Spotted Wing Drosophila
Part 2: Natural History

Spotted wing drosophila (SWD) is an invasive vinegar (fruit) fly that was first detected in the United States in 2008 and in Pennsylvania in 2011. SWD differs from other vinegar fly species in that female adults have large, serrated ovipositors that allow them to pierce and lay eggs in unripe fruit. Thus with SWD, larvae may be present in the fruit even before it is ripe. Some Pennsylvania and Maryland growers lost large portions of blackberry, fall-bearing raspberry, and day-neutral strawberries to this pest in 2011.

Environmental Preferences

SWD prefers environments with moderate temperatures and high humidity. Adults are most active at temperatures around 70°F, and their activity is greatly decreased when temperatures are only 15 degrees colder or warmer. Adults are the overwintering life stage, and they are likely to survive northeastern U.S. winter conditions only in protected locations, even when temperatures were as mild as during the winter of 2011–2012. Adults need shelter when temperatures drop below about 50°F and begin hibernation at 40°F. Female adults exposed to cold temperatures lay very few eggs, and the eggs and larvae are killed by several days of exposure to temperatures just above freezing. Thus, seasonal populations are likely to start out extremely low in each spring, increase as temperatures warm, decline during hot spells, and then increase very rapidly during early fall when temperatures become more ideal. Regardless of whether SWD can overwinter in a region, it can be readily reintroduced in fruit that is shipped from warmer regions. This is indicated by the spread of this pest throughout the eastern United States in only two to three seasons and the detection of SWD in the produce sections of many retail stores.

SWD has been found in both field and high-tunnel environments. Whether or not SWD prefers high tunnels to field conditions is likely to depend on the year and weather conditions. Presumably, the warmer temperatures in tunnels and lack of wind would be attractive to SWD early in the growing season and in the fall.

Life Cycle

SWD progresses through four life stages: egg, larva, pupa, and adult. The time required to complete each life stage depends on temperature, with warmer temperatures speeding up development to a certain maximum. For example, according to one study, an increase in temperature (from 59°F to 77°F) decreased the time required to complete all four stages from 23 days to 10 days.

As mentioned above, SWD primarily overwinters as adults in protected locations, and females may become active a few days earlier in the year than males. Adult SWD may be found flying in protected locations even during the winter on abnormally warm days, but generally they are expected to emerge in the Northeast in May. However, in 2011 detections in traps in Pennsylvania began only in early to mid-July. Adults live for 2 to 9 weeks, except for overwintering individuals, which may survive from fall into early summer. Females begin laying eggs in fruit as it starts to turn color. An individual female may lay between 100 and 600 eggs during her lifetime depending on the host crop and the temperature. Depending on the temperature, eggs may hatch in as little as 2 hours to as much as 3 days. Larvae (maggots) feed in the fruit for 3 to 13 days (Fig. 1), and

Figure 1

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pupation lasts for 3 to 15 days either inside the fruit or on the ground. Females emerging from pupation begin laying eggs an average of 2 days after emergence.

Thus, multiple generations per year occur, with eight to nine generations per year expected for the Mid-Atlantic region, and the proportion of fruit affected can increase rapidly during the season. As with all fruit flies, SWD will continue to breed in dropped fruit residues after harvest has been completed, sometimes for the remainder of the growing season.

Host Plants and Feeding Preferences

SWD was originally called the "cherry vinegar fruit fly" because it has been problematic on cherries in its native region and is now a serious problem of cherries in the Pacific Northwest. In the northeastern United States, raspberries and blackberries have been preferred crops for SWD, with fall-harvested cultivars at most risk because of increases in SWD late season populations. On fall raspberries, SWD may be found feeding on juice on raspberry receptacles even after the fruit has been harvested (Fig. 2).

Figure 2

Day-neutral strawberries harvested in the fall have also been severely injured in some cases. Other crops in the Northeast that have been hosts to SWD include raspberries, blackberries, cherries, blueberries, peaches, nectarines, hardy kiwi, cranberries, and grapes. SWD has not been problematic on short-day strawberries in the Northeast because of the early season harvest dates. Wild plants that can be hosts include wild raspberries, blackberries, blueberries, elderberries, and even dogwood, viburnum, and bush honeysuckle. SWD has also been found on tomatoes, though primarily when the fruit is already cracked or injured.

Site-Specific Effects

The extent to which a particular crop is affected by SWD varies widely with availability of alternate host plants throughout the growing season. This makes diversified fruit farms with multiple crops maturing throughout the season particularly at risk. Which other host plants are in the area, SWD host preferences, size of plantings, pesticide applications, and the relative timing of fruit ripening among hosts in the area will affect SWD incidence on a particular crop. For example, in Pennsylvania, high populations of SWD were found in cherry orchards well into the fall, indicating that farms with cherries in the vicinity should be closely monitored the following spring.

Fruit variety grown also affects SWD preferences. Generally, darker-colored fruit is preferred over light-colored fruit, and a thicker/tougher skin may dissuade SWD from choosing certain varieties. Sugar or volatile levels of individual varieties could play a role as well, though little data exist in this area.

Monitoring each susceptible crop on a farm is strongly recommended, as a complete picture on which sites are most likely to be at risk is not yet clear. See the Penn State Extension fact sheet "Spotted Wing Drosophila, Part 3: Monitoring" for additional information on this topic.

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