.** This is the only fruit fly in our area with a wing spot, which makes the males easy to identify. The spots can be seen with the naked eye, but a hand lens can be helpful.
- Females lack the wing spot.

Larvae: tiny legless, headless, white, cream-colored or transparent cylindrical maggots, 1/8 inch long at maturity; shown in a cherry on the right.



Cherry fruit flies also deposit white larvae in cherries, but their larvae are much larger than drosophila larvae. They also burrow deeper into the fruit. Drosophila larvae tend to feed shallowly.

Pupae: After maturing, the larvae may pupate in the fruit or exit to pupate elsewhere.

- The pupae are cylinder-shaped, reddish-brown, about 1/8" in length with 2 small projections on the end. Pupae are shown on blueberries on the right.



LIFE CYCLE:

The female lays one to three eggs inside the fruit, where the larvae develop. Multiple flies can lay eggs in the same fruit. Eggs hatch in one to three days. Larval feeding causes the surrounding area to collapse, forming a soft indentation and brown, sunken areas on the fruit. Fungal and bacterial infection and secondary pests may also contribute to fruit deterioration. The larvae go through three instar stages before pupating. Adults emerge, start laying eggs between 1-4 days later, and typically live 20-30 days. Adults emerging in late summer and fall can overwinter and lay eggs the next year on early ripening fruit.

Short life cycle, varying with the weather. The colder it is the longer it takes for the SWD to develop:

- At 54 degrees it takes 50 days to develop from egg to adult.
- At 64 degrees it takes 19 days to mature.
- At 77 degrees 8.5 days;
- 82 degrees, 7 days, one generation a week.
- Beyond 85-86 degrees the males become sterile. Reproduction ceases at that point.

Up to 10-13 generations a year in Japan; in Western Washington they are expected to have up to 5 to 6 generations per year. The speed of reproduction means large populations could develop quickly. A female can lay 350+ eggs in her lifetime, and as estimated by the OSU/USDA group, one female can give rise to 22,500 flies in two generations.

The flies could be active from April to November. In his press release of November, 2009, however, Dr. Doug Walsh, Washington State IPM Coordinator, said first emergence in Western Washington is likely between mid-June and early July. The OSU/USDA training said the flies need temperatures at or above about 50 degrees for several days before they become active. During overwintering, flies may wake up and be active but not lay eggs, and become inactive again if it then turns cold.

WHAT YOU MAY SEE AT THE CLINIC:

- You may have SWD flies brought in, but the flies are small and home gardeners may not even notice they are around.
- You could have fruit brought in with ovipositor scars, as on the cherry at the right. They are small, however, and home gardeners may not notice them.
- You are more likely to see fruit with brown, sunken areas caused by larval feeding, shown in the cherries to the right.
- Because early symptoms are subtle, home gardeners may not notice a problem until the fruit is being harvested. You may get samples of berries or other fruits with maggots.



MANAGEMENT:

Eradicating Spotted Wing Drosophila will probably not be possible. Crops ripen at different times during the season, and the wide host range of SWD means the flies can move from one crop to another. Also, one of its hosts is wild blackberries, both Himalayan and Evergreen, which are abundant.

Since the fly is new to North America, there is an intense research effort under way. WSU is collaborating with OSU, the University of California, and Canadian researchers to investigate SWD and determine the best management techniques. In his 11/09 press release Dr. Walsh, the Washington State IPM Coordinator, said “A management program has not been determined for this prospective pest.”

Information on *Drosophila suzukii* has been added to Hortsense pages for all small fruits except currant/gooseberry, and to the pages for cherries and peaches... Echoing Dr. Walsh, Hortsense currently says “Management recommendations are currently being developed for this pest.”

Chemical Management:

Regarding chemical management, Hortsense currently says only that “Chemical management options for spotted wing Drosophila have shown varying results in research trials. Management options will continue to be revised as new information becomes available.”

Dr. Catherine Daniels, WSU Pesticide Coordinator and the arbiter of which pesticides Master Gardeners can recommend, said in an e-mail on March 15, 2010: “From what I can tell there is agreement that one product is effective but since it’s not a home & garden product, the MGs would not be able to recommend it. We’ll keep listening to see what comes out of the discussions and put an entry on the Hortsense page as soon as we can.”

Remember that when we speak as Master Gardeners we can recommend only what is approved by WSU. You will find an increasing amount of information on the internet about Spotted Wing Drosophila, including discussions of chemical trials. If the website or other information you are checking is issued by another state, do not repeat its chemical management suggestions to your clients. Check Hortsense regularly for management updates for our area.

The OSU press release of 3/12/10 notes that “This [SWD] is not a problem that can be wiped out with a barrage of chemical sprays, according to the researchers. Controls must not harm pollinating insects or other beneficial organisms that are necessary for healthy orchards and fruit fields. In addition, chemical resistance is a problem when combating any insect with up to 10 generations a year, as has been reported for this fly in Japan.”

Other Management Techniques:

Once the egg is in the fruit, there is no control measure. The focus has to be on controlling flies before they lay eggs and on reducing breeding sites.

Reduce moisture in the field. SWD prefers cool, shade, moisture and high humidity, so Western Washington is more likely to incur damage than the warmer and drier areas of the state. To reduce moisture, water at the base of your plants. If water hits the foliage when you are watering, try to water when the foliage can dry quickly.

Netting of fruit has been used in Japan. That might work for smaller fruits like strawberries (using row cover, for example), but would be more difficult for things like raspberries, blueberries, or fruit trees. The mesh of the netting has to be quite small since the flies are only 1/8” long and netting would have to be firmly anchored all the way around the plant. Clients may want to use traps to monitor for flies before applying the netting—if they are already flying around, you might just trap the flies inside and increase the damage.

Trapping is a way to monitor for the presence of the flies and also to reduce the population and prevent egg-laying.

- Set traps out when fruit begins to ripen and ambient air temperature has been above 50 degrees for several days.

- If you are using traps only to monitor for the presence of SWD flies, one trap might be sufficient. To reduce the fly population, multiple traps will be needed.
- Suspend traps at the level of the ripening fruit, hanging them on a shady or cooler side of the plant. For strawberries, set the trap at ground level. (Unfortunately ground level traps may attract slugs.)
- There are commercial fruit fly traps, or you can make your own. The holes on commercial traps are typically larger than the 3/16" that is recommended by OSU/USDA. Any smaller and SWD typically do not enter; any larger and the trap is more likely to attract bees, mason bees and yellow jackets.
- A mixture of yeast, sugar and water initially was thought to be the most effective bait for your traps. OSU/USDA have found on further investigation that the yeast/sugar/water solution is effective short-term, when it is bubbling, but then loses its effectiveness. Apple cider vinegar maintains its attractiveness and is now the recommended bait for your trap. Apple cider vinegar also has the advantage of being clear so you can see more easily what you have caught. The yeast/sugar/water mixture is murky.
- Put 1 ½ inches of the bait in your traps.
- For homemade trap construction OSU/USDA recommends the following:
 - Use 32 oz. or 16 oz. clear plastic cups (possibly obtainable at Cash & Carry or Dollar stores).
 - Do not drill holes in the trap's lid because rain will dilute the bait in the trap. Instead, drill four 3/16" holes in the side of the cup. Leave one area of the cup without any holes so you can pour the bait out to examine it for flies without the bait dripping out a hole.
 - Place a yellow sticky card (obtainable at greenhouse suppliers) loosely on the inside wall of the cup to reduce fly escapes out holes, to catch flies on both sides and for easy counting of flies.
 - Add a wire strap to the cup in order to hang the trap.
- Alternatively, you could drill holes in the side of a plastic pop or water bottle. Screw the cap over a length of string to serve as a hanger.
- Because these traps may also capture other species of *Drosophila*, check the trap captures to confirm the presence of male flies with spotted wings. OSU/USDA has found there is typically a 50-50 proportion of males to females in their traps, so identify the males and assume there are at least as many females present.
- Renew the bait weekly. Do not pour out used bait near the fruit. Bury the bait and bugs, or place them in a plastic bag to discard.

Reduce Breeding Sites

- Promptly harvest fruit as it ripens.
- Immediately remove infested fruit if you can identify it. Bury it or place it in a plastic bag to discard. Infested fruit that remains in the field allows eggs and larvae to fully develop and serves as a source of more flies
- SWD can affect fruit both on the plant and on the ground. Sanitation is critical to reducing breeding habitat Do not throw unusable fruit onto the ground, and promptly remove any fruit that falls to the ground.
- Remove and dispose of all overripe fruit on the plant.
- Hortsense says "Composting fruit will likely not be effective at destroying maggots and pupae."

Biological Controls

No biological controls are known at this point. Researchers are investigating possible biological controls such as parasitic wasps, predatory mites, fungal pathogens and environmental factors such as cold and heat. It is likely, however, that the rapid reproduction rate of SWD would create populations large enough to overwhelm populations of biological controls.

How can you tell if your fruit is infested?

- You may be able to see evidence on the fruit of ovipositor stings, or brown, sunken areas.
- Crush some of the fruit and look for larvae. Detection of small larvae may require a hand lens.
- OSU/USDA suggest the “Fruit-Dunk Flotation Method”
 - Randomly collect 80-100 ripening fruits from the plant.
 - Lightly crush fruit sufficient to break open all fruit.
 - Place the fruit in a quart-size zip-lock bag or other container.
 - Add a sugar-water solution (1/4 cup sugar to 1 quart water) to the bag with the crushed fruit and stir the mixture.
 - After several minutes SWD larvae should float to the top of the water and separate out from the fruit pulp which will sink.
 - The proportion of sugar to water is critical. Too little sugar and everything will sink; too much sugar and everything will float.

What should you do if your fruit is infested and you don't want to try to deal with SWD?

Home gardeners who don't want to take steps to control the flies and reduce breeding sites may find removal of the fruiting plant to be the best option. If infested fruit is allowed to stay on the plant it provides breeding sites for increased populations of flies that can affect other people's nearby fruits.

Should you use infested fruit?

If only some fruit are infested, you can salvage some of the crop by harvesting the fruit immediately and sorting it, removing fruit with stings on the surface.

Clients may ask whether it is safe to consume fruit with larvae in it. Master Gardeners have no information on this issue and cannot make any recommendation on it.

Joyce Harms
3/25/10