Collecting an inventory of parasitoid wasps for potential biocontrol of SWD in South Eastern Australia

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- The exotic pest Spotted Wing Drosophila (SWD) is a major threat to the Australian berry industry
- SWD is difficult to control with chemicals
- An initial study has found endemic parasitoid wasps that may have potential in the future biocontrol of SWD

Drosophila 'vinegar flies' are a common sight for any gardener, commercial grower, and wine maker. Whilst these flies are not ideal for wine makers, they are important for helping with ecosystem composting [Seehausen et al., 2020; Ridland & Lye, 2021]. However, there is one species, Spotted wing drosophila (SWD) (*Drosophila suzukii*), that has resulted in significant damage to soft-skin crops in large parts of Asia, Europe, and North America, and it would be expected to be a big problem for the Australian berry industry should it ever establish and spread here.

Typically, SWD has resulted in production losses of between 20-40%, with crop specific losses averaging 35% in raspberries, 29% in blackberries, 20% in cherries, 12% in blueberries, 9% in strawberries, and 6% in table grapes. In real terms, SWD has caused damages of greater than $AUD 500m per year in North America.

D. suzukii closely resembles the common non-risk endemic species *D. melanogaster*, although a distinguishing feature of SWD is the spots that appear on the wings of the male flies.

The female uses a distinctive serrated ovipositor to lay eggs inside unripe fruits (up to 400 eggs in a lifetime), where her larvae devour the fruit from the inside and emerge as adult flies.

SWD has an optimal range of 10-25°C, but has also survived short intervals of temperatures below zero and as high as 43°C.

This means SWD can adapt and establish, using refuge shelters with microclimates. Spread and establishment prediction modelling has recently been applied to *D. suzukii* in a series of simulated incursions (Hort Innovation project MT17005).

Most of the eastern seaboard and some parts of south-western WA are likely to be suitable for establishment, and it is predicted that the fly would fill its ecological niche in these areas within 6 years.

There are multiple SWD control techniques such as strategic pruning, exclusion netting, weed matting to prevent larvae from pupating, surveillance (including various traps), reducing harvest intervals, post-harvest quality control via staff training and application of floatation tests, and strict waste disposal.

A recent preparedness study by Cesar Australia and the University of Melbourne involved taking an inventory of parasitoid wasp species that exist in Melbourne and the Yarra Ranges, and which may have potential to be used against SWD in future IPM biocontrol programs.

SWD is a threat because the fly is difficult to control with chemical applications, and it is known to shield itself within fruits. Excessive insecticide spraying against SWD overseas caused increased chemical resistance and resulted in secondary pests (such as Scale) becoming a problem.

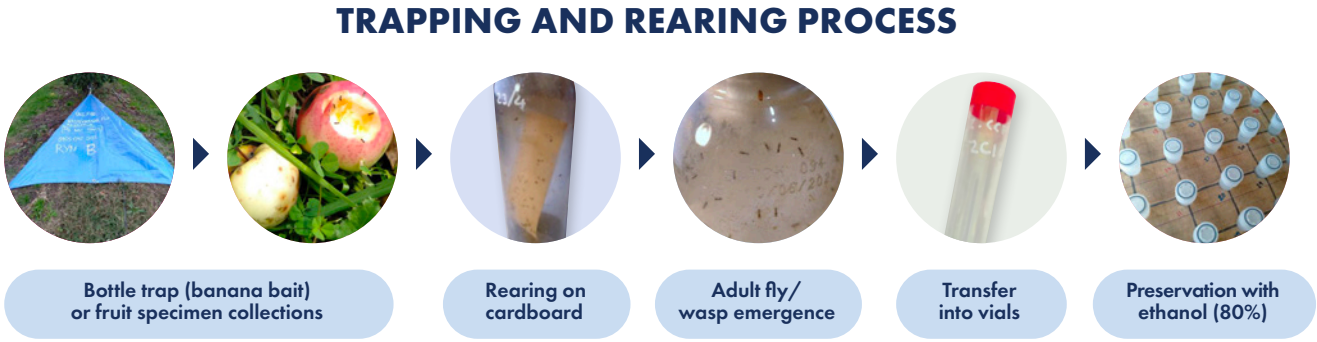

Figure 1. Photo credit: Michael Edwards

Controlling SWD this way can also be expensive, ranging from $AUD 450 to $1100 per hectare (overseas) (De Ros et al., 2015; Mazzi et al., 2017). Furthermore, restrictions and permits are required, and whilst it may be possible to initiate a 'minor use and emergency permit system' for chemical controls, they must be appropriately timed to target the adult flies.

Australian biosecurity has importation restrictions in place for live insects, and although there are several identified exotic parasitoids of SWD, importing a biocontrol can be a lengthy and costly activity.

Potential parasitoids already exist in Australian berry growing regions, but there is very little information about these species (some of the last studies were done in the 1970s), or how they interact with standard Drosophila on a landscape-scale, which would be useful for IPM programs. Once the endemic parasitoids are known, it may be possible to rear them on-site in preparation for an incursion by SWD, and then enable the wasps to establish populations in optimal habitat, e.g. sheltered areas, near water sources, and with mixed native vegetation.

Throughout 2021, sites in both metropolitan Melbourne and the Yarra Ranges were selected for trapping of endemic wasp species (specifically four urban community gardens, three commercial production farms, two vineyards, and one fruit and vegetable store were chosen). At each site, there were three trap installations with homemade bottle traps (using fermented banana and yeast as a bait), which were visited every two weeks (from April 8 – June 24, 2021) until enough samples were gathered.

Decomposing fruit was also gathered and taken back to a lab, where all the samples were kept between 6°C – 24°C to allow adult flies and wasps to emerge.

Once the parasitoids came out of the deceased flies, the wasps were preserved and identified by experts at the Cesar Australia labs in Melbourne. See Figure 1 above.

The results show that at least one parasitoid wasp was present – *Asobara persimilis* (an endemic species that is known to be found further north in tropical environments). The Asobara genus is potentially important for further investigation as researchers in the Czech Republic have previously collected this species and found that it can parasitise SWD in preliminary experiments (J Hrcek, pers comms).

Figure 2. Asobara persimilis
Photo credit: Michael Edwards

Two of the ten sites had high numbers of A. *persimilus* wasps, a vineyard and a commercial orchard, which were both in the Yarra Ranges. Although both sites were organic, there were applications of agricultural chemicals between 20 – 50 metres away. In both cases, the wasps had nearby shelter (between 5m - 80m) caused by shade, mixed vegetation, reduced wind gusts, and influenced by water from dams. Interestingly, wasps were found in only 1 out of 3 trapping locations at each property and away from processing/winemaking sheds, even though there was an abundance of endemic Drosophila flies around these buildings. A third site, an organic commercial orchard between metropolitan Melbourne and the Yarra Ranges, also had wasps although at lower levels than the sites in the Yarra Ranges.

Extra data will be required to test for variability amongst sites, but the common factors of parasitoid presence are associated with shelter from winds and excessive heat/cold, which allows the flies to inhabit the space, and allows the wasps to easily find hosts.

This small-scale survey represents the first targeted monitoring study to be conducted for potential SWD biocontrols in Australia and sets the scene for more substantial investigations. Additional surveys should be conducted to investigate seasonal differences in wasp populations, wasp diversity in other locations – especially in stone fruit growing regions, and the effects of landscape and vegetation types on wasp abundance.

Sightings of exotic species should be reported via the EXOTIC PLANT PEST HOTLINE ON 1800 084 881

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