Spotted winged drosophila

What would management look like?

Spotted winged drosophila (*Drosophila suzukii*) is a significant horticultural pest native to Asia that has been spreading to a growing number of countries and regions over the past two decades (Fig 1). It has not been found in Australia.

If spotted winged drosophila is found in Australia, and if eradication is not considered possible, growers will need to learn how to manage this serious pest quickly to minimise economic impacts.

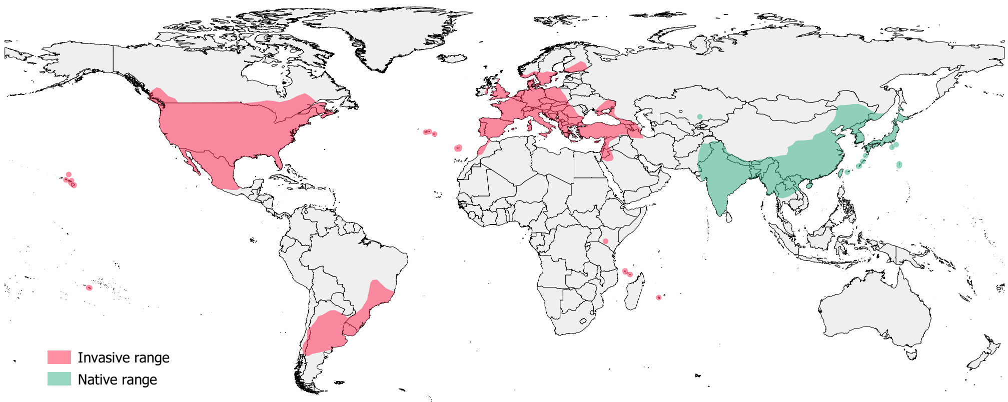


Figure 1. Global distribution of spotted winged drosophila. Source: M. Ørsted, with data from Ørsted and Ørsted (2019)

Consider management from all angles

Overseas management of spotted winged drosophila follows an integrated approach, with a high focus on cultural controls, such as good farm hygeine. In Australia, management would involve introducing a range of practices to maintain crop quality and minimize losses. Highlighted below are key considerations for management based on current international practices and research findings.

Generation time and fecundity

- A female fly lays 1-3 eggs per site and up to 400 eggs throughout her lifetime.
- Population growth throughout a season is highly dependent on environmental conditions (Table 1).
- Spotted winged drosophila will rapidly increase its population size under mild conditions (approx. 22°C).

Table 1. Scenarios for spotted winged drosophila population increase. Source: Tochen et al. (2014)

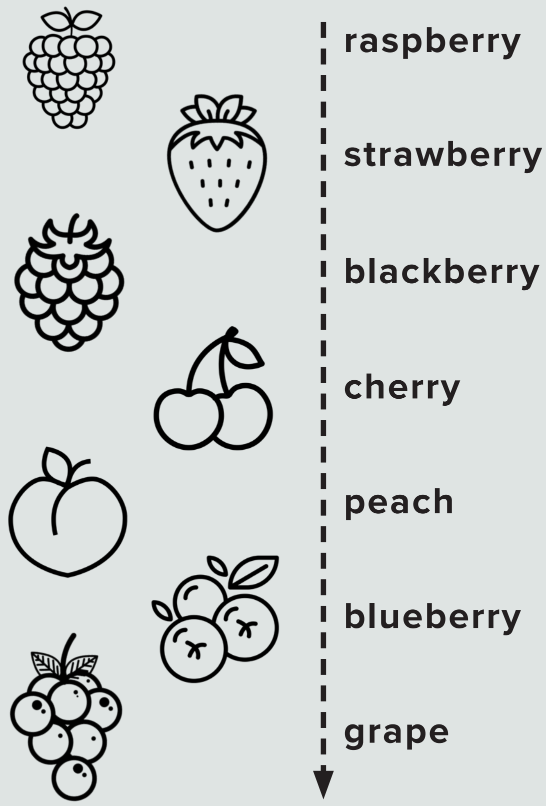
°C	Generation time	
	cherry	blueberry
14	43 days	39 days
22	24 days	25 days
28	12 days	12 days

°C	Reproductive rate	
	cherry	blueberry
14	Low	Low
22	High	High
28	Very low	Very low

If there is an incursion, it is possible that efficiencies could be made by aligning certain practices with those used to manage Queensland fruit fly or Mediterranean fruit fly depending on the location.

Host preferences

- Raspberries bear the brunt of egg laying compared to strawberries, blueberries, and blackberries. This may be due to the thin skin of the raspberry, but research into what drives preferences is ongoing.
- A Host Preference Index (Bellamy et al. 2013) suggests the following preference hierarchy:



Exclusion and mulches

- Exclusion netting must be at least 80 grams.
- Netting must be in place before spotted winged drosophila adults are detected in the area.
- Plastic weed barriers will stop larvae from burrowing into soil to pupate and will reduce presence of standing water, reducing humidity.

Reducing harvest intervals

- Reducing harvest intervals will: reduce olfactory attractants from over ripe fruit; reduce the number of preferred egg laying sites; reduce the number of larvae that develop into adults, limiting population growth.
- Research using raspberry has indicated that harvesting every two days gives good protection from egg lay and does not significantly impact yield. Harvesting every three days resulted in a noticeable difference, with more eggs and larvae detected.

Waste disposal

- Fruit waste should be removed during and after harvest. This includes fruit that has already dropped.
- Waste should be sealed in pallet bins or drums. Fermenting of waste for 2-4 days at 18°C, creates an anaerobic environment that will kill larvae.

Microclimate manipulation

- A humid environment is important for spotted winged drosophila viability.
- Strategic pruning and plant spacing will allow for greater airflow, better chemical coverage and will reduce shading.
- Research into optimised pruning methods is ongoing overseas.

Chemical control & trapping

- If detected in Australia, the minor use and emergency permit system (and registrations) would support access to appropriate chemistry.
- Chemical control must be timed to target the adult.
- Overseas, regular use of a limited number of chemicals has increased risk of resistance. Flare-ups of secondary pests, such as scale, has also been an issue.
- A trapping network set up early in the growing season will give an indication of adult presence, which can help inform strategic spraying (Fig 2).
- A range of lures and trapping systems are now available commercially, or traps can be made at home using basic ingredients, such as wine.

Natural enemies

- Ground dwelling generalists, such as carabid beetles and earwigs are likely to have a suppressive effect (and will need to be protected from off-target insecticide impacts).
- Certain endemic parasitoid wasp species already found in Australia hold potential as biological controls, although further research is needed.

Quality control

- The floatation test can be used as a batch test for infected fruit (Fig 3).
- Training pack shed staff to remove fruit with feeding symptoms (e.g. sunken blemishes) adds another layer of quality control.

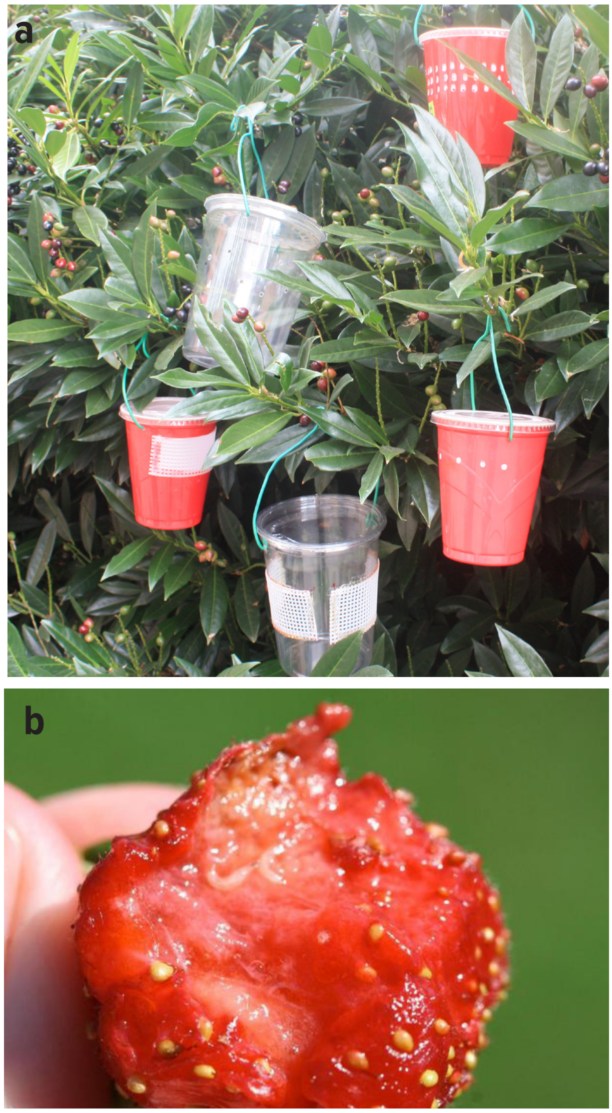
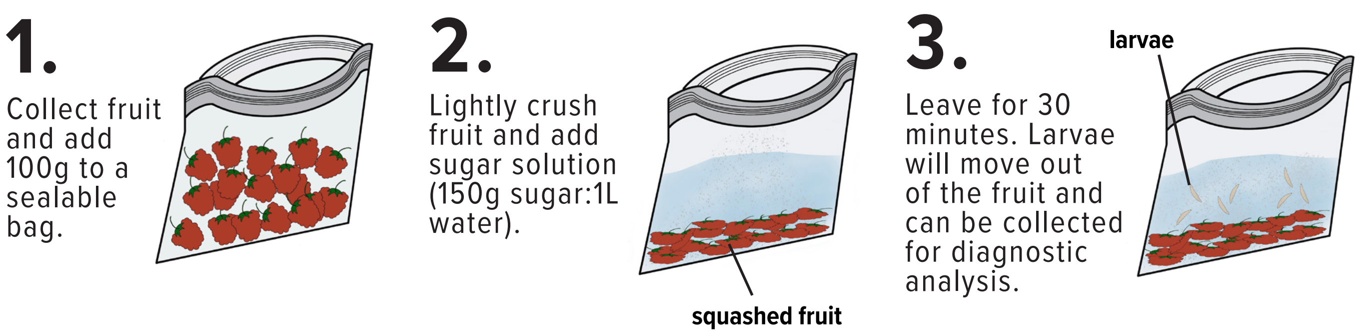


Figure 2. a) Traps to monitor for spotted wing drosophila hang from a *Prunus* sp. Research has shown that red is an attractive colour for this pest, b) The larvae of spotted winged drosophila feed on the fruit pulp of soft skinned fruits, including berries, grape, stonefruit and pome fruit.

Photo 2a: Amy Dreves, Oregon Department of Agriculture, flickr.com, used under licence NonCommercial-NoDerivs 2.0 Generic CC BY-NC-ND. Photo 2b. Hannah Burrack, North Carolina State University, Bugwood.

Figure 3. Do you know how to conduct the sugar flotation test?



Biological control options in Australia

Naturally occurring biological controls are used overseas to help suppress spotted winged drosophila populations in non-cropping and cropping landscapes. There is a chance that beneficial species able to suppress spotted winged drosophila populations may already occur in Australia.

Specialists

The spotted winged drosophila immune system is particularly geared towards defense against parasitoid attack by encapsulating parasitoid eggs or larva in melanized cells. Few larval or pupal parasitoid species can overcome this. Two candidate parasitoid species have been identified in eastern Asia for classical biological control of spotted winged drosophila. These species are *Ganapsis brasiliensis* and *Leptopilina japonica* subsp. *japonica*.

This project investigated Australian parasitoid wasp species that lay eggs in Australian *Drosophila* species, such as the vinegar fly, in order to identify candidate species that may aid in control of spotted winged drosophila, were it to be found in Australia. It found Australian records of wasp species from the *Leptopilina* and *Ganaspis* genus that use endemic *Drosophila* species as hosts for their eggs. Could they also use spotted winged drosophila as a host? Project findings also suggest that parasitoids of the genus *Asobara* and *Leptolamina* (also found in Australia) represent candidates for spotted winged drosophila control.

There remains further work to do before it is clear whether or not there may be a suppressive benefit offered by these endemic wasps. There have been few surveys of parasitoid wasp species in Australia, and there is not a great deal known about their distributions. However, this research does indicate that importation of specialist parasitoids is not the only option for control if spotted winged drosophila were to establish in Australia.

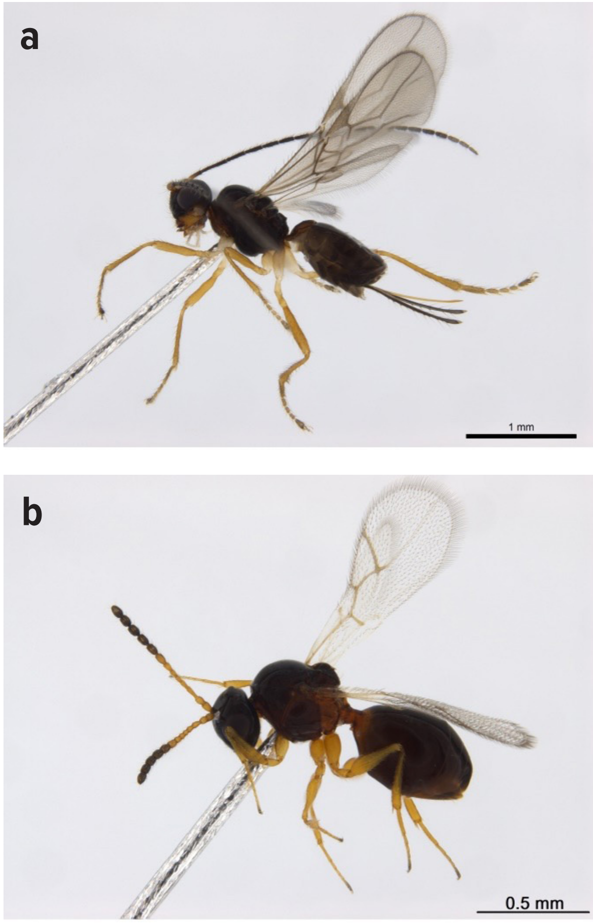


Figure 4. Two parasitoid wasps that represent candidate species for SWD control in Australia: (a) *Asobara persimilis*, (b) *Leptopilina* sp.

Specimens were collected by Dr Peter Kriesner in Victoria. Ken Walker from the Museum Victoria supplied assistance with photographing field-collected specimens. Photo source: Kriesner (2017).

New insights into predicted seasonal activity

Regional climate is expected to have a strong effect on spotted winged drosophila seasonal activity based on project findings. In relating seasonal abundances to environmental predictors, specifically temperature, the project found strong negative effects of exposure to high (>25°C) and low (<5°C) temperatures during the preceding month. In particular, early season abundance is modulated by climate, particularly the depth of cold extremes experienced in the preceding month.

This means that in the future there is the potential to develop degree day models to support predictions on spotted winged drosophila abundance in the lead up to the growing season – a powerful tool that could be applied to different growing regions.

Generalists

Ground dwelling generalists, such as spiders, carabid beetles, ants, damsel bugs, and earwigs, represent another area that should be considered for biological control of spotted winged drosophila. They are likely to have a suppressive effect as they can play a role in 'mopping up' pupae and larvae that drop from fruit to the ground (Fig 5 & 6).

Woltz and Lee (2017) have demonstrated significant reductions in spotted wing drosophila in-crop populations when generalist predators are also present. Infestations were shown to be reduced by 19-34% in strawberries and 28-49% in blueberries as a result of predator foraging. Ants and spiders were common predators observed in these trials, and ants were even observed to actively remove spotted winged drosophila pupae from the soil.

Wolf et al. (2018) has previously shown that 43% of earwigs collected from organic and untreated cherry, blackberry and raspberry fields had ingested spotted winged drosophila.

Management planning will need to consider how generalist beneficial species would be protected from off-target insecticide impacts. Species of earwig or carabid often only have one or two generations per year, therefore recovery of resident populations after pesticide impact can take time.

If you are interested in learning more about what ground dwelling generalist predators may be found close to your crop throughout the year, pitfall or shelter traps may be set up and regularly checked. Alternately, you can get your torch out for some spotlighting after dark.

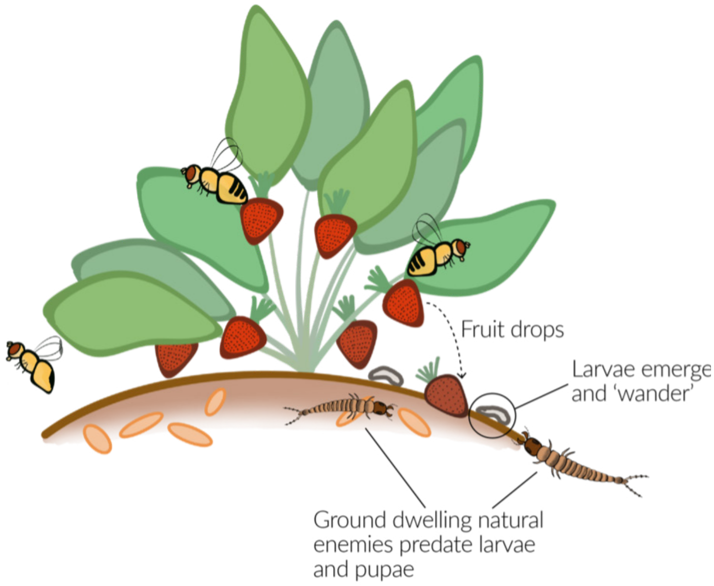


Figure 5. Overseas studies show that ground dwelling generalist natural enemies will be important in control of spotted winged drosophila. Image: Cesar Australia

Figure 6. Generalist natural enemies such as the native common brown earwig (left) and carabid beetles (right) may provide suppressive benefits against spotted winged drosophila. Images: Cesar Australia

Attributions

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Personel involved in the MT18010 project: Dr Jessica Lye (Cesar Australia; Project Lead), Dr James Maino (Cesar Australia), and Dr Peter Ridland, independent consulting entomologist. The fact sheet author was Dr Jessica Lye. The Hort Innovation project manager was Dr Greg Chandler. MT18010 research reports developed thorughout the project, as well as a variety of outreach materials, can be accessed by contacting Hort Innovation.

The spotted winged drosophila global distribution map was supplied by Dr Michael Ørsted, Section of Biology and Environmental Science, Department of Chemistry and Bioscience, Aalborg University, Aalborg E, Denmark.

Disclaimer

Sources

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