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Spotted Wing Drosophila: Potential Pest of Arkansas Fruit

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The spotted wing drosophila (SWD) (*Drosophila suzukii*, family Drosophilidae) is a native of Southeast Asia. It attacks almost any soft summer fruit whether unripe, ripe, overripe or rotten.

Background

The spotted wing drosophila was found in California in 2008. From 2009 to 2011, it was detected from Oregon to British Columbia, Louisiana, Michigan, North and South Carolina, Utah (Beers et al. 2010; Davis et al. 2010; Caprile et al. 2011), Alabama, New Jersey, Pennsylvania, Georgia and Virginia (personal communication, H. Burrack). Traps in Arkansas have not detected this pest.

Identification

Unlike many other similar vinegar flies, SWD adult females have a serrated ovipositor (Fig. 1 and 3) (Walsh 2009; Beers et al. 2010; Davis et al. 2010).

The white, oval SWD eggs (Fig. 3 and 4) are 0.6 mm long by 0.18 mm wide with two filaments at one end. Eggs may be laid either on the fruit surface or in the fruit interior (MOA 2009; Walsh 2009).

FIGURE 1. FEMALE SWD with serrated ovipositor.
Photo: BugGuide.net

Legless SWD larvae (Fig. 5 and 6) range from 1 to 3.5 mm long and are brownish-white and cylindrical with two stalks or small finger-like projections on one end (spiracles) and two black mouthparts (MOA 2009; Davis et al. 2010). Larvae develop through three instars in as few as 5 to 7 days (Gerdeman 2011).

The SWD pupae (Fig. 7) are initially white or transparent and football shaped with distinct projections at both ends. Pupae become darker brown with red eyes when mature and reach 2 to 6 mm in length. Females are slightly larger than males (MOA 2009; Beers et al. 2010; Davis 2010).

Adult SWD flies (Fig. 1 and 2) are more robust in appearance than their fruit/vinegar fly counterparts (MOA 2009). Adult SWD are small (2 to 3 mm) with clearly visible red eyes, small featherlike antennae called aristae and pale brown bodies with black stripes on the abdomen. Adult SWD males have one black spot toward the tip of both wings (Fig. 2) that distinguishes them from other species, whereas the female has no wing spot but has a serrated ovipositor (Fig. 1 and 3) (Walsh 2009; Davis et al. 2010).

FIGURE 2. MALE SWD with black spot on wings and large red eyes.
Photo: Davis et al. (2010)

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FIGURE 3. SWD adult female serrated ovipositor and egg.
Photo: Beers et al. (2010)

FIGURE 4. SWD eggs on and below surface of fruit.
Photo: Gerdeman (2011)

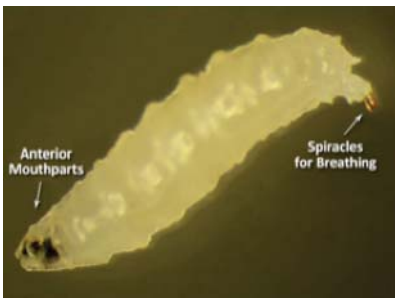

FIGURE 5. SWD larvae; may appear darker as develops.
Photo: Gerdeman (2011)

Biology

As temperatures increase in the spring, overwintered adults emerge (see **Degree Days**), are attracted to and lay eggs into fruits as they ripen. A single female lays an average of 350 eggs (MOA 2009; Walsh 2009; Davis et al. 2010; Gerdeman 2011; Caprile et al. 2011). Eggs hatch quickly within 12 to 72 hours, which is why quick action after detection is so necessary (see **Chemical Control**) (Gerdeman 2011). Pupation, either inside or outside of the fruit, usually takes around 4 to 15 days (Gerdeman 2011). SWD has as many as 13 generations per year in California and 5 in British Columbia (Davis et al. 2010; MOA 2009).

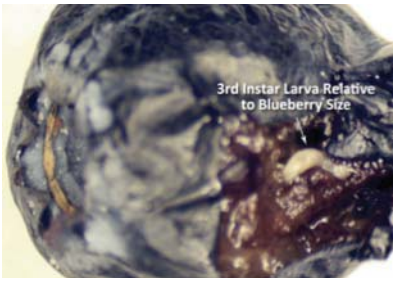

FIGURE 6. SWD larva on a blueberry.
Photo: Gerdeman (2011)

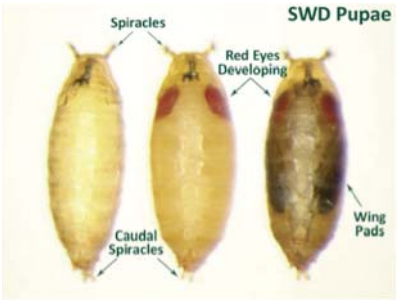

FIGURE 7. Three SWD pupal stages.
Photo: Gerdeman (2011)

Damage

Adults and larvae cause the most damage to fruit. Females can saw into fruit during oviposition and leave a depression (Fig. 8) that can lead to secondary fungal and pest infestations (Davis et al. 2010; Walton et al. 2010).

A female will lay a clutch of one to three eggs in each fruit, with several females laying on a single fruit. Eggs hatch within hours of oviposition, and larvae are then quick to tunnel into the fruit causing abscesses that render the fruit useless (Fig. 6 and 9). This tunneling also increases the risk of secondary fungal infection and secondary pest infestations. In 2009 in California, yield loss estimates ranged from 0 to 80 percent, depending on location and crop (Dean et al. 2009; MOA 2009; Davis et al. 2010; Caprile et al. 2011).

Susceptible Hosts

Susceptible hosts and varieties are numerous. At the time that this fact sheet was written, SWD was found to attack tree fruits like apple, apricot, cherry, mulberry, nectarine, peach, persimmons, plum and pluot; small fruits including blackberry, blueberry, boysenberry, grapes, raspberry and strawberry; vegetable fruits including melons and tomatoes; and almost any other soft-skinned fruit (Beers 2010; BugGuide.net; Davis 2010; Dean et al. 2009; MOA 2010; Walsh 2009; Walton 2010; Caprile et al. 2011).

Sampling

Trapping can determine the presence of adult SWD in a fruit planting. About a month before harvest, hang baited traps in a fruit planting. To set up a bait trap (Beers et al. 2010), use a 1-quart plastic cup punctured with two or three 3/16-inch holes near the top. Pour 3 inches of brown apple cider vinegar into the cup as bait. Then place a yellow sticky card inside the trap and attach the cup cover (Fig. 10). About a month before harvest, hang traps in shade inside and outside of the field near fruit plants. Vinegar should always have a drop or two of unscented dish soap included to break surface tension, and it should be changed weekly. Dump used vinegar away from the crop. Traps should be monitored weekly to twice weekly (Walsh 2009; Beers et al. 2010; Davis et al.

FIGURE 8. Oviposition scar in cherry.
Photo: Bolda et al. (2010)

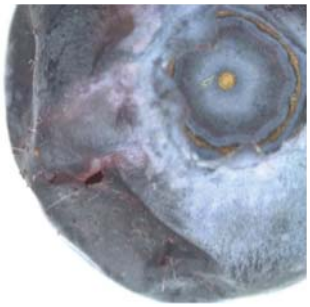

FIGURE 9. Blueberry just three days after egg laying.
Photo: Walton (2010)

FIGURE 10. SWD apple vinegar trap with 3/16-inch holes and yellow sticky card inside.

Photo: Davis et al. (2010)

2010; Dow Agrosciences 2011; Van Steenwyk 2010; Caprile et al. 2011).

You should also check ripening fruit twice weekly for SWD fruit damage symptoms (Fig. 6, 8 and 9) (Walton et al. 2010). Collect suspicious ripening fruit that you might eat. Use the fruit-dunk method to detect SWD larvae by lightly crushing fruit in a container or plastic zip-bag. Add sugar-water (4 cups water and 1/4 cup sugar) to the bag and look for SWD larvae floating to the top (OSU 2010).

Degree Days (DD in °F)

Once present in Arkansas, you could begin sampling for overwintered SWD as early as April or May. Seasonal emergence of overwintered females takes place between 253 and 514 DD accumulated daily since January 1 when temperatures exceed a lower developmental threshold (LDT) of 48°F (Walsh 2009; Davis et al. 2010; Caprile et al. 2011).

Equation to calculate daily DD:

DD = Mean daily temperature – LDT

Males become sterile at temperatures over 86°F (Davis et al. 2010; Caprile et al. 2011). Adults are most active around 68°F when they lay eggs in ripening fruit. The SWD completes a full generation in 338 DD or as few as 13 days (Davis et al. 2010; Caprile et al. 2011; Van Steenwyk 2011). If any SWD are captured in a trap, implement control tactics immediately (see **Cultural** and **Chemical Control**).

Cultural Control

In addition to the chemical control option, there are important cultural practices to help minimize SWD damage. The most important method for avoiding SWD damage is to maintain field cleanliness throughout the season by removing any spoiled, fallen or infested fruit. To reduce the chance of eggs hatching from this fruit, it should be buried, burned or sealed in a sturdy plastic bag and stored at 35°F for 96 hours, then disposed of in the trash or solarized for several days (Caprile et al. 2011; Davis et al. 2010; Dow Agrosciences 2011). It is also important to remove unused orchards, backyard host trees and other potential rearing sites around a property.

Furthermore, ripe fruit should be taken out of the field in as timely a manner as possible either through frequent harvest or harvesting earlier and letting crops ripen while stored (Davis et al. 2010; Dow Agrosciences 2011).

There is also some evidence that exclusion may aid against SWD. Fine-mesh floating row covers can help protect some crops with lower growing heights (Davis et al. 2010).

Finally, the same method used to trap and monitor SWD mentioned earlier in this fact sheet may be used to mass trap to reduce SWD populations. Four to five traps per tree are recommended to trap and kill adults (Davis et al. 2010; Caprile et al. 2011).

Chemical Control

It is being recommended that growers apply full coverage insecticide sprays every 4 to 5 days beginning when SWD is first detected. Residual insecticide control was reported to drop off 3 days after treatment (Davis et al. 2010; Van Steenwyk 2011; Bruck et al. 2011b; Tanigoshi et al. 2011). Re-apply when monitoring traps indicate continued presence of SWD populations and/or you see new SWD larvae in fruit (Bruck et al. 2011a). A list of recommended pesticides is included in Table 1. Be sure to read the label for general directions to apply an insecticide; note rate per acre, restricted-entry interval (REI) and pre-harvest interval (PHI) for each specific fruit or vegetable crop.

TABLE 1. Preliminary recommended insecticides against spotted wing drosophila (Davis et al. 2010; Castagnoli et al. 2010), IRAC # (mode of action) and reported percentage mortality (Bruck et al. 2011a).

Product Name	Active Ingredient	IRAC #	% Mortality (Bruck et al. 2011a)
Sevin	carbaryl	1A	70
Lannate	methomyl	1A	100
Diazinon	diazinon	1B	100
Malathion	malathion	1B	100
Thionex	endosulfan	2A	70
Baythroid	beta-cyfluthrin	3A	100
Brigade	bifenthrin	3A	100
Asana	esfenvalerate	3A	100
Danitol	fenpropathrin	3A	100
Pounce	permethrin	3A	100
Mustang Max	zeta-cypermethrin	3A	100
Provado	imidacloprid	4A	70
Delegate	spinetoram	5	100
Success	spinosad	5	100
Abba	abamectin	6	63
Organic Options			
Aza-Direct	azadirachtin	UN	12 to 40
Entrust	spinosad	5	100
Pyganic	pyrethrin	3A	70 to 90
Oletrol	soybean oil		40 to 60

Bolda (2011) reported that laboratory assays showed that SWD were tolerant to Pyganic (pyrethrins), an organic insecticide. Pyganic (pyrethrins) and Entrust (spinosad) are the two most effective organic control methods against SWD, but both have short residual control times and must be applied frequently. This is a recipe for resistance development. **Plan to rotate insecticides of different modes of action (IRAC #)** (Burrack 2011).

Reporting

Watch for spotted wing drosophila so we can delay their establishment in Arkansas as long as possible. Pathways of potential introduction include hitchhiking on ripe fruit from infested states. Entomologists need to document the expanding range of this pest. Anyone who finds specimens that seem to be the spotted wing drosophila can report them to their county Extension agent, the USDA-APHIS-PPQ (Little Rock) at 501-324-5258 or the Arkansas State Plant Board at 501-225-1598.

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