Table salt added to diluted Concord grape juice prior to fermentation results in a highly attractive bait for spotted-wing drosophila

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Pest monitoring is a cornerstone of IPM. In order to effectively time insecticide sprays to mitigate damage by spotted-wing drosophila (SWD), growers need to monitor SWD populations. Commercial food-based lures are available for monitoring purposes. However, those lures are based on fermentation materials and consequently they also attract a comparatively high number of other fly species that belong to the same family (Drosophilidae) as SWD, as well as other non-target insects. Captures of unwanted insects hinders trap performance and increases sorting time. Thus, bait selectivity, cost, and accessibility are important factors influencing growers' decision to adopt monitoring systems

Diluted Concord grape juice (DGJ) was previously reported to be highly attractive to male and female SWD. Our interest in DGJ stemmed from its local availability and low cost. Results from fermentation studies (see fall 2020 issue of *Fruit Notes*) revealed that female SWD captures can be increased if traps are left for up two weeks in the field (we did not evaluate longer intervals). However, the fermentation process will also attract more non-target insects. It is known that preservatives such as borax and table salt influence microbial fermentation. The presence of and choice of preservative may alter bait effectiveness either directly by adding additional volatile attractants, or indirectly by affecting rate and amount of fermentation.

Here, we report the results of cage and field studies that sought to assess whether the response of adult SWD and of other drosophilids could be manipulated by the addition of varying amounts of table salt to DGJ prior to fermentation. More specifically, we attempted to make fermented DGJ less attractive to non-target insects without affecting SWD captures.

Materials & Methods

Cage studies. This study was conducted from 3 June to 20 July 2021 using experimental cages (2 x 2 x 2 ft) made of nylon woven mesh. Four wires (6 inches in length) were suspended equidistantly at each of the four corners of the cages. The following four materials were evaluated: (1) fresh DGJ, (2) 1-week old DGJ with no table salt added, (3) 1-week old DGJ with 2% table salt (roughly between 1/16 and 1/8 teaspoon for 6 oz. of DGJ), and (4) 1-week old DGJ with 4% table salt. All materials were evaluated using 2 ml polypropylene microcentrifuge tubes. Prior to treatment application, the lids of the microcentrifuge tubes were removed, a 3 cm wire was wrapped around their neck, and a thin coating of Tangletrap insect coating was applied to the outer surface of the tubes to capture alighting flies. On each observation day, 15 males and 15 females were released inside each cage between 0815 and 0830 hours. Observations were initiated immediately after introducing the Tangletrap-coated centrifuge tubes with the odor treatments. One person quantified the number of males and females that were captured 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. Each trial was replicated 12 times.

Field studies. We conducted two field experiments. The first experiment compared the attractiveness of (1) fresh DGJ, (2) DGJ aged for one week in the absence of table salt, (3) DGJ aged for one week with 2% table salt (Figure 1), and (4) Scentry® SWD lure, to male and female SWD, and to non-target insects using 1-quart platic traps (Figure 1). This study was conducted in a commercial cherry block at the University of Massachusetts Cold Spring Orchard (Belchertown, MA) from 1 June to 17 July 2021. Five cherry trees were used for this evaluation, and each tree served as a replicate. Traps were inspected twice a week.

Figure 1. Trap baited with diluted Concord grape juice aged for 7 days in the presence of 2% of table salt.

Results

Cage studies. DGJ aged for one week in the presence of 2% table salt was much more attractive to males and females than any other treatment (Figure 2). Increasing the concentration of table salt to 4% resulted in decreased attraction, which was comparable to that recorded for the no-salt treatment. Each of the aged materials was significantly more attractive to males and females than fresh DGJ. This is interesting because we know that fresh DGJ is about 3 times more attractive to SWD than some commercial lures.

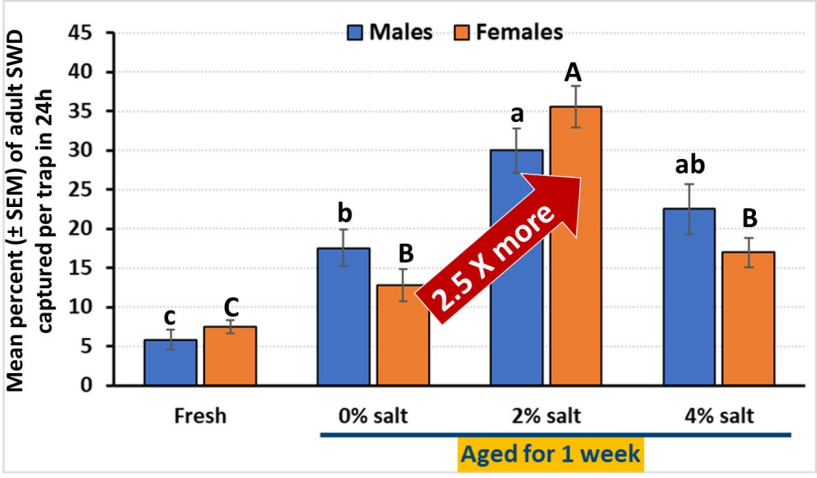

Figure 2. Response, expressed as the percentage of male and female SWD captured over a 24-hour period in cages, to fresh diluted grape juice either, fresh or aged for 7 days with 0, 2, and 4% of table salt added prior to fermentation. For each fly gender, bars superscribed by the same letter are not significantly different at odds of 19:1.

Field studies. Figure 3 presents the results of the comparison of fresh DGJ, DGJ aged for 1 week in the absence and presence of 2% table salt, and the Scentry® SWD lure. For both males and females, 1-week old DGJ that was aged in the presence of 2% table salt attracted significantly more SWD than any other treatment. For males, the response to 1-week old DGJ with no table salt added was intermediate, and fresh DGJ was not attractive when compared to water control. For females, the response to DGJ that was aged for 1 week in the absence of table salt did not differ statistically from that recorded to fresh DGJ, and both materials were significantly more attractive than water control. Captures of non-target insects were significantly greater in Scentry® SWD lure-baited traps than in traps containing other treatments, which were statistically similar.

The second field experiment was conducted in a commercial raspberry orchard in Whately, MA, from 26 July to 12 August 2021. The five olfactory treatments evaluated here were: (1) fresh DGJ, (2) DGJ aged for one week with 2% table salt, (3) Scentry® SWD lure, (4) Trécé broad spectrum PEEL-PAK® multi-component lure, and (5) Trécé high selectivity 3-component lure. Each treatment was replicated six times. Traps were hung from the upper wire of the trellis system, along the perimeter of the block. Trap-capture data were collected twice a week.

In the second field study, DGJ that included table salt at 2% concentration and aged for 1 week outperformed the fresh DGJ and the three commercial lures. Fresh

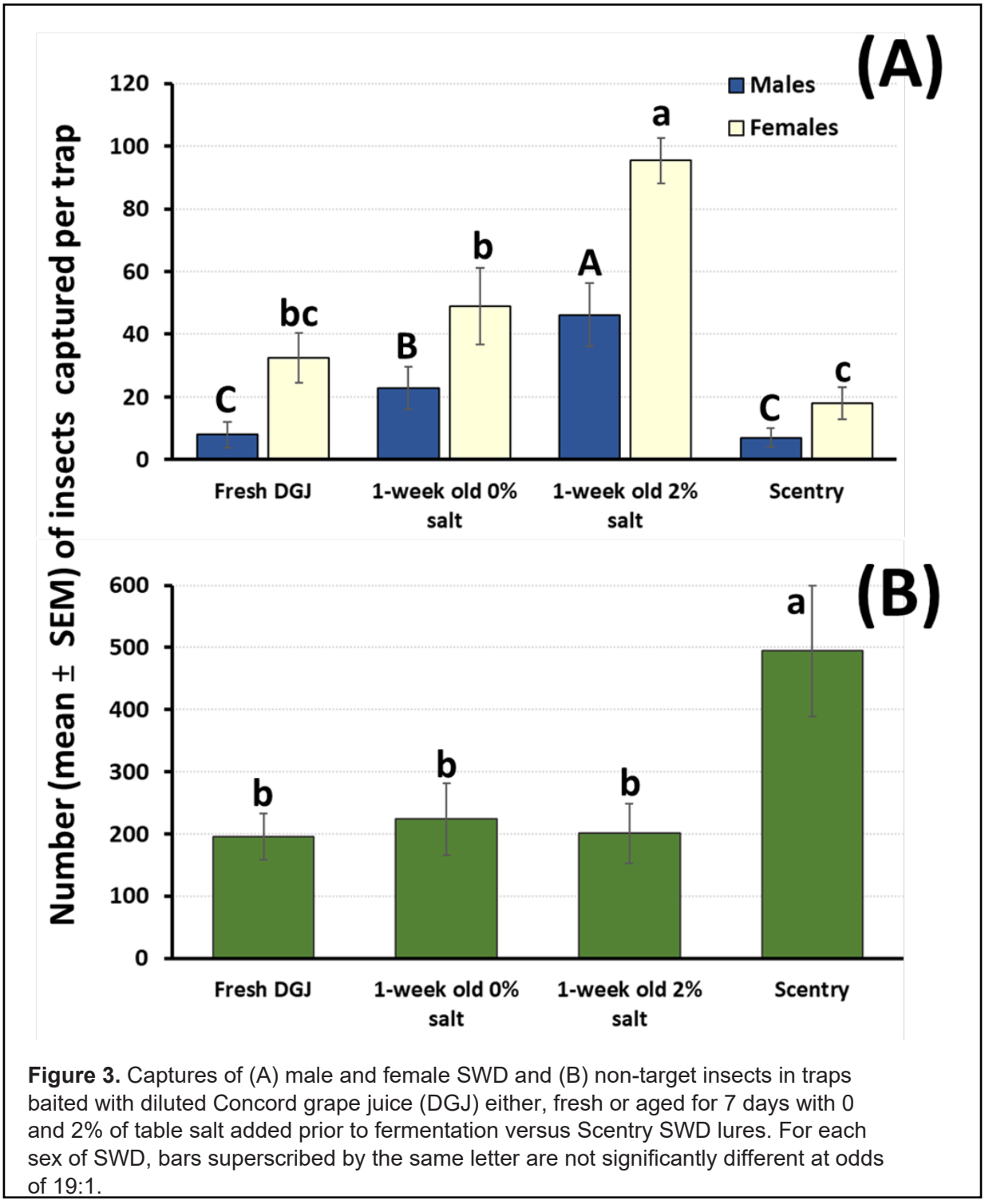

Figure 3. Captures of (A) male and female SWD and (B) non-target insects in traps baited with diluted Concord grape juice (DGJ) either, fresh or aged for 7 days with 0 and 2% of table salt added prior to fermentation versus Scentry SWD lures. For each sex of SWD, bars superscribed by the same letter are not significantly different at odds of 19:1.

DGJ was as attractive to males as the Trécé selective and the Scentry® SWD lures. Fresh DGJ was significantly more attractive than the Trécé broad spectrum lure. The response of females to fresh DGJ was comparable to that shown to the Trécé selective and Scentry® SWD lures, but greater than that recorded to the Trécé broad spectrum lure (Figure 4A). In terms of captures of non-target insects, the Trécé selective lure attracted the fewest number of non-target insects whereas the Scentry® SWD lure attracted significantly more insects than any other treatment except for the Trécé broad spectrum lure (Figure 4B).

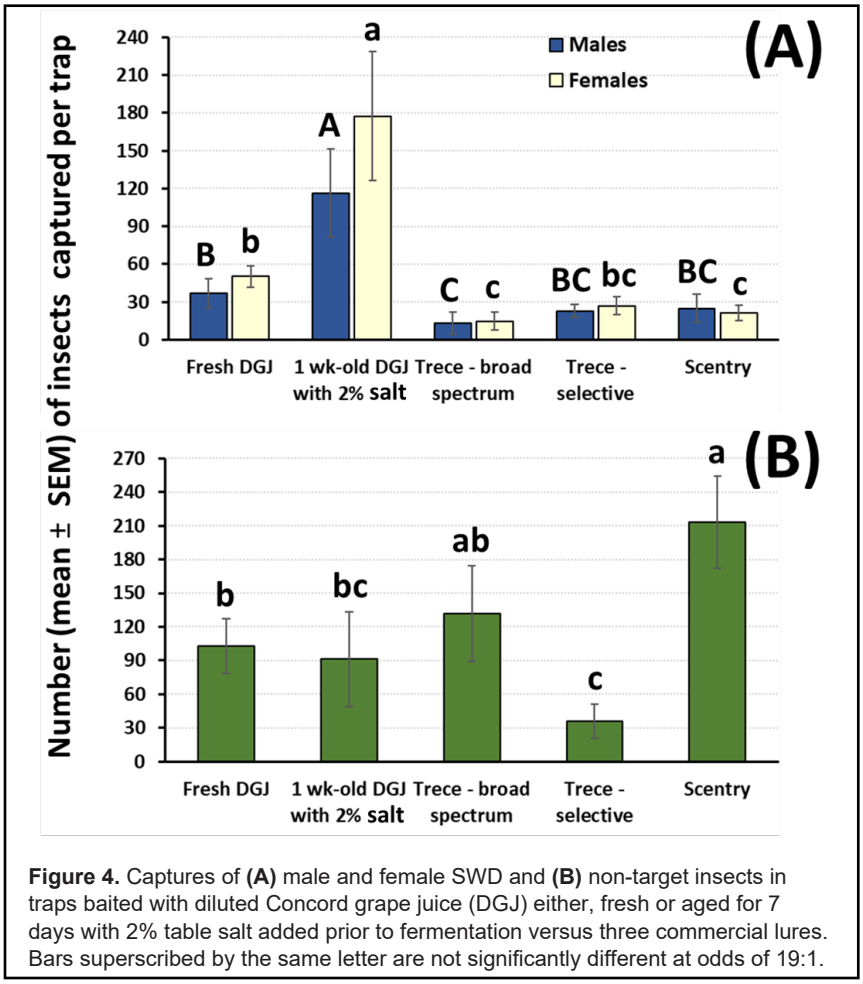

Figure 4. Captures of **(A)** male and female SWD and **(B)** non-target insects in traps baited with diluted Concord grape juice (DGJ) either, fresh or aged for 7 days with 2% table salt added prior to fermentation versus three commercial lures. Bars superscribed by the same letter are not significantly different at odds of 19:1.

Conclusions

When table salt is added to DGJ the resulting material outcompetes the performance of commercial lures and greatly reduces captures of non-target insects, thereby increasing bait selectivity. Taken together, these results when combined with its low cost and accessibility make DGJ a feasible monitoring option for small-scale growers who are not able to monitor or manage SWD populations because commercially available baits are too expensive or inaccessible.

RECIPE for making the UMass diluted Concord grape juice (materials for 5 traps):

- 25 oz. of tap water
- 9 oz. of Concord grape juice
- 1 tablespoon of table salt

Mix all ingredients, divide in equal parts, bait, and hang traps.

Acknowledgments

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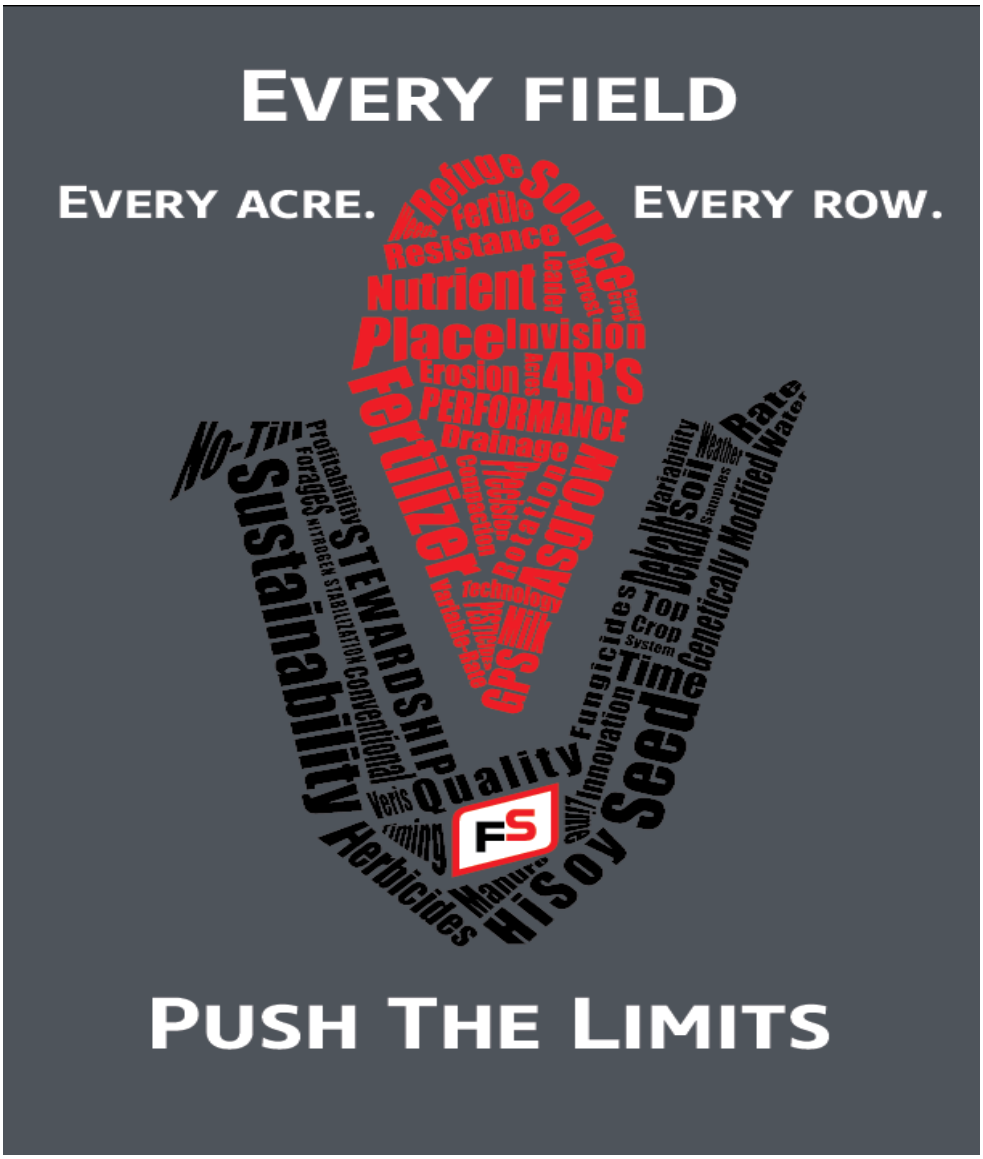

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