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Managing Spotted Wing Drosophila in Florida Blueberries[1]

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Spotted wing drosophila (SWD), Drosophila suzukii (Matsumura) (Diptera: Drosophilidae), is an invasive pest that was introduced into Florida in 2009. This pest originated in Southeast Asia and resembled other common Drosophila flies that accumulate on over-ripe fruit beginning to decay.

Since its first detection in 2009, SWD has been established in all of Florida's fruit-producing counties. Surveys indicate that SWD are active year-round in Florida's warm climate, with peak activity from April to May when the blueberry harvest is at its peak. Although SWD is a significant pest of blueberries in Florida, with good cultural practices, proper monitoring, and appropriate insecticide applications it can be successfully managed. This publication is intended to be used as a resource for Florida blueberry growers to successfully identify and manage SWD.

Damage

Adult female SWD lay their eggs primarily in ripe fruit, and the larvae hatch and consume the fruit from the inside, ultimately causing the fruit to collapse. Punctured holes in the fruit from egg-laying females can lead to secondary infections by fungal and/or bacterial pathogens, either in the field or post-harvest. The presence of SWD larvae and the resulting damage is unacceptable for the fresh berry market. Visible larvae or damage on the fruit will often cause entire loads of blueberries to be rejected by packing houses or distributors. However, infested fruit can sometimes go unnoticed until the fruit is in consumers' hands.

Management

The low tolerance for SWD in fruits demands appropriate management tactics to protect Florida blueberry crops. To date, there are no action thresholds for SWD; therefore, correct identification of the pest is essential. Integrated pest management (IPM) techniques should be used to manage SWD, including identification and monitoring, good cultural practices, and the application of appropriate labeled insecticides.

Identification

Adult SWD are small (1/8 in or 3–4 mm), with a yellowish-brown body, black stripes across the abdomen, and prominent red eyes. The male SWD can be recognized by a single dark spot on the front margin of their wings that is lacking in most other Drosophila flies (Figure 1). The female SWD lacks the dark wing spots and has a large, serrated ovipositor (egg-laying organ) that is used to cut into ripe fruit to lay eggs underneath the fruit skin (Figure 2). A single adult female can produce 300–600 eggs during its lifetime. The eggs have breathing tubes that extend through the berry skin (Figure 3). Spotted wing drosophila eggs produce white cylindrical larvae (maggots) with black mouthparts (Figure 4) that feed on soft fruit tissues before the berries are harvested, causing the fruit to degrade. Each generation can take as little as 8–10 days from egg to adult at optimal temperatures ranging from 22°C to 28°C (71.6°F–82.4°F), and there can be multiple overlapping generations present during the blueberry harvest window.

Spotted wing drosophila belongs to a different family from fruit flies, which belong to the family Tephritidae and include Mediterranean fruit fly, blueberry maggot fly, Caribbean fruit fly, Oriental fruit fly, and Mexican fruit fly, as well as others often reported in the news media. Drosophilid flies are not closely related to tephritid flies, and management of the two groups is different. For instance, rare outbreaks of Mediterranean fruit flies in Florida have been managed in part with mass releases of sterilized male Mediterranean fruit flies, but so far there has been no research on SWD in Florida that has been focused on releasing sterilized insects.



Figure 1. Male (left) and female (right) spotted wing drosophila. Note dark wing spots on male.
Credit: Arden R. Lambert and Lyle Buss, UF/IFAS



Figure 2. Spotted wing drosophila female ovipositor.
Credit: Arden R. Lambert and Lyle Buss, UF/IFAS



Figure 3. Spotted wing drosophila breathing tube. Spotted wing drosophila eggs are deposited under the skin of a blueberry fruit. Breathing tubes can be seen protruding from the blueberry surface.
Credit: Lyle Buss, UF/IFAS



Figure 4. Spotted wing drosophila larva on blueberry fruit.
Credit: Lyle Buss, UF/IFAS

Monitoring

Producers can determine whether SWD are present on their farms by monitoring strategically placed traps for captured adults. Place traps and begin monitoring them during the early stages of fruit development and continue through the end of harvest. Hang traps throughout the field and along the field border. Place traps in the center of the bushes, in the shade, and away from morning sun; and check the traps at least weekly.

Spotted wing drosophila traps are commercially available from different suppliers. Two of the most commonly used traps with lures are the Scentry and Trécé traps. Both have lures that are intended to mimic the SWD's food source. The Scentry (Figure 5) and Trécé (Figure 6) traps are a wet trap and a sticky card, respectively. One study has shown that a red sticky trap using the Trécé lure was more effective at trapping the initial emergence of SWD (i.e., it trapped SWD earlier than the other traps included in that study). The same study showed that the Scentry wet trap captured more SWD overall, although it also captured many beneficial insects (Panthi et al. 2022).

Monitor for larvae in fruit by placing a sample of at least 15 berries in a strong salt solution (one cup of salt to one gallon of water). If any larvae are present, they will begin to emerge after approximately 30 minutes. A sugar solution or boiling can also be used, which involves submerging fruit that is possibly infested with SWD maggots into a sugar solution or into boiling water to induce any maggots to emerge from the fruit.

If you detect any adults or larvae, take action immediately to manage the infestation.



Figure 5. Scentry wet trap.
Credit: Arden R. Lambert, UF/IFAS



Figure 6. Trécé sticky trap.
Credit: Arden R. Lambert, UF/IFAS

Cultural Practices

Pruning

Spotted wing drosophila adults are sensitive to temperatures higher than 30°C (86°F) and conditions dryer than 20%–33% RH, so they tend to prefer the inside and lower parts of the plant canopy, where it is cooler and more humid (Tochen et al. 2015; Enriquez and Colinet 2017). Pruning to open the plant canopy, in addition to helping with disease management, can also make the canopy less hospitable to SWD. A less dense canopy can also improve pesticide spray coverage.

Weed Mat

Spotted wing drosophila can pupate in the beds beneath blueberry plants. Weed mat on plant beds can provide a barrier that prevents SWD from entering the soil to complete their life cycle, reducing the number that emerge as adults.

Harvest Intervals and Sanitation

Cultural practices that reduce SWD breeding sites include short harvest intervals (every 4–5 days when possible) and properly disposing of overripe or damaged fruit. Unmarketable fruit should be buried or sent to municipal disposal sites. It is important to bury fruit at least 6 inches (15 cm) deep to reduce SWD emergence from the soil. The fruit can also be placed inside plastic bags in the sun or frozen to kill any SWD.

Alternate SWD Hosts

Removing alternate SWD hosts (e.g., wild blackberry, Rubus ursinus; wild Vaccinium species; honeysuckle, Lonicera spp.; pokeweed, Phytolacca americana; beautyberry, Callicarpa americana; nightshade Solanum spp.; wild grape, Vitis vulpine; holly, Ilex spp.; etc.) from areas adjacent to production fields can help reduce infestations of SWD.

Postharvest Cooling

Fruit should be cooled to 35°F as soon after harvest as possible to maintain fruit quality and inhibit the development of any SWD eggs and larvae inside the berries.

Tillage

Tillage in the row middles can help to reduce SWD populations by destroying microhabitats that contain developing larvae and pupae.

Biological Control

Ganaspis kimorum (formerly G. brasiliensis) is a solitary larval parasitoid wasp of SWD. It is one of the tools being evaluated for the biological control of SWD. Ganaspis kimorum is native to Asia and was approved in January 2022 for release in Florida. Information on release protocols is still being developed. However, Ganaspis kimorum has been released in several natural areas adjacent to blueberry farms with the long-term goal of controlling SWD in adjacent overwintering sites. Specific areas where the releases will be done are still being studied. In 2024, we recaptured a small percentage of the wasps released in 2024, potentially indicating that they can survive Florida's conditions and continue their life cycle (O. E. Liburd unpublished data).

Pesticides

Apply registered insecticides immediately upon detecting SWD. Again, as of the date of this publication, no action thresholds have been established for this pest. Some blueberry growers make preventative applications of insecticides, especially if SWD are seen in traps adjacent to production areas or have been present during previous years. Table 1 lists registered insecticides for use against SWD. These insecticides target adult flies; there are no insecticides available for egg or larval control inside fruit. Spray applications should be made in the early morning or late evening, when SWD adults are most active, and good spray coverage is essential. If flies are absent as indicated by a rigorous monitoring program, pesticide sprays for SWD may be delayed until a presence is detected. A rotation program using insecticides with different modes of action should be used to minimize the development of resistance. All label instructions for insecticides must be followed. If you are exporting fruit, carefully check the maximum residue limits for the importing jurisdiction.

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Table 1. Suggested conventional insecticides for managing SWD in highbush blueberries. Table 1 lists registered pesticides that should be integrated with other pest-management methods. Contact your local UF/IFAS Extension office for more information.

Pesticide active ingredients (Commonly used products)	IRAC MOA	Application (rate and total/year)	Reentry (days)	Application methods and effectiveness (blank if unknown); other pests controlled (see product label for details) (restricted use is indicated in bold type)
zeta-cypermethrin (Mustang Maxx®)	3A	4 fl oz per acre, max 6 applications/year	12 hours	**Restricted Use** Highly effective against SWD Also used for aphids, armyworms, bean leaf beetle, Colorado potato beetle, cutworms, corn borers, grasshoppers, leafhoppers, loopers, Lygus bugs, mealybugs, stink bugs, tomato fruitworm, whiteflies, webworms, white grubs, and other species
spinetoram (Delegate®)	5	3–6 oz/acre, max 5 applications/year	4 hours	Highly effective against SWD Also used for codling moth, leafrollers, thrips, blueberry maggot, corn earworm, beet armyworm, Colorado potato beetle, grape berry moth, oriental fruit moth, tomato fruitworm, plum curculio, cabbage looper, diamondback moth, and other species
cyantraniliprole (Exirel®)	28	13.5–20.5 fl oz/acre, max 4 applications/year	12 hours	Highly effective against SWD Also used for lepidopteran and dipteran leafminers, fruit flies, beetles, weevils, whiteflies, thrips, aphids, and psyllids
malathion (Malathion®)	1B	1.5–2.5 pt/acre, max 3 applications/year	12 hours	Moderately effective against SWD Also used for aphids, spider mites, thrips, whiteflies, and other species
fenpropathrin (Danitol®)	3A	10–16 fl oz/acre, max 2 applications/year	24 hours	Highly effective against SWD Also used for aphids, whiteflies, thrips, armyworms, and other species
bifenthrin (Brigade®)	3A		12 hours	Moderately effective against SWD Also used for stink bugs, plant bugs, bollworms, mites, and other species
phosmet (Imidan®)	1B	1.5–2 ln/acre, max 3 applications/year	24 hours	Highly effective against SWD Also used for apple maggot, codling moth, plum curculio, and other species
acetamiprid (Assail®)	4A	2.5–4 oz/acre	12 hours	Moderately effective against SWD Also used for aphids, leafhoppers, thrips, whiteflies, and other species
tolfenpyrad (Apta®)	21A	8–12 oz/acre	12 hours	Moderately effective against SWD Also used for aphids, leafrollers, ambrosia beetles, and other species

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Preferred insecticides include Imidan, Mustang Maxx, Exirel, and Delegate. It is important to rotate among chemical classes to decrease the risk of insecticide resistance. See the 2024 Blueberry Integrated Pest Management Guide for additional information.

Table 2. Suggested organic insecticides for managing SWD in highbush blueberries. Table 2 lists registered pesticides that should be integrated with other pest-management methods. Contact your local UF/IFAS Extension office for additional information (UF/IFAS locations at the bottom of the webpage).

Pesticide active ingredients (Commonly used products)	IRAC MOA	Application (rate and total/year)	Reentry (days)	Application methods and effectiveness (blank if not known); other pests controlled (see product label for details)
Spinosad (Entrust®)	5	4–6 fl oz/acre, max 3–6 applications/year	1–7 days depending on crop	Highly effective against SWD Also used for armyworms, thrips, leafminers, codling moths, fruit flies, and other species
Pyrethrum (Pyganic®)	3A	16–64 fl oz/acre, max 8 applications/year	12 hours	Moderately effective against SWD Also used for aphids, beetles, caterpillars, whiteflies, and other species
Chromobacterium subtsugae (Grandevo®)	Unlisted	1–3 lbs/acre	4 hours	Moderately effective against SWD Also used for aphids, leafhoppers, thrips, mites, and other species
Burkholderia spp. (Venerate®)	UNB	1–4 qts/acre	4 hours	Moderately effective against SWD Also used for aphids, leafhoppers, thrips, mites, and other species
Azardirachtin and Pyrethrins (Azera®)	UN and 3A	1.5–2.5 pt/acre	12 hours	Moderately effective against SWD Also used for aphids, beetles, caterpillars, whiteflies, and other species

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Organic growers are at a higher risk of SWD infestation due to the limited number of chemical tools available for its control. Entrust is the base for management in an SWD program along with the rotation of another other insecticides labelled for organic use. Suggested organic insecticides include Entrust®, Pyganic®, Grandevo®, Venerate®, and Azera®

Always check with your organic certifier before applying any pesticides.

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