

Summary: Classic Bio-Control for the Spotted Wing Drosophila - What to Expect

Guest Speaker, Dr. Kent Daane is a UCCE Specialist in Entomology located at UC Berkeley. His research focuses on the development of ecologically-based insect pest management systems.

Challenges in Spotted Wing Drosophila (SWD) Control

- 1) Spotted wing Drosophila has a wide host range including wild blueberries, wild blackberries and even cactus, which provides substantial habitats for the SWD near the field, especially in the natural riparian zones. Pesticides therefore need to be applied frequently to control the constantly emerging populations.



Figure 1: Spotted Wing Drosophila Infestation on Cherries

- 2) SWD can develop from egg stage to adult stage in 10-12 days (Fig.1). Conventional chemical control offers limited pesticide options, and most of the pesticides that are registered for SWD control are highly toxic to honey bees.
- 3) Contact pesticides have limitations on SWD control because the egg, larvae and often times the pupae are inside the fruits.

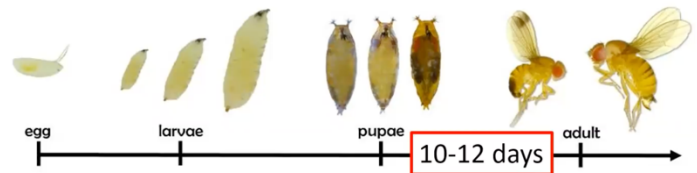


Figure 2: Life Cycle of Spotted Wing Drosophila

Drosophilid Parasitoid Community in California

There are two groups of parasitoids that can attack fruit flies in family Drosophilidae at different stages:

Pupal parasitoids: *Pachycrepoideus vindemiae* (Pteromalidae), *Trichopria drosophilae* (Diapriidae);

Larval parasitoids: *Leptopilina heterotoma* (Figitidae), *Leptopilina boularidi* (Figitidae), and *Asobara tabida* (Braconidae).

<p><i>Pachycrepoideus vindemiae</i></p> <ul style="list-style-type: none"> • Widespread geographic range <ul style="list-style-type: none"> • Large host range • 0-10% parasitism • Can be mass-reared • <u>Augmentation trials in USA</u> • Not yet available in USA 	<p><i>Trichopria drosophilae</i></p> <ul style="list-style-type: none"> • Not everywhere in the USA • Narrower T° tolerance <ul style="list-style-type: none"> • 0-10% parasitism • <u>Augmentation trials in Europe & Mexico</u> • Not yet available in USA

Figure 3: Two examples of parasitoid that can attack SWD outside USA

Since there are no native parasitoids in the US that attack SWD, classical bio-control strategy needs to be adopted to import SWD larval parasitoids from outside of US. Three species were selected to be the candidate natural enemies including *Asobara japonica*, *Ganaspis brasiliensis*, and *Leptopilina japonica*.

Classic Bio-Control: the Introduction of Exotic Natural Enemy (NE)

Classical biological control is the regulation of a pest population (insect, mite, mammal, weed, pathogen) by exotic NEs (parasites, predators, pathogens) that are imported for this purpose. The introduction of the candidate NEs went through four main stages including: Foreign explorations (2013-2018), Quarentine studies (2014-2018), Taxonomic studies (2014-present), and USDA APHIS Petition (2019-present).

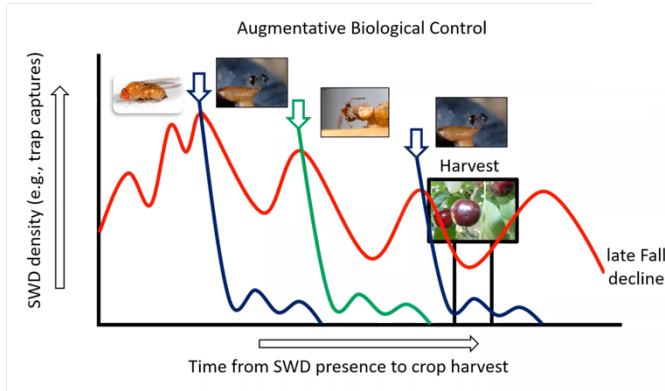


Figure 4: Schematic Diagram of Augmentative Biological Control Strategy, NEs are released multiple times in high density throughout the season to reduce the pest population as the NE population dose not sustain itself

What Do We Know About the Candidate Parasitoids?

Research was conducted in a number of regions globally to understand the biology and distribution of the candidate NEs.

- The three species can reach to a parasitism rate of 20%-60% on plant hosts including *Rubus* species, mountain strawberry, and elderberry, which indicate their potential to significantly reduce the SWD population in the US.

- *Asobara japonica* was more efficient than either figitid in terms of searching efficiency.
- Both *G. brasiliensis* and *L. japonica* species prefer to oviposit (lay eggs) in 1 ro 2-day-old SWD.

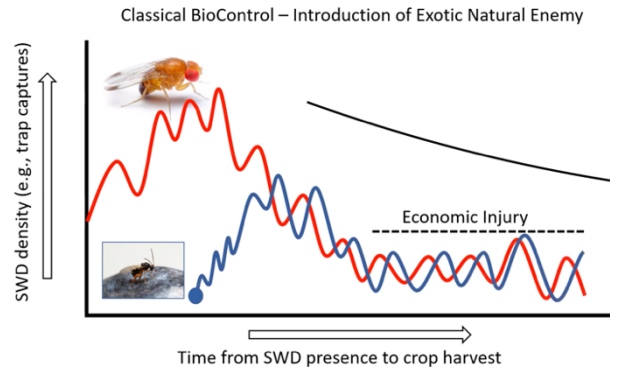


Figure 5: Schematic Diagram of Classical BioControl Strategy, NEs are released in smaller numbers to various systems and eventually reduce the pest population to under the economic injury threshold

Where to Acquire the Three Parasitoids to release in the US?

Petitions have been created for those who wanted to release the three species in the US. They could be acquired from Dr. Daane’s lab, and there will be no cost on it. Make sure not to acuire them outside the US (such as Canada and Mexico) as it is against the law!

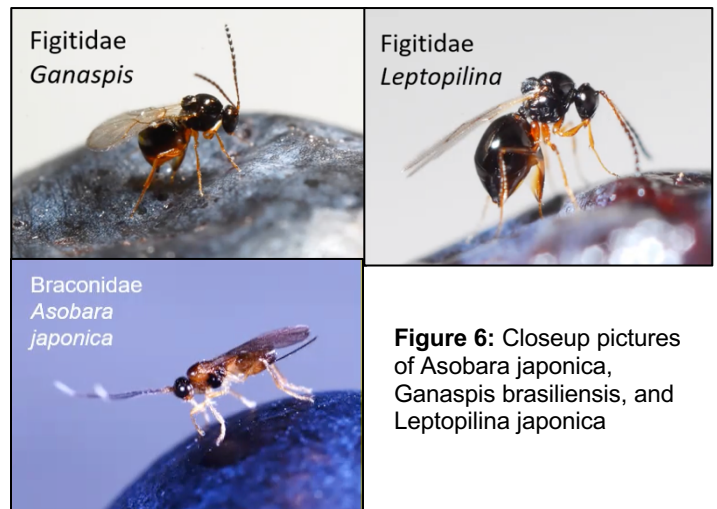


Figure 6: Closeup pictures of *Asobara japonica*, *Ganaspis brasiliensis*, and *Leptopilina japonica*