

Potential Impacts of Irrigation and Biocontrol on Spotted-wing Drosophila Populations

C. Bezerra Da Silva, B.E. Price, D. Dalton, D. Rendon, K. Park, L. Brewer, V. Walton, M.V. Rossi-Stacconi

Wasp helps control SWD

Biocontrol (biological control) is the use of a living organism to control a pest problem. This publication explains how a naturally occurring parasitic wasp in Oregon can help control spotted-wing drosophila in Oregon blueberry production.

Water delivery, and the environmental conditions that water delivery creates, can significantly affect biocontrol in production units. In particular, drip irrigation provides a variety of advantages compared to overhead sprinkler irrigation by affecting SWD development while accurately delivering water and nutrients and reducing weed management costs.

Pachycrepoideus vindemmia is present in Oregon and able to successfully attack and kill SWD in the field (Figure 1a and Video 1, page 2). These tiny wasps attack pupae of many fly species, and help to control SWD in Oregon.

Under laboratory conditions, an adult *P. vindemmia* female can kill up to 600 SWD pupae during its lifespan. This wasp lives longer when water and sugar are available. Adult wasps receiving water and honey lived up to 60 days; those fed on honey alone lived about 30 days. Those provided only water and no honey lived about 10 days.

When other food sources are less available, female parasitoids are able to feed on SWD pupae to obtain the required nutrients. This process, known as “host-feeding,” kills SWD pupae (Figure 1b and Video 2, page 2). Host-feeding occurs after a female wasp stings an SWD pupa

and starts feeding on the pupal blood (hemolymph) to supplement water and other nutrients.

Low water availability and low relative humidity result in significantly higher death rates of SWD and reduced egg laying (Figure 2a and Figure 2b). The same conditions increase *P. vindemmia* host-feeding on SWD pupae (Figure 2c, page 2).

In dry environments, parasitoids prey at higher rates on SWD than when water is present. Irrigation practices, pruning and other cultural practices including the use of weed fabric, may reduce SWD reproduction and survival. Drip irrigation, particularly, may contribute to the drier conditions that encourage the wasp to attack

Key points from this fact sheet

- *Overhead irrigation increases humidity—creating more favorable conditions for the development of spotted-wing drosophila (SWD) pest populations.*
- *Drip irrigation can limit conditions that favor SWD population increase.*
- *Pachycrepoideus vindemmia is a parasitic wasp (parasitoid) that attacks SWD by laying its eggs on SWD pupa. Drip irrigation may increase parasitism by P. vindemmia.*
- *Adult parasitic wasps also lower SWD populations by directly feeding on SWD pupae (host-feeding). Host feeding can increase under drip irrigation.*
- *The parasitic wasp is well-adapted to attack SWD and may contribute to its control in Oregon.*



Photo: C. S. Bezerra Da Silva and Briana E. Price

Figure 1. Adult female *Pachycrepoideus vindemmiae* attacks pupae of spotted-wing drosophila (SWD). (a) She drills her ovipositor through the SWD pupal case, stings and paralyzes the pupa, then lays an egg on the pupal surface. The developing *P. vindemmiae* feeds on and kills the SWD pupa. (b) She host-feeds on the hemolymph (blood) of an SWD pupa after making a wound in it with her ovipositor. Use your phone camera to scan the QR codes to watch the videos of both the parasitism and host-feeding behaviors of *P. vindemmiae* against SWD. (Bezerra da Silva et al. 2019b.)



SWD pupae. These lab and field tests indicate that growers who maintain drier conditions in the fields may see reduced SWD reproduction and survival in their fields.

Further readings

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Rendon, D. and V. M Walton. 2019. Drip and overhead



Video 1: Female wasp inserting her ovipositor through the SWD's pupal case and performing internal evaluation of the host prior to oviposition. Note the wasp's ovipositor moving between the SWD pupal case and the pupa. <https://doi.org/10.1371/journal.pone.0218301.s004>



Video 2: Female wasp host-feeding on hemolymph of a SWD pupa following ovipositor withdrawal. Note the wasp's abdomen engorging as host-feeding takes place. <https://doi.org/10.1371/journal.pone.0218301.s005>

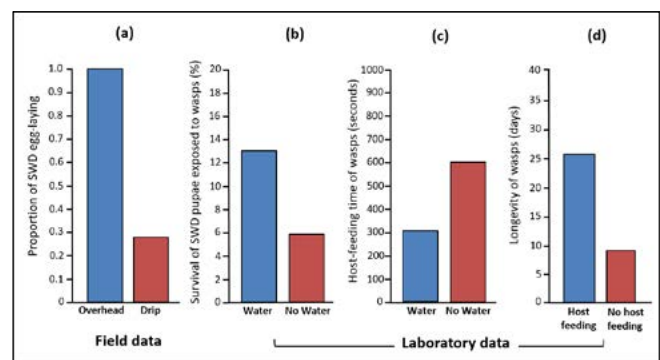


Illustration: C.S. Bezerra Da Silva and M.V. Rossi-Stacconi

Figure 2. Impact of water on spotted-wing drosophila (SWD, *Drosophila suzukii*) and its parasitoid, the wasp *Pachycrepoideus vindemmiae*. (a) Proportion of SWD egg laying under drip irrigation in comparison to overhead irrigation in a blueberry field (Corvallis, OR). (b) Survival of SWD pupae exposed to the parasitic wasp when water is and is not provided. (c) Time invested in host-feeding by the parasitoid when water is available and when it is not. (d) Longevity of the wasp when it host-feeds on SWD pupae in comparison to when host-feeding is not allowed.

sprinkler irrigation in blueberry as cultural control for *Drosophila suzukii* in Northwestern United States. *Journal of Economic Entomology* 112, 745–752.

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About the authors

Cherre Bezerra Da Silva, Laboratory of Entomology, Empresa Brasileira de Pesquisa Agropecuária, Campina Grande, Brazil; Dalila Rendon, former post-doctoral researcher, horticultural entomology, Department of Horticulture, Oregon State University; Brianna Price, technical assistant, Honey Bee Lab; Kyoo Park, graduate student, Department of Horticulture; Linda Brewer, senior faculty research assistant, Department of Horticulture; Vaughn Walton, professor of horticultural entomology, Department of Horticulture; Marco Valerio Rossi-Stacconi, post-doctoral researcher, horticultural entomology, Department of Horticulture; and Daniel Dalton, graduate student, horticultural entomology, Department of Horticulture, all of Oregon State University.

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