

# Cultural control strategies to manage spotted-wing drosophila

Dalila Rendon, Serhan Mermer, Linda Brewer, Daniel Dalton, Cherre Bezerra Da Silva, Jana Lee, Rachael Nieri, Kyoo Park, Ferdinand Pfab, Gabriella Tait, Marco Rossi-Stacconi, Nik Wiman and Vaughn Walton

## Key points

- Spotted-wing drosophila undergo complete metamorphosis (egg, larva, pupa, adult). Eggs can develop to pupae inside fruit. The developing larvae feed on the pulp of the fruit and commonly leave the fruit to find suitable pupation sites. SWD pupae are often found in the ground.
- Immature life stages within the fruit are protected from adverse environmental conditions and pesticides.
- SWD adults are more susceptible to pesticide applications than earlier life stages because they live outside of fruit pulp.
- SWD egg laying is more elevated in shady, humid portions of the crop canopy.
- Temperatures on weed fabric are less optimal for the survival of pupating SWD larvae.
- Overhead sprinklers create a more suitable climate for SWD than drip irrigation.
- Canopy pruning concurrently reduces microclimate suitability and egg-laying.
- Surrounding vegetation may offer optimal habitat and microclimates and increase pest pressure.
- Proper management of surrounding vegetation may reduce SWD survival.

# Spotted-wing drosophila life cycle

Cultural controls can reduce spotted-wing drosophila population pressure by modifying the microclimate within the crop so the environment does not promote SWD reproduction and survival.

The rate of SWD development and reproduction depends on temperature and humidity. Flies can develop from the egg stage to reproductive adults within one to two weeks when temperatures are within optimum range: 71–82°F (22–28°C) and humidity is 80%–90%.

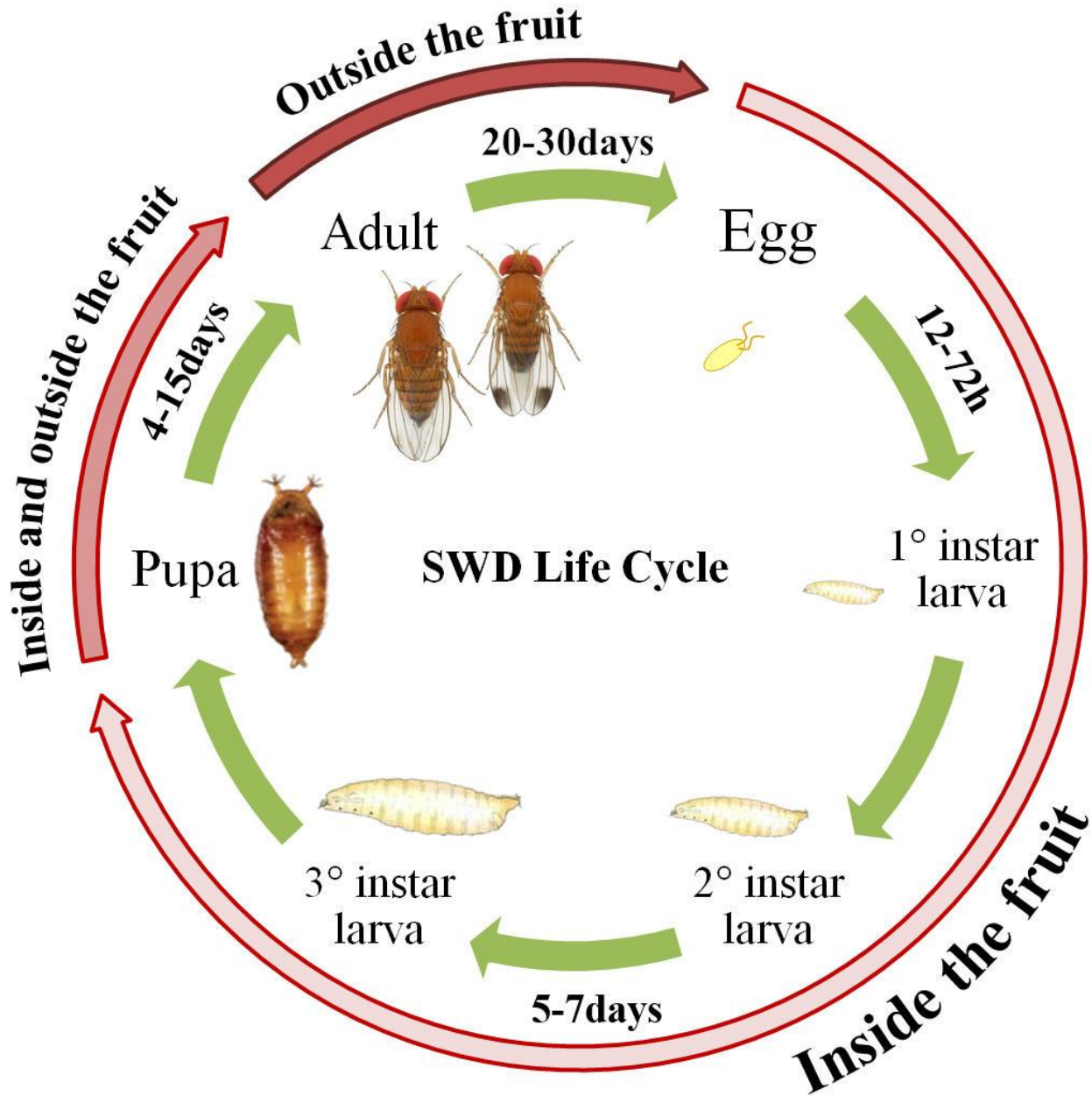


Figure 1. Spotted-wing drosophila spend part of their life inside the fruit and part outside.

Illustration: Marco Rossi-Stacconi, © Oregon State University

SWD undergo a complete metamorphosis. Eggs develop into three larval stages, pupae and finally adults. During the growing season, the egg, larval and pupal stages last from one to three, five to seven, and four to 15 days, respectively. In the mid-Willamette Valley, SWD have five to ten generations during the growing season (Figure 1).

Adult life span during the growing season is about three to five weeks. Flies emerging late in the season are adapted to overwintering and may live longer. A single female can lay up to 40 eggs per day and 200–400 eggs total in her lifetime. A female fly lays approximately one to three eggs per oviposition site. Multiple females may lay eggs in the same fruit, giving rise to greater infestation of individual fruits and multiple clutches of larvae.

Immature life stages are sheltered inside the fruit. Eggs are laid directly beneath the skin of the fruit. As the eggs hatch, the larvae consume the fruit pulp. Ultimately, they molt into pupae. Life stages within fruit are protected from adverse conditions, such as dehydration, temperature fluctuations, and full-cover insecticide applications. SWD pupae and adults are more susceptible to adverse environmental conditions than earlier life stages. SWD can pupate inside or outside the fruit. At high infestation levels, a greater proportion of pupae will be found outside the fruit. In such cases, larvae will drop out of fruit before they develop into pupae. Once out of the fruit, pupae tend to burrow into the soil to find a more suitable and protected environment.

#### FACTORS AFFECTING SWD ENVIRONMENT SUITABILITY

- 1 – Irrigation type
- 2 – Presence of weed mat
- 3 – Pruning intensity
- 4 - Surrounding vegetation

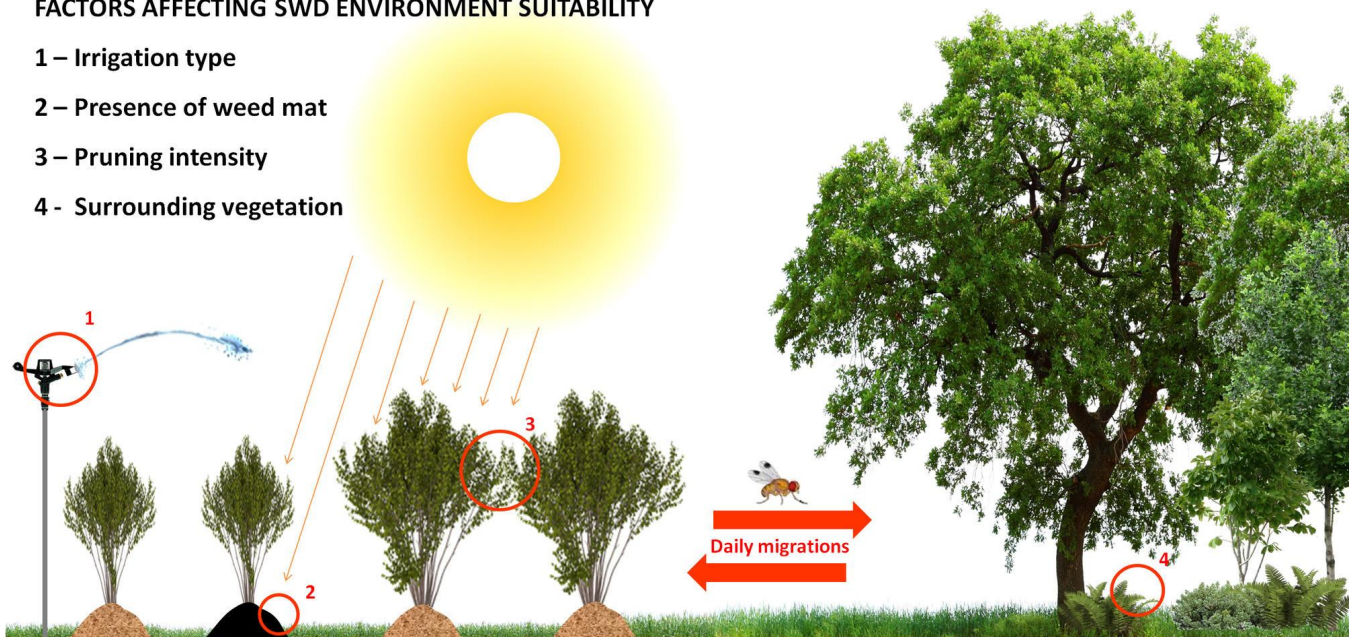


Figure 2. Microclimates can fundamentally change SWD pressure.

1. Drip irrigation reduces relative humidity, creating less suitable microclimates compared to overhead irrigation.
2. Weed fabric reduces the ability of pupating larvae to burrow into more suitable microclimates under the soil.
3. Heavier pruning increases light penetration and reduces shade, resulting in microclimates within the crop canopy that are less suited to SWD. Heavier pruning allows greater penetration of any chemical controls applied to the crop.
4. Surrounding vegetation can serve as a population reservoir if it is close to production areas.

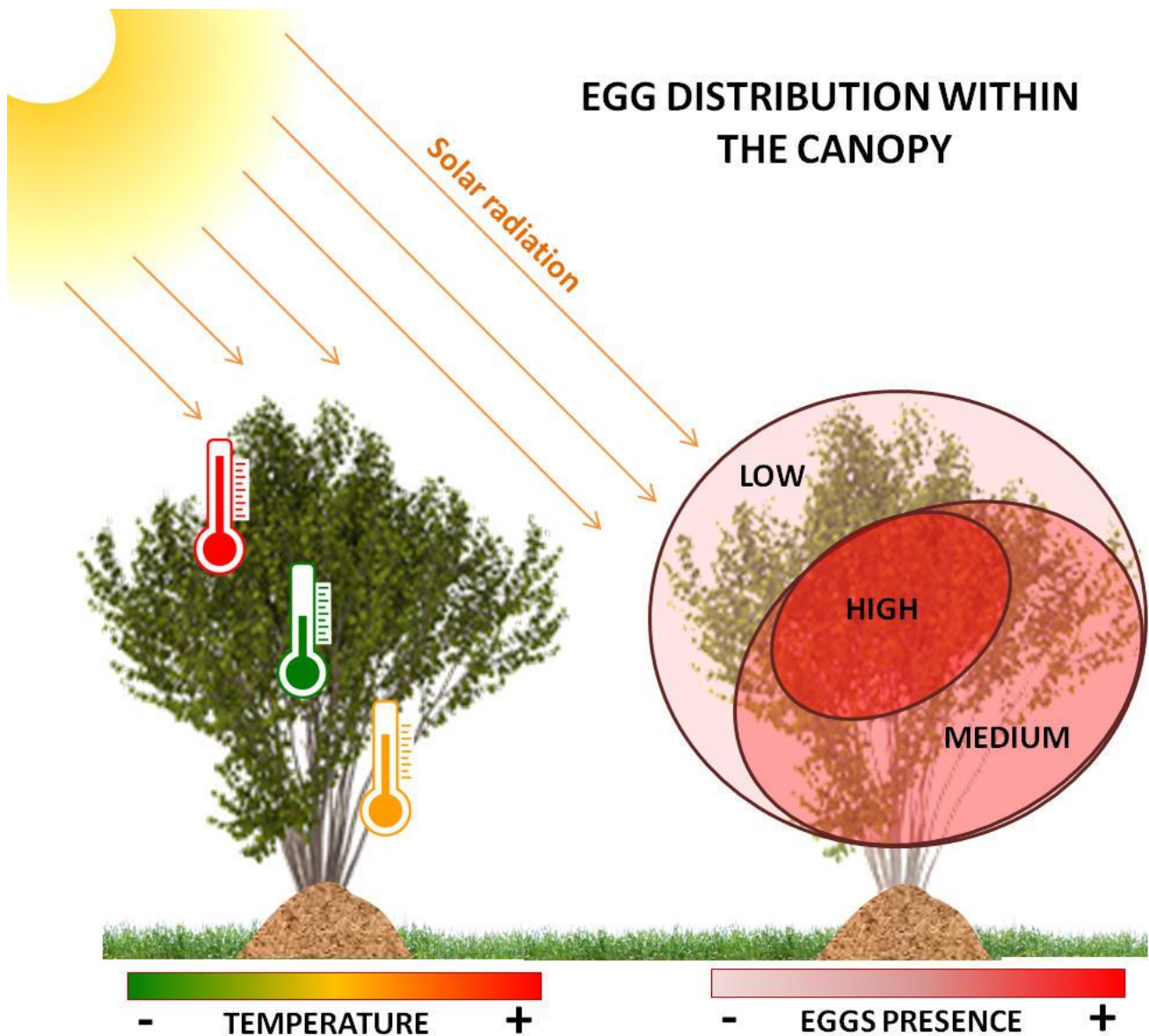
# Microclimates

All factors that affect temperature and humidity in an orchard will also affect the environment for SWD (Figure 2). Overhead irrigation increases humidity and can lead to higher rates of SWD reproduction and development compared to drip irrigation.

Weed fabric prevents pupating SWD larvae from burrowing into the soil. SWD find more suitable temperature and humidity conditions an inch under the soil surface, as opposed to warmer and drier conditions found on the soil surface or weed fabric.

Pupae are very susceptible to desiccation and do not survive when exposed to low humidity.

Surrounding vegetation provides more optimal habitat and microclimates for SWD during the hottest hours of the day. Proper management of surrounding vegetation may alleviate SWD pressure by reducing “hot spots” outside the crop where SWD can overwinter or escape field sprays.





**Figure 3. Temperature and sunlight differences within the canopy affect the distribution pattern of SWD eggs. Because lower temperatures and higher relative humidity are more suitable for SWD survival, flies prefer shaded fruits and fruits in more dense portions of the canopy for egg laying.**

Illustration: Marco Rossi-Stacconi, © Oregon State University

Detailed work showed that SWD lay eggs at elevated levels in the center of the plant canopy. Fewer eggs are laid in the upper and outer portions of the canopy. Eggs laid in fruit in the upper and outer portions of the canopy are more prone to high temperatures during the summer period (Figure 3).

Heavier pruning of dense canopies where SWD hotspots occur can reduce suitable microclimates and result in lower SWD pressure on the crop. Areas where pressure is reduced may require less pruning.

## Resources

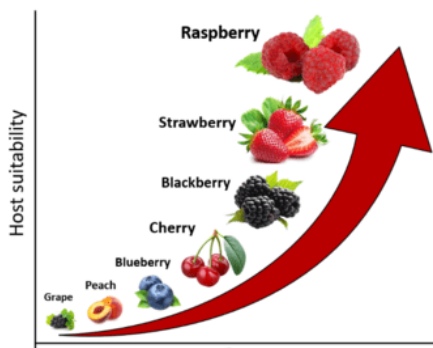
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## About this series

This publication is one of a series of nine publications focused on strategies for controlling spotted-wing drosophila in Oregon. The publications in this series include:

- EM 9261: [How seasons affect population structure, behavior and risk on spotted-wing drosophila](https://catalog.extension.oregonstate.edu/em9261) (<https://catalog.extension.oregonstate.edu/em9261>)
- EM 9262: [Cultural control strategies to manage spotted-wing drosophila](https://catalog.extension.oregonstate.edu/em9262) (<https://catalog.extension.oregonstate.edu/em9262>)
- EM 9263: [Host range and characteristics affecting fruit susceptibility to spotted-wing drosophila](https://catalog.extension.oregonstate.edu/em9263) (<https://catalog.extension.oregonstate.edu/em9263>)
- EM 9264: [Noncrop host plants used by spotted-wing drosophila](https://catalog.extension.oregonstate.edu/em9264) (<https://catalog.extension.oregonstate.edu/em9264>)
- EM 9265: [Chemical control of spotted-wing drosophila: Spray applications](https://catalog.extension.oregonstate.edu/em9265) (<https://catalog.extension.oregonstate.edu/em9265>)
- EM 9266: [Chemical control of spotted-wing drosophila: Insecticide efficacy](https://catalog.extension.oregonstate.edu/em9266) (<https://catalog.extension.oregonstate.edu/em9266>)
- EM 9267: [Monitoring techniques for spotted-wing drosophila](https://catalog.extension.oregonstate.edu/em9267) (<https://catalog.extension.oregonstate.edu/em9267>)
- EM 9268: [Potential impacts of irrigation on biocontrol on spotted-wing drosophila populations](https://catalog.extension.oregonstate.edu/em9268) (<https://catalog.extension.oregonstate.edu/em9268>)
- EM 9269: [Biocontrol of spotted-wing drosophila](https://catalog.extension.oregonstate.edu/em9269) (<https://catalog.extension.oregonstate.edu/em9269>)

## Related publications



### Host range and characteristics affecting fruit susceptibility to spotted-wing drosophila

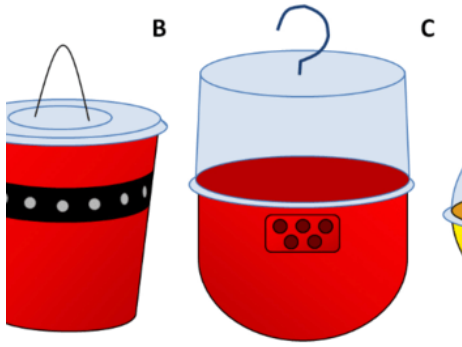
<https://extension.oregonstate.edu/catalog/pub/em-9263-host-range-characteristics-affecting-fruit-susceptibility-spotted-wing>

Spotted-wing drosophila thrives on various soft-skinned fruits, complicating pest management as they can move between hosts with different ripening times for a year-round survival and reproduction.

Vaughn Walton, Marco Rossi-Stacconi, Gabriella Tait, Dalila Rendon, Jana Lee, Rachael Nieri, Linda Brewer | Sep 2024 | EXTENSION

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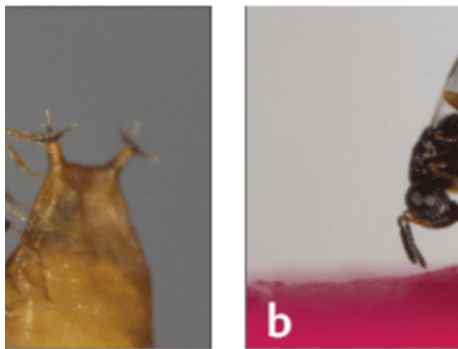


## Monitoring techniques for spotted-wing drosophila

(<https://extension.oregonstate.edu/catalog/pub/em-9267-monitoring-techniques-spotted-wing-drosophila>)

Commercial fruit growers use trapping to monitor for adult spotted-wing drosophila in fields and field borders. They monitor other fruits for infestation using a fruit dunk flotation technique.

Gabriella Tait, Marco Rossi-Stacconi, Elizabeth Miller, Daniel Dalton, Jana Lee, Kyoo Park, Vaughn Walton, Tom Peerbolt, Linda Brewer | Nov 2024 | EXTENSION CATALOG PUBLICATION [Peer reviewed \(Orange level\)](#) (<https://extension.oregonstate.edu/peer-review-guidelines>)



## Potential impacts of irrigation on biocontrol of spotted-wing drosophila

(<https://extension.oregonstate.edu/catalog/pub/em-9268-potential-impacts-irrigation-biocontrol-spotted-wing-drosophila>)

A naturally occurring parasitic wasp in Oregon can help control spotted-wing drosophila in blueberries, but overhead irrigation can limit the effectiveness of this biocontrol method.

Cherre Bezerra Da Silva, Brianna F. Price, Daniel Dalton, Dalila Rendon, Kyoo Park, Linda Brewer, Vaughn Walton, Marco Rossi-Stacconi | Sep 2024 | EXTENSION CATALOG PUBLICATION [Peer reviewed \(Orange level\)](#) (<https://extension.oregonstate.edu/peer-review-guidelines>)



Credit: © Oregon State University (Cropped from original)

## Biocontrol of spotted-wing drosophila

(<https://extension.oregonstate.edu/catalog/pub/em-9269-biocontrol-spotted-wing-drosophila>)

Biological control agents target SWD, predators, parasitoids, nematodes and microorganisms such as fungi and bacteria. Predators eat SWD, removing a substantial portion from the production system.

Marco Rossi-Stacconi, Linda Brewer, Elizabeth Miller, Daniel Dalton, Jana Lee, Kyoo Park, Ferdinand Pfab, Vaughn Walton, Cherre Bezerra Da Silva | Sep 2024 | EXTENSION CATALOG PUBLICATION [Peer reviewed \(Orange level\)](#) (<https://extension.oregonstate.edu/peer-review-guidelines>)

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