

Spotted Wing Drosophila

Part 2: Natural History

Spotted wing drosophila (SWD) is an invasive vinegar (fruit) fly that was first detected in the western United States in 2008 and in the Northeast in 2011. SWD female adults have large, serrated ovipositors that allow them to pierce and lay eggs in unripe and ripe fruit. Thus, their larvae can be found in ripe fruit, whereas most other drosophila can lay eggs only in over-ripe and rotten fruit. Some northeastern growers have lost large portions of blackberry, fall-bearing raspberry, blueberry, and day-neutral strawberry crops to SWD.

Environmental Preferences

SWD prefers moderate temperatures and high humidity. Adults are most active at temperatures around 70°F; their activity is greatly decreased when temperatures are only 15 degrees colder or warmer than this. Adults are believed to be the primary overwintering life stage, though in the Pacific Northwest, adults have emerged from pupal cases in early winter. Adults need shelter when temperatures drop. Female adults exposed to cold temperatures lay few eggs, and eggs and larvae can be killed by several days of constant exposure to temperatures barely above freezing. In the Northeast, populations are likely to start out very low in the spring, increase as temperatures warm, decline during hot, dry spells, and then increase during early fall. Regardless of whether SWD can overwinter in a region, it may be reintroduced on infested fruit shipped in, or it may migrate north from southern locations in midsummer.

SWD has been found in both field and high tunnel environments. Contrary to expectations, SWD infestations have tended to be lower in tunnels, possibly due to better cultural management in tunnels (e.g., more frequent harvest intervals, no missed harvests) or longer residual activity of insecticides. Though experience is very limited, SWD was not found overwintering in tunnels kept closed during the winter in Pennsylvania.

Life Cycle

SWD progresses through four life stages: egg, larva, pupa, and adult. The time required to complete each stage depends on temperature, with warmer temperatures accelerating development to a point. In one study, an increase in temperature from

59 to 77°F decreased the time required to complete all four stages from 23 days to 10 days.

SWD is thought to primarily overwinter as adults in protected locations, and females may become active a few days earlier than males. Adult SWD have been found flying during the winter on abnormally warm days, but they generally are expected to become active in the Northeast in May. In 2012, the first year with overwintered SWD in Pennsylvania, the earliest captures were made in mid-June. This followed an unusually warm early spring. Detections in traps in Pennsylvania became more routine in early to mid-July. Degree-day models developed in the Pacific Northwest may be valuable in predicting SWD activity and behavior.

Adults may live for 2 to 9 weeks during the growing season. 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. Larvae hatch in 2 hours to 3 days. Larvae (maggots) feed in the fruit for 3 to 13 days (Fig. 1), and 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.



Figure 1

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Multiple generations per year occur, with eight or nine generations per year plausible for the Mid-Atlantic. Thus, the proportion of fruit affected can increase rapidly during the season.

Host Plants and Feeding Preferences

SWD was originally called the “cherry vinegar fruit fly” in its native region; SWD adults have been found in cherry orchards in central Pennsylvania whether fruit was present or not. In the Northeast, SWD has had the most impact on raspberries and blackberries, especially fall-harvested cultivars. 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 been severely affected on occasion. Other crops in the Northeast suffering significant losses include summer raspberries and mid- to late season blueberry cultivars. Peaches, nectarines, and hardy kiwi have also been affected. To date, June-bearing strawberries and cherries in Pennsylvania have escaped injury. SWD may attack grapes, and oviposition wounds may serve as entry points for fungi that cause fruit rots. Wild host plants include raspberry, blackberry, blueberry, elderberry, pokeberry, and even dogwood, viburnum, bush honeysuckle, and common buckthorn. SWD has been found in large numbers on cull muskmelons and cantaloupes discarded in the field.

In its native range, SWD has been observed feeding on oak sap and ovipositing in certain species of flowers, and adults are thought to survive on honeydew excreted from piercing/sucking insects. This may explain why SWD has been found in unexpected locations and how it survives when fruit is not available.

Site-Specific Effects

The extent to which a particular crop is affected by SWD varies widely. Fruit farms that grow a succession of attractive crops are especially at risk. Other host plants in the area, SWD host preferences, planting size, pesticide applications, and the timing of fruit ripening among hosts will affect SWD damage. For example, fall berry crops near fields of discarded muskmelons were heavily infested with SWD. Conversely, small, isolated plantings of berry crops surrounded by agronomic crops were unaffected

or only minimally affected by SWD, suggesting that rearranging farm crop layout may be helpful.

Fruit variety also affects SWD preferences. Generally, SWD prefer darker 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, though little data currently exist.

Monitoring each susceptible crop on a farm is strongly recommended since the sites most at risk are probably farm specific. See “Part 3: Monitoring” for more information on methods.

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