Latest Research Results

organic SCIENCE CLUSTER 3

Ecological pest management for Spotted Wing Drosophila

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(Photo by Warren Wong)

Spotted wing drosophila (Drosophila suzukii, SWD) remains a top priority for agricultural research programs because of its destructive impact on small fruit production. Growers need additional ecological and cultural controls to sustain and grow organic production of berries and other small fruits, while also reducing economic losses and managing pesticide resistance. Our research sought to develop multiple, independent but potentially synergistic management strategies for SWD.

Floral cover crops in alleyways

We explored whether certain plants interspersed in berry crops could reduce SWD levels through repelling SWD directly or by attracting beneficial, predaceous insects that attack SWD. We found that peppermint plants (and peppermint essential oil) have promise for reducing SWD emergence. However, interplanting peppermint might require intensive management to reduce its spread. We alternatively explored the use of alley cover crops in strawberries, planting sweet alyssum adjacent to strawberry crops to attract beneficial insects that parasitize SWD. While we did not see a reduction in SWD in berries adjacent to sweet alyssum, we found low SWD levels overall. We hypothesize that low levels of SWD at this site may be due to the diversity of resources found across our organic research farm that supported high beneficial insect diversity. Additionally, early season strawberries may avoid SWD in time. Interplanting with flowers may be more effective for later season berry crops and/or on sites with fewer alternative resources (i.e. low plant diversity). An ongoing pilot trial in later season blackberries will be used to evaluate the potential of sweet alyssum and goldenrod as alley cover crops to support beneficial insects. Additional on-farm research evaluating the use of floral cover crops in berries to support pest management and other co-benefits is ongoing, and will use a range of sites that vary in landscape characteristics.

Monitoring SWD in ecologically relevant contexts

Our team led the development of Sticky Pi, a novel automated camera trapping system created to describe the activity of SWD through space and time. Sticky Pi documented peaks of activity for SWD and has led to the further development of a platform for image recognition that can support bio-surveillance of other insect pests. We deployed over 65 automated traps, performed proof-of-concept experiments that supported the efficiency of this product, and applied this technology to new studies that will harness Sticky Pi's capability to gather high-quality, high-resolution insect data. We continue to improve the Sticky Pi platform for use in other research questions and maintain open access documentation to support collaboration and further development by other research teams.

Biological control – microbes

We evaluated the potential effectiveness of microbial biopesticide agents against SWD through oral insecticidal activity, and found that multiple *Pseudomonas* species (*P. protegens, P. fluorescens, P. aeruginosa*) exhibited significant insecticidal effects on SWD. *Pseudomonas* species decreased larval

emergence rate and increased adult SWD mortality rate. These results contribute to existing research demonstrating the insecticidal activity of *Pseudomonas*, and can support further development of a microbial biocontrol program. Research exploring specific targets of insecticidal effects is ongoing, including in related *Drosophila melanogaster*.

Biological control – wasps

A key project goal was to document the forecasted safety and efficacy of two species of parasitic wasps of Asian origin (*Leptopilina japonica* and *Ganaspis brasiliensis*). This was to support a petition to release these agents in Canada to provide long-term, self-sustaining control of SWD. One year into the project, we discovered that these two parasitoid species were already established (i.e., adventive) in south coastal BC, the first time they had been detected in North America. However, since they were not known to be present in other regions of BC nor elsewhere in Canada, and redistribution of their populations is a possibility, it was nonetheless important to ensure the ecological safety of any biocontrol agents that would be released.

Non-target effects: We found 18 species of flies that were closely related to SWD in the Okanagan Valley of BC (some of them native species) and conducted surveys to see if these related flies were attacked by the two adventive wasps in Coastal BC. These results indicated that several flies related to SWD and present in BC are vulnerable to attack by one of the two Asian parasitoid species (*L. japonica*) but that the other parasitoid (*G. brasiliensis*) is highly specialized and thus an excellent candidate for redistribution. The less specific species, *Leptopilina japonica,* will still provide some biological control of SWD as it spreads on its own even if not intentionally redistributed.

Climate suitability: We sought to answer whether the two wasp species have the capacity to survive harsh

A male Leptopilina japonica parasitoid faces its species host, the female spotted-wing drosophila (Drosophila suzukii), on top of a blueberry (Photo by Warren Wong)

Canadian winters. Our results showed that both wasp species are clearly able to overwinter in south coastal BC, and we discovered that the main factors driving their entry into diapause is temperature, not photoperiod. The capacity of G. *brasiliensis* to overwinter in harsher winter climates of Ontario and Quebec is still unclear, as data collection is ongoing.

Seasonal phenology, host plant associations, and effectiveness: Through exploratory surveys, we found that L. *japonica* and G. *brasiliensis* were well established across the mainland of south coastal BC and attacked SWD on a variety of host plants in many different habitat types. However, parasitism levels varied greatly by year and parasitoid attack of SWD in commercial crops was much less common than in unmanaged habitats. Thus, these parasitoids may be contributing to reducing SWD populations on a landscape scale, but do not provide immediate control on seasonal scales within fruit crop fields. Collaborating with an international team of scientists, we led the development of an extensive suite of scientifically rigorous sampling and identification tools to understand these parasitoids' impact on SWD and incorporate them into IPM programs in the years to come.

The University of British Columbia and AAFC team sampling for parasitoid wasps of spotted wing Drosophila in Chilliwack, BC in July 2021. Pictured (left to right): Pierre Girod (UBC), Juli Carrillo (UBC), Warren Wong (AAFC/UBC), and Michelle Franklin (AAFC) (Photo credit: Paul Abram).

Redistribution: We incorporated our results from the above objectives with research conducted elsewhere to determine whether it would be appropriate to redistribute G. *brasiliensis* to Eastern Canada (Ontario, Québec, and the Atlantic Provinces). Based on our results and consultations with collaborators and stakeholders, we have prepared a proposal for the redistribution of *Ganaspis brasiliensis* to Ontario, with other provinces to be considered in the future. We expect that the first releases in Ontario will occur in 2024, pending some final consultation. The adventive and released populations of these two parasitic wasp species across the country are expected to help provide naturally occurring, self-sustaining suppression of SWD populations in both crop and non-crop habitats indefinitely into the future.

For more information visit the OSC3 Activity 20 webpage and/or DAL.CA/OACC/OSCIII & https://organicfederation.ca/organic-science-clusters/

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BC blueberries Powered by nature.

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