Spotted Wing Drosophila: Potential Pest of Arkansas Fruit

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).

**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).
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; Gerdeeman 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) (Gerdeeman 2011). Pupation, either inside or outside of the fruit, usually takes around 4 to 15 days (Gerdeeman 2011). SWD has as many as 13 generations per year in California and 5 in British Columbia (Davis et al. 2010; MOA 2009).

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. 2010; Caprile et al. 2011).
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:

\[ DD = \text{Mean daily temperature} - \text{LDT} \]

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, back-yard 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).**

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Active Ingredient</th>
<th>IRAC #</th>
<th>% Mortality (Bruck et al. 2011a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sevin</td>
<td>carbaryl</td>
<td>1A</td>
<td>70</td>
</tr>
<tr>
<td>Lannate</td>
<td>methomyl</td>
<td>1A</td>
<td>100</td>
</tr>
<tr>
<td>Diazinon</td>
<td>diazinon</td>
<td>1B</td>
<td>100</td>
</tr>
<tr>
<td>Malathion</td>
<td>malathion</td>
<td>1B</td>
<td>100</td>
</tr>
<tr>
<td>Thionex</td>
<td>endosulfan</td>
<td>2A</td>
<td>70</td>
</tr>
<tr>
<td>Baythroid</td>
<td>beta-cyfluthrin</td>
<td>3A</td>
<td>100</td>
</tr>
<tr>
<td>Brigade</td>
<td>bifenthrin</td>
<td>3A</td>
<td>100</td>
</tr>
<tr>
<td>Asana</td>
<td>esfenvalerate</td>
<td>3A</td>
<td>100</td>
</tr>
<tr>
<td>Danitol</td>
<td>fenpropathrin</td>
<td>3A</td>
<td>100</td>
</tr>
<tr>
<td>Pounce</td>
<td>permethrin</td>
<td>3A</td>
<td>100</td>
</tr>
<tr>
<td>Mustang Max</td>
<td>zeta-cypermethrin</td>
<td>3A</td>
<td>100</td>
</tr>
<tr>
<td>Provado</td>
<td>imidacloprid</td>
<td>4A</td>
<td>70</td>
</tr>
<tr>
<td>Delegate</td>
<td>spinetoram</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Success</td>
<td>spinosad</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Abba</td>
<td>abamectin</td>
<td>6</td>
<td>63</td>
</tr>
</tbody>
</table>

**Organic Options**

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Active Ingredient</th>
<th>IRAC #</th>
<th>% Mortality (Bruck et al. 2011a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aza-Direct</td>
<td>azadirachtin</td>
<td>UN</td>
<td>12 to 40</td>
</tr>
<tr>
<td>Entrust</td>
<td>spinosad</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Pyganic</td>
<td>pyrethrin</td>
<td>3A</td>
<td>70 to 90</td>
</tr>
<tr>
<td>Oletrol</td>
<td>soybean oil</td>
<td></td>
<td>40 to 60</td>
</tr>
</tbody>
</table>
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 #) (Burrrack 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.

References


Much of the information obtained for this fact sheet was gathered by the authors at the University of Arkansas, Fayetteville. All chemical information is given with the understanding that no endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned. Before purchasing or using any pesticide, always read and carefully follow the directions on the container label.

Printed by University of Arkansas Cooperative Extension Service Printing Services.

DR. DONN T. JOHNSON is professor and Extension entomologist - fruit, Department of Entomology, University of Arkansas Division of Agriculture, University of Arkansas, Fayetteville. JOSEPH O’NEILL is an undergraduate student in the Horticulture Department, University of Arkansas, Fayetteville.

FSA7079-PD-12-11N

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director, Cooperative Extension Service, University of Arkansas. The Arkansas Cooperative Extension Service offers its programs to all eligible persons regardless of race, color, national origin, religion, gender, age, disability, marital or veteran status, or any other legally protected status, and is an Affirmative Action/Equal Opportunity Employer.