

Spotted Wing Drosophila Management in Maryland Small Fruit

Spotted wing drosophila (SWD), *Drosophila suzukii*, is an invasive, destructive pest, originating from eastern Asia that has recently been found in Maryland infesting blackberries and raspberries. The adult SWD looks like many other *Drosophila* species (also called vinegar flies) that attack rotting fruit. SWD can be a devastating pest because it attacks undamaged, ripe or unripe fruit. This pest was first found on the west coast of the United States in 2008. In 2010, it was found in the Midwest, FL and PA, primarily in strawberry or grapes. This rapid spread through the country was most likely due to human intervention.

Identification SWD adults are small (1/10 inch) flies with red eyes and a pale brown body with black stripes on their abdomen. The most distinctive trait of adult males is a black spot towards the tip of each wing (Photo 1). Females DO NOT have these spots, but instead have a dark, serrated ovipositor with 2 rows of prominent teeth that they use to cut into fruit and lay their eggs (Photo 2). The ovipositor can only be correctly identified by using significant magnification (at least 20x). The immatures of the SWD are very small, clear or white maggots that are found in the fruit (Photo 3).



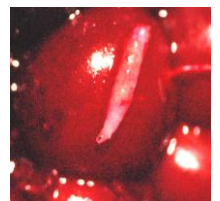
Photo 1. Male SWD. Arrows show a key characteristic of males—the spot near the tip of their wings



Photo 2. Female SWD. Showing serrated teeth on ovipositor

Life Cycle SWD overwinter as adults and become active in the early spring. They are most active when highs are between 62° and 83°F, conditions are humid, and fruit is available. In laboratory studies, they are most active at 68°F; with activity becoming reduced at temperatures above 86°F, when adult males become sterile (Hoddle 2010). The SWD can complete one generation in as short as 12-14 days, allowing it to quickly develop large populations. The SWD probably has 10-12 generations per growing season in the mid-Atlantic.

Photo 3. SWD larva



Damage The major difference between the SWD and other vinegar flies is that this pest attacks healthy, ripening fruit as well as damaged or rotting fruit. The serrated ovipositor of the female allows her to penetrate fruit and lay eggs just under the skin, causing a depression, dimple or puncture that can easily be seen in smooth skinned fruit such as cherry (Photo 4). Any thin skinned fruit is vulnerable, such as blueberry, raspberry, blackberry, cherry, strawberry, grape and to a lesser extent plum cherry, apple, persimmon, plum, peach, and other tree fruit. The female will lay 1-3 eggs each on many fruit. Because many female flies will oviposit on the same fruit over time, there often are larvae of different sizes (ages) within a single fruit. Eggs hatch and the maggots develop and feed inside the fruit (Photo 5), causing the fruit to turn brown and soft (Photos 6 and 7). Larvae pupate in or outside of the fruit. In

Photo 4. SWD punctures (red arrows) and dimple (white arrow) in cherry



Photo 5. SWD maggot in fruit



smooth-skinned fruit like blueberries and cherries, an ooze of fluid often appears on the surface of the fruit. As the sugar content of fruit increases, the amount of oviposition by female flies also increases, as does the survival of larvae.

Photos 6 and 7. Blackberries and raspberries have similar looking damage, which includes collapsed or softened drupelets (yellow arrows), but the center core of raspberry fruit often begin to rot when maggots feed (white arrow).



Monitoring An essential part of any management program for SWD is to monitor both the adults and the fruit. Flies need to be monitored to be sure treatments are made before fruit is attacked. The easiest way to monitor the adults is to use a trap. Traps are not hard to construct and there are several web sites that tell you how to construct one out of a plastic cup and wire (see web resources at end of this article). Additionally, there are commercial traps available, which make for easy and consistent trapping results (Photo 7). An effective and easy bait to use in these cup traps is apple cider vinegar which is readily available, inexpensive and stores for long periods of time without refrigeration or spoilage (Beers, et al. 2010). The trap should contain 1-2 inches of the liquid bait, which should be changed every 2 weeks or so. Traps should be placed in the field at fruit level (Photo 7) as soon as fruit begins to develop and checked every 3-5 days. Traps should be located in an area where fruit is developing and in the shade as much as is possible.

Photo 7. Commercial SWD trap in grapes



Male SWD caught in traps can be identified with the unaided eye, although magnification of 10X can help. SWD females need a higher magnification (15-20X) for proper identification, which should be left to an Extension Entomologist or Fruit Specialist. Fruit also should be inspected every 3-5 days for any depressions or signs of larval activity starting from the time any color shows and as the fruit ripen. In blackberries and raspberries the drupelets will collapse and soften when larvae are feeding (Photos 6 and 7). Fruit also should be torn open at this time to look for larvae. Once inside the fruit larvae will not be affected by any foliar sprays. As fruit begin to become over-ripe on the plant, other *Drosophila* species will begin to invade. In Maryland raspberries and blackberries, 60-70% of the adults captured in traps in areas of over ripe fruit are not SWD, but other *Drosophila* species that are only feeding on rotting fruit. Growers should be sure to correctly identify SWD as the harvest season progresses, and not assume every fly around fruit or in a trap is a SWD.

Management

Chemical Sprays must be applied before eggs are laid in fruit. If SWD are caught in monitoring traps, insecticide applications should be made quickly to prevent damage. There are several insecticides that have been found to be effective at reducing SWD damage and lowering adult populations. These include: Pyrethroids: fenpropathrin (Danitol), zeta-cypermethrin (Mustang Max), and lambda-cyhalothrin (Warrior); Neonicotinoids: acetamiprid (Assail) and imidacloprid (Provado); Spinosyns: spinetoram (Radiant) and the organophosphate Malathion, which has a short preharvest interval (PHI), making it useful during harvest. Fenpropathrin also has a short PHI. Be sure to READ THE LABEL before applying any insecticide to your crop as some chemicals can be used on some fruit, but not others and preharvest intervals can also vary by fruit crop. After treatments begin, SWD adult populations may not be reduced to low numbers (hence their numbers could stay up in trap catches), but new damage to fruit is greatly reduced (Anon. 2011). Therefore, it is important to assess both adult populations and fruit damage to get a complete understanding of how management tactics are working.

Organic The organic pyrethrums have some effect on reducing SWD damage as do neem products. SWD is susceptible to infection from *Beauveria bassiana*, a fungus that attacks many different insect species. The commercial product *balEnce* (Rincon-Vitova Co.) is a strain of *B. bassiana* specific to flies that reportedly works against *Drosophila*.

Sanitation Just as in sap beetle management, it is important to eliminate any fruit that have fallen to the ground and any infested fruit remaining on plants. This will help reduce populations of flies that might infest later ripening crops or varieties or even next year's crop.

Differing Fruit Susceptibility Among the caneberries, raspberries and blackberries appear to be the most susceptible. Strawberries are also susceptible but only if very moist conditions are present and fruit are not harvested frequently. Blueberries are attractive to SWD, but tend to be less so when it is hot and dry. Tree fruits are also vulnerable with cherries the most likely to suffer heavy damage.

Web resources

How to build a SWD Trap:

http://extension.oregonstate.edu/douglas/sites/default/files/documents/hort/2010/spotted_wing_drosophila_traps_osulecture1.pdf

http://ipm.wsu.edu/small/pdf/SWD_Bulletin_Eastern_WA_v1_04.pdf

<http://www.youtube.com/watch?v=xZpQEsKnQIA>

Commercial SWD traps: <http://www.contech-inc.com/products/traptypes/>

References cited

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Beers, E. H., T. J. Smith, and D. Walsh. 2010. Spotted Wing Drosophila, Orchard Pest Management On-Line. Tree Fruit Research & Extension Center, Washington State University, WA.

Hoddle, M. 2010. Spotted Wing Drosophila or Cherry Vinegar Fly. UC Riverside: Center for Invasive Species Research. Riverside, CA.

Photo credits

Photo 4. U.C. Statewide IPM Program, 2009 Regents University of California; Photo by G. Arakelian

All other photographs by Gerald Brust

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