# Using Diluted Grape Juice for Early-season Monitoring and Its Potential for Attract-and-kill of Spotted Wing Drosophila, *Drosophila suzukii*

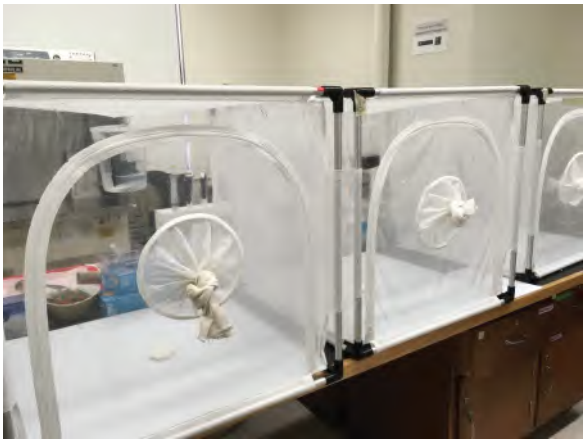
**Jaime C. Piñero[1], Xiaojian Wen[1,2], and Emily Begonis[1]**
[1]***Stockbridge School of Agriculture, University of Massachusetts***
[2]***Beijing Forestry University, Beijing, China***

Spotted Wing Drosophila (SWD), *Drosophila suzukii,* is primarily a pest of berry crops (brambles, blueberries, elderberries, and grapes) and some stone fruits (cherry, nectarine, and peach). While most commonly encountered fruit (or vinegar) flies typically infest over-ripe or damaged fruit, SWD is different in that it attacks healthy ripening fruit. The female flies possess a serrated ovipositor that can cut into sound fruit to insert their eggs. Current management options for SWD rely heavily on insecticide applications. While monitoring tools are critical to implementation of pest control tactics against SWD, effective monitoring represents a challenge for pest managers largely due to a lack of species-specific attractants. Commercial food-based SWD lures are available to monitor SWD populations. However, lures are based on fermentation materials and they attract a comparatively high number of other Drosophilid species (and other non-target insects), hindering trap performance and increasing sorting time.

In the fall 2018 issue of *Fruit Notes*, we reported on the high attractiveness of Concord grape juice, a low-cost and readily available material, to male and female SWD. When diluted at a ratio of one part grape juice to three parts water, diluted grape juice was three times more attractive to male and female SWD than one commercial lure under field conditions. Grape juice diluted at the 1:3 ratio also attracted significantly fewer (about three times less) non-targets than the commercial lure, highlighting the greater selectivity of grape juice. Here, we assessed the efficacy of traps baited with diluted grape juice at monitoring SWD early in the season, compared to two commercial lures. A secondary objective was the quantification of the relative trapping power of traps baited with either, diluted grape juice and three commercial lures using large cages in the laboratory.

### *Materials & Methods*

**SWD monitoring.** On April 30, 2019, three sets of traps were deployed at five Massachusetts locations: Deerfield (two locations), Belchertown (UMass Cold Spring Orchard), Whately, and Amherst (UMass campus). For the first three locations, traps were hung from cherry trees. In Whately, traps were deployed in a non-host area located next to commercial raspberries. In Amherst, traps were positioned 50 cm above elderberry plants using steel wire. Three olfactory treatments were evaluated at each location: (1) grape juice diluted at the



Experiment layout for the comparison of the attractiveness of diluted grape juice against that of commercial lures to male and female Spotted Wing Drosophila in the laboratory. Cage dimensions: 55 $cm^3$.

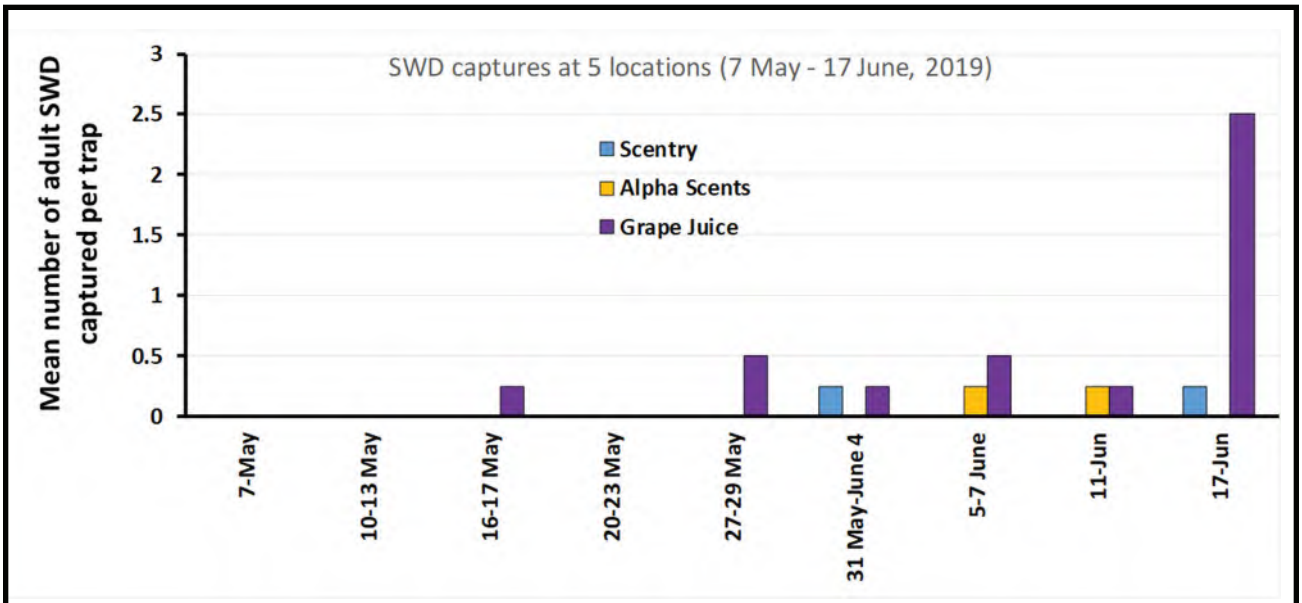



Figure 1. Captures (average number of insects per trap) of adult SWD (male and female data combined) by traps baited with either, grape juice diluted at a 1:3 ratio, Scentry® SWD lure and Alpha Scents® SWD lure. Each set of three traps was deployed at five Massachusetts locations. Traps were baited with commercial lures on 30 April 2019, and lures were replaced on 27-29 May 2019. Diluted grape juice was replaced at each inspection date.

1:3 ratio (1 part of grape juice and 3 parts of water), (2) SWD Scentry® lure (purchased from Great Lakes IPM), and (3) Alpha Scents® SWD lure (purchased from Alpha Scents, Inc.). Except for a few dates, all traps were serviced twice a week (on Tuesdays and Fridays) to minimize the effects of grape juice fermentation.

**Trapping efficiency.** Two experiments were conducted using screened cages (55 $cm^3$) in the laboratory (Amherst). The first experiment compared the attractiveness of diluted grape juice (200 ml) against that of the Scentry® SWD lure, and the Alpha Scents® SWD lure. Traps with commercial lures had 200 ml of unscented soapy water as drowning solution. The second experiment compared the attractiveness of diluted grape juice (200 ml) against that of Suzukii Trap® (200 ml). All attractants were evaluated using 1 L low-density containers with 12 openings in the sides to allow adult SWD to get inside (Figure 1).

For each observation day, 15 males and 15 females (4-6 days old) were released inside each cage between 8:45 and 9:00 am. Observations were initiated immediately after introducing the traps with the treatments. One person quantified the number of males and females that were captured by traps at 4, 8, and 24 hours after starting the experiment. Results show the percentages of males and females that were captured by traps over a 24-hour period.

### *Results*

**SWD monitoring.** Monitoring traps were inspected 6-10 times from 7 May to 17 June 2019. Diluted grape juice was the only bait that detected SWD in the 16-17 May (1 female) and 27-29 May (1 female) sampling dates. Subsequent SWD captures took place on 27-29 May (2 females), 31 May – 4 June (1 male, 1 female), 5-7 June (1 male, 2 females), 11 June (2 females), and 17 June (11 females) (Figure 1).

Across all trapping dates, two males (one in a trap baited with the Scentry® SWD lure and one in a trap baited with the Alpha Scents® SWD lure) and 18 females were captured by traps. Traps baited with diluted grape juice captured 88.8% of all females; whereas, each of the two commercial lures captured 5.6% of the females (Figure 2).

In terms of non-targets, 21,119 insects belonging to the family Drosophilidae were captured by traps across all locations, bait treatments, and sampling dates.

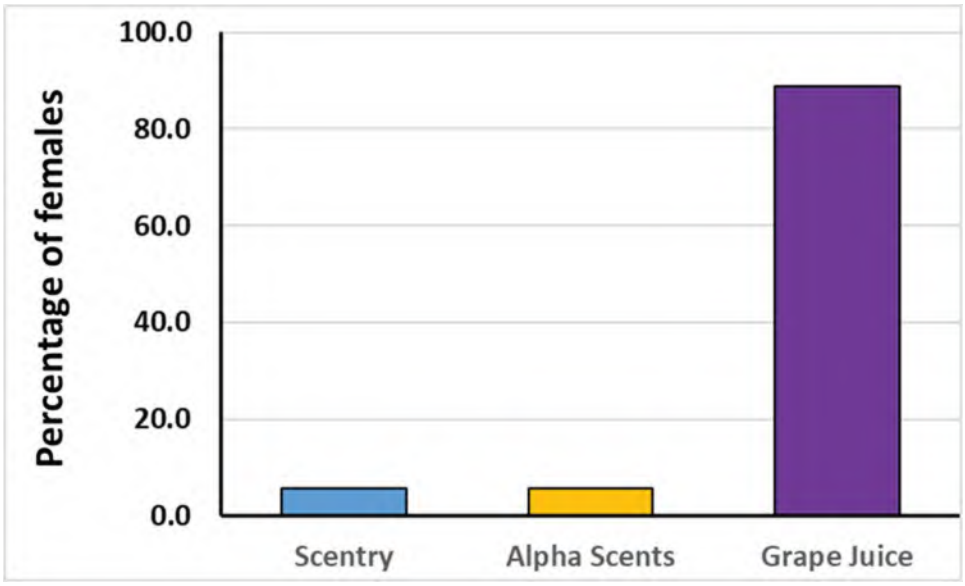



Figure 2. Distribution (expressed as percentages) of captures of female SWD according to olfactory treatment (n= 18 females).

Traps baited with the Scentry® and Alpha Scents® lures captured the most non-targets (6,766 and 11,325 specimens, respectively) whereas traps baited with diluted grape juice captured 3,048 non-targets. Efforts were made to minimize the effects of juice fermentation by checking traps twice a week. However, for some weeks, traps were inspected only once; therefore, captures of non-targets in traps baited with diluted grape juice may have been influenced by fermentation of this material.

**Trapping efficiency.** In the first experiment, traps baited with diluted grape juice captured 58% of the males and 87% of the females that were released inside cages, in a 24-hour period (Figure 3A). Traps baited with the Scentry® and Alpha Scents® lures captured significantly fewer males (29.7 and 36.7%, respectively) and females (23 and 35%, respectively) than traps baited with diluted grape juice, in a 24-hour period. Our results also revealed that twice as many females responded to grape juice than did males, suggesting that grape juice is female-biased. In the second experiment, traps baited with diluted grape juice captured twice as many females than the Suzukii Trap (average of 65.6 and 32.2%, respectively); whereas, male captures over a 24-hour period were similar between the two olfactory treatments (Figure 3B).

**Conclusions**

Our results indicate that diluted grape juice was effective at attracting the first SWD of the season at each of the five locations. In addition, traps baited with diluted grape juice captured most (89%) of the females that were trapped over a 6-week period, highlighting the effectiveness of this inexpensive material for SWD monitoring. The cage studies revealed that a statistically greater percentage of both males and females (first experiment), respectively, were killed by traps baited with diluted grape juice within a 24-hour period, when compared to three commercial lures. Diluted grape juice shows promise for monitoring and potentially for attract-and-kill of SWD.

***Acknowledgments***

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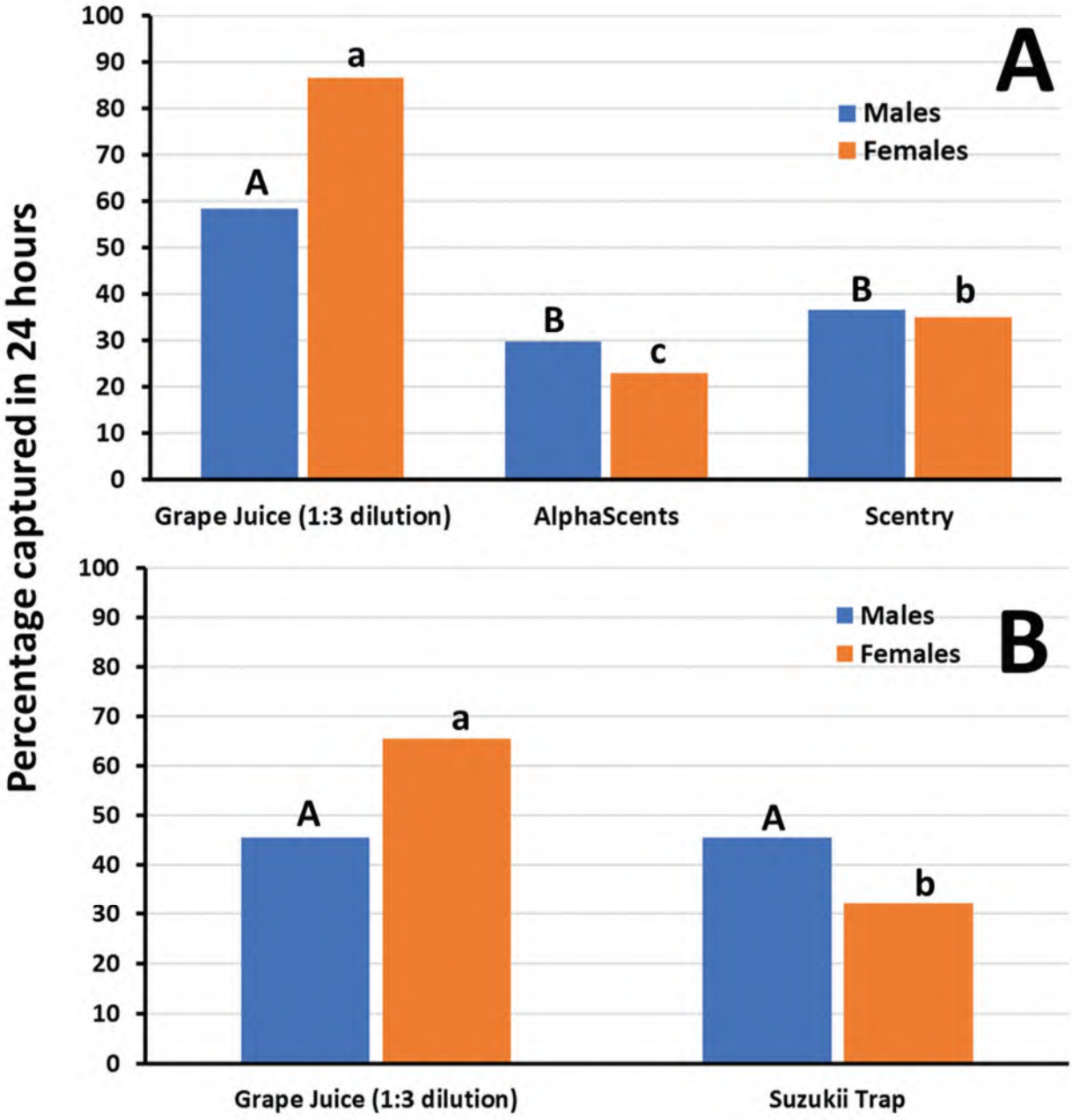


Figure 3. Captures of male and female SWD in traps baited with (A) diluted grape juice, Scentry® SWD lure, and Alpha Scents® SWD lure, and (B) diluted grape juice and Suzukii Trap®, in 55 $cm^3$ cages. Results are for combined captures across a 24-hour period. For each sex, means superscribed by the same letter (uppercase= treatment comparison among males; lowercase= treatment comparison among females) are not significantly different at odds of 19:1.

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