



Spotted-wing Drosophila: Management in Home Plantings

Fact Sheet No. 5.596

Insect Series | Home & Garden

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Spotted-wing drosophila (SWD)² is an insect only recently found in Colorado that has proven to be very damaging to several kinds of fruit crops. Small fruits, notably late bearing raspberries and strawberries, are at particular risk of damage. Damage is caused by the developing larvae, which feed within fruit causing it to rapidly soften (Figure 1).

Spotted-wing drosophila is native to Japan and was first observed in North America (California) in 2008. It then spread rapidly throughout much of the United States and Canada. First detected in Colorado (Fort Collins) in 2012, it has since been found to occur in numerous sites in both eastern and western Colorado.



Figure 1: Larvae of spotted-wing drosophila in a raspberry.

Life History and Habits

Spotted-wing drosophila (*Drosophila suzukii*)² is a member of the “small fruit fly” or “vinegar fly” genus *Drosophila*. The small fruit flies are familiar insects to many people, sometimes found abundantly indoors, where they feed on yeasts associated with overripe fruit or the sediment of beverage containers. An important difference in the habit of the spotted-wing drosophila is that

it develops within ripening fruit rather than on yeasts.

Adults of the spotted-wing drosophila are tiny flies (ca 1/10-inch length, 1/5-inch wingspan), light brown and in general appearance, fairly typical of most other small fruit flies. The males are distinguishable from other species of *Drosophila* by having a dark spot towards the tip of the wing, a “spotted wing” (Figure 2). Females are less easily distinguished, requiring some magnification. They possess a structure used to lay eggs (ovipositor) that is relatively large and uniquely serrated, which allows them



Figure 2: Adults of a “vinegar fly” or “small fruit fly” on an overripe peach. These can be common insects in homes or areas where fermenting materials are present, but do not attack intact fruit as does the spotted-wing drosophila.



Figure 3: Comparison of a female (left) and male (right) spotted-wing drosophila. Photograph by Eric LaGrasa, courtesy of the Washington Department of Agriculture.



Quick Facts

- Spotted-wing drosophila is a small fly that develops within many kinds of fruits. It is particularly damaging to late fruiting plantings of raspberries, blackberries, and strawberries.
- The young stages are tiny maggots that feed within berries and cause them to rapidly soften.
- Regular picking of all ripe fruit at least twice a week is useful in reducing damage by spotted-wing drosophila.
- Insecticides are available to help control spotted-wing drosophila but they can only be applied during times of the day when pollinating insects are not actively visiting the crop.

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² *Drosophila suzukii* Diptera: Drosophilidae



to insert eggs into thin-skinned fruits (Figure 3).

Winter is spent in the adult stage with the flies remaining in a semi-dormant condition (diapause) during the cold months. During this time they may use many different sites for winter protection, but areas within the skins and husks of decaying fruit can be particularly important places where they will survive winter. With the return of warm weather in spring the adults will emerge and seek out honeydew, nectar and oozing sap to sustain themselves.

As ripening fruits become available in late spring and early summer, egg laying resumes. When laying eggs, the female creates a small slit in fruit skin and inserts 1 to 3 eggs. This is repeated over a period of weeks and a single female can lay up to 350 eggs in her lifetime (Figure 4).



Figure 4: Eggs of spotted-wing drosophila laid on a strawberry fruit. Photograph courtesy of Hannah Burrack, North Carolina State University.

Depending on temperature, the eggs can hatch in 12-72 hours. The larvae, tiny maggots pale in color, will then feed inside the fruit (Figure 5). They become full grown in approximately 5 to 7 days after which they transform into pupae. Larvae may either remain inside the fruit to pupate or crawl away to pupate in another

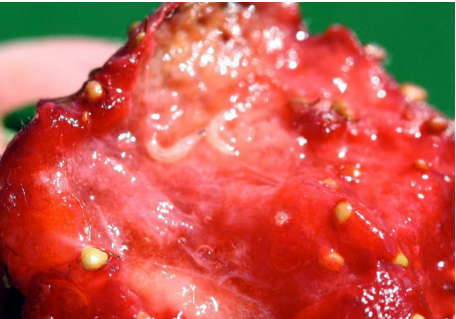


Figure 5: Larvae of spotted-wing drosophila in a strawberry fruit. Photograph courtesy of Hannah Burrack, North Carolina State University.



Figure 6: Adult male (left) and female (right) spotted-wing drosophila. Photograph courtesy of Beverly Gerdeman, Washington State University.

Table 1. The relative importance of various fruits for spotted-wing drosophila (SWD), based on Colorado surveys.
Most Highly Favored Host Plants Raspberrry Strawberry Blackberry
Moderately Important SWD Host Plants Chokeberry Elderberry Sweet cherry Nanking cherry Tart cherry Plums Redtwig dogwood Currant (particularly Red Lake) Gooseberry Apples, Crabapples (after fallen on the ground and thoroughly softened)
Other Fruiting Plants that Support SWD Regent serviceberry European cotoneaster Scarlet Hawthorn, Arnold Hawthorn Yew Grapes (after fully ripening) Tatarian honeysuckle Viburnum 'Emerald Triumph' Blueberry
Fruiting Plants Grown in Colorado that Have Not Been Observed as SWD Hosts) Asparagus* Barberry Cactus Cotoneaster (except European) Bittersweet Chokecherry* Euonymus 'Recap European' Hawthorn (except Arnold, Scarlet) Junipers Mock strawberry Mountain-ash Cheyenne privet (<i>Ligustrum</i>) Rose* Russian olive Skunkbush Sugar hackberry Snowberry Viburnum (except Emerald Triumph) Virginia creeper
* These plants have been reported elsewhere as being capable of supporting development of spotted-wing drosophila

sheltered location. In 4-15 days, adults emerge from the pupae to mate and lay eggs continuing the cycle (Figure 6).

Optimal conditions for development are around 68°-77°F (20°-25°C) and several generations are produced annually. Populations typically start to increase rapidly in early July. The highest numbers of insects are usually present in August and September.

Spotted-wing drosophila can breed and develop within a wide variety of ripening thin-skinned fruits, including various berries, tree fruits, and fleshy fruits produced by various trees and shrubs (Table 1). They can also develop in additional fruits, such as apples and crabapples, after they have become overripe.

Management of Spotted-wing Drosophila

Trapping/Monitoring

This insect can easily be captured in traps baited with apple cider vinegar and other attractants. A typical trap design uses a red plastic cup with a clear plastic lid to keep out water (Figure 7). The flies enter the trap through a series of holes (3/16" to 1/4" diameter) punched along the sides near the top of the cup. The trap is hung from the plants using a string or twist tie that threads through two of the holes.

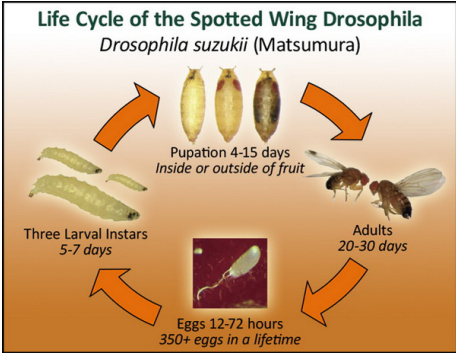


Figure 7: Life cycle of the spotted-wing drosophila. Figure courtesy of Cornell University/NYS IPM Program.

A small amount (one or two ounces) of attractant is then put in the bottom of the cup. Apple cider vinegar is probably the most commonly used attractant and is quite easy to use. But there are many other effective lures, typically involving red wine or various fermenting materials, alone or in combination. Adding a drop or two of detergent can improve capture.

The trap should then be placed in a shaded area, hung within the crop near the fruit. Traps should then be checked on a regular basis, at least once a week. When checking a sample dump the contents into a shallow light colored tray. To then identify spotted-wing drosophila one must closely examine all the fruit flies in the sample. A bit of magnification is very useful for this, as it is necessary to observe the small spot on the wing of the males to determine if SWD is present. (These traps will collect other species of small fruit flies but they will not have a spot on the wing. Female SWD also lack the spot on the wing.) Record the number of male spotted-wing drosophila each time the traps are examined. Add fresh bait and rehang the trap after each sampling.

Monitoring spotted-wing drosophila with these traps is useful for three reasons. For one, it can let one know if the insect is present at the site, as many areas have not yet become infested. Where the insect is known to be present, traps can indicate when the adult flies begin to move into susceptible crops. And, if traps are regularly checked and captures recorded, it is possible to detect if there are increases – or decreases – in the numbers of insects present. This is useful information when deciding what type of management might be needed.

Although these traps are very effective in capturing spotted-wing drosophila, they only capture a fraction of the flies that are attracted to the traps, perhaps a third. Furthermore, SWD is a fairly mobile insect and new flies can be expected to continuously move into plantings. As a result, when used alone, trapping has not proved an effective method to control this insect.

Cultural and Mechanical Controls

Frequent harvest intervals

As fruit ripens it should be regularly and thoroughly picked. If done every 3 or 4 days, this can prevent insects from successfully developing in the crop, reducing their numbers.

Harvested fruit should either be immediately consumed or stored in a refrigerator. If left unrefrigerated any insects present will continue to develop and damage

the fruit. Refrigerated to 35°F (2°C) will prevent any further development of insects and kill those that are present within about 3 days.

Any damaged fruit that is not harvested for consumption should also be removed and destroyed. Placing culled fruit in a plastic bag and allowing it to heat in the sun can reliably kill developing insects. Putting infested fruit in a compost pile is not a reliable way to kill developing SWD.

Sanitation

Many kinds of trees and shrubs produce fruits that can support the development of spotted-wing drosophila (Table 1). Some of these can be particularly important for this insect and it is useful to remove these alternate foods. Dropped apples and crabapples that soften on the ground should be cleared out. Fallen peaches and plums are also important food sources that are relatively easy to remove.

Crop Canopy Management

Spotted-wing drosophila prefers dense shade and cooler areas in the canopy. Pruning crops in ways that open up the crop canopy can deter insects from colonizing the crop.

Cultivar selection

The crops most badly damaged by SWD are late season cultivars of raspberries, blackberries and strawberries. Shifting to cultivars that bear early in the year (“June bearers”) can largely avoid damage since SWD populations are low when crops ripen.

Crop coverings

Nets of fine mesh (1 mm) can be used to exclude flies from plants. Such coverings need to be in place before ripening fruit is present that will attract adult SWD. The netting should also be draped in a way to prevent direct contact with the fruit to avoid eggs being laid through the mesh.

The use of these coverings will also exclude other insects, including pollinators. This can be an important consideration when the crop is not self-fertile and benefits from cross pollination.



Figure 8 a, b: Two trap designs for spotted-wing drosophila. One (a) is a red plastic cup with a clear top with entry holes punched near the top. The second (b) uses a clear container but has red tape to attract the insects and has holes in the top. Both designs can use lures such as vinegar, red wine, or similar fermenting material. Photographs courtesy of (a) Bob Hammon and (b) Deryn Davidson, Colorado State University.

Chemical Control

Insecticides applied to kill the adult flies can be effective for control of spotted-wing drosophila. However, in home gardens options of available products are quite limited (Table 2). Also, some SWD susceptible crops flower and produce fruit over an extended period, such as raspberries. In these situations special care must be taken to prevent killing bees and other pollinators visiting the crop.

Products containing the active ingredient spinosad (spinosyns) can provide control for about 5 to 7 days. Less commonly available is the insecticide acetamiprid, which is similarly effective. Insecticides that have very short residual activity, such as pyrethrins or insecticidal soaps, have not proven to be effective for control of spotted-wing drosophila.

Thorough spray coverage is important for effective control. Particular attention should be given to cover the underside of leaves and the interior of plantings where SWD flies spend the most time. Adding a small amount of sugar to the spray solution (2 tsp/gal) has been shown to improve control when using spinosad or acetamiprid. The adult flies feed on sugars and by adding sugar to the spray solution it increases its effectiveness by producing a bait in addition to a cover spray.

If plants continue flowering when susceptible ripening fruit is present potential conflicts with pollinating insects can occur. When this happens there are specific label instructions that must be followed to avoid killing these desirable species. No pesticides, of any type, may be applied to a flowering crop during periods of the day when bees are actively present and foraging in the crop. The insecticides listed in Table 2 can be safely applied if they are used during times of the day when bees are no longer on the crop, such as dusk or dawn. These periods of time may also be most appropriate for control since the adult flies are most active in the crop during these times.

Table 2. A summary of insecticides useful for control of spotted-wing drosophila on raspberries, blackberries and strawberries in home gardens

Active Ingredient: Spinosad/Spinosyns

Trade Names: Bonide Captain Jack's Dead Bug Brew, Natural Guard Spinosad Landscape & Garden Insecticide, ferti-lome Borer, Bagworm, Leafminer & Tent Caterpillar Spray, others

Preharvest Interval (caneberries, strawberries): 1 day

Minimum Interval Between Treatments: 5 days

Pollinator Protection Statement: "This product is toxic to bees exposed to treatment for 3 hours following treatment. Do not apply this pesticide to blooming, pollen-shedding or nectar-producing parts of plants if bees may forage on the plants during this time period."

Active Ingredient: Acetamiprid

Trade Names: Ortho Flower, Fruit and Vegetable Insect Killer

Preharvest Interval (caneberries, strawberries): 1 day

Minimum Interval Between Treatments: 7 days

Pollinator Protection Statement: "This product is toxic to bees exposed to direct treatment. Do not apply this product while bees are actively visiting the treated area."