

How selective is diluted Concord grape juice laced with table salt at attracting spotted-wing drosophila?

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Fourteen years of research has accumulated since the continental U.S. invasion of spotted-wing drosophila (SWD), *Drosophila suzukii*. An important component in the effective management of SWD is to determine when adult flies become active and the presence of larvae in the fruit. Monitoring should take place from early stages of fruit development until the end of harvest. Adult SWD can be monitored using traps and a great variety of commercial lures and baits have become available for SWD monitoring. The efficacy of insect traps and lures is determined by their attractant power as well as their specificity towards the target species. Research involving the evaluation of fruit juices, in particular diluted Concord grape juice (DGJ) as SWD attractants has been conducted at UMass since 2018. The most recent research findings indicate that the level of attractiveness of fresh DGJ to male and female SWD was enhanced when DGJ was aged for one week in the presence of 2% table salt prior to field deployment in traps. By using 1-week old DGJ laced with 2% table salt captures of non-target insects were reduced drastically, increasing bait selectivity.

The above results, when combined with its low cost and accessibility make DGJ a feasible monitoring option for small-scale fruit growers. The objective of the present study was to compare and validate the performance and specificity of fermented DGJ containing 2% salt when compared to two commercial lures at six commercial fruit orchards in Massachusetts.

Materials and Methods

Three treatments were evaluated: (1) Diluted Concord grape juice (DGJ) fermented for one week in the laboratory in the presence of 2% table salt,

(2) Scentry SWD lure, and (3) Trécé high selectivity 3-component lure. Traps used for the evaluations were made of 1-L clear plastic containers with 12 small holes (0.15 in in diam.) on the side to allow responding flies to enter the trap. Each trap had 7 oz of either, DGJ or unscented soapy water (as a drowning agent) in the case of the Scentry and Trécé lures. On May 2nd, 2022, one set of three traps each was deployed at each of seven Massachusetts locations: Deerfield, Belchertown, Northborough, Brookfield, Leominster, Phillipston, and Amherst. For the first two locations, traps were hung from cherry trees and then moved to grape vines after cherries were harvested. In Northborough, traps were deployed on blackberry plants. In Brookfield and Leominster, traps were deployed on raspberry plants. In Amherst, traps were positioned 2 feet above elderberry plants using steel wire. All traps were removed on August 25th, 2022. The DGJ bait was replaced weekly whereas the two commercial lures were replaced every four weeks. The results hereunder present the mean number of insects (either SWD or non-target insects) captured per trap, per month. Insect capture specificity was calculated as the number of catches of target species divided by the total number of catches.

Results

The first SWD of the 2022 growing season was one female captured on May 25th by a trap baited with DGJ with 2% salt. The total number of male and female SWD and non-target insects captured per month across all three treatments is shown in Table 1. In all, 3,934 SWD (males and females combined) and 28,337 non-target insects were captured by traps, regardless of the treatment. While captures of SWD represented roughly 12% of the total number of insects trapped, there were differ-

ences in the selectivity of the various materials that were evaluated.

Across all treatments, SWD captures increased 16-fold during the month of August when compared with July captures. In terms of treatment performance, during the months of June and July the Scentry lure attracted similar numbers of SWD males and females as the 1-week old DGJ with 2% salt (Figure 1A,B).

During August, the period of highest SWD captures, the highest captures of males took place in traps baited with 1-week old DGJ with 2% salt and with Scentry lures, whereas SWD female captures were significantly greater in traps baited with 1-week old DGJ

with 2% salt than in traps baited with commercial lures (Figure 1C). During July and August, the Scentry lure outperformed the Trécé lure (Figure 1B,C).

Table 2 shows the results concerning the selectivity of the DGJ and the two commercial lures. Consistently, the most selective material was 1-week old DGJ with 2% salt. In fact, the specificity of this material, which was replaced weekly, improved over time, a result that might be due to increased fermentation of the DGJ with greater ambient temperatures. For all three treatments, the ratios of non-targets to SWD improved (i.e., numbers were lower) over time. During June, the ratio of

Table 1. Captures of spotted-wing drosophila males and females and non-target insects (mostly other drosophilids) across all traps according to month.

Month	Total number of SWD males	Total number of SWD females	Total number of non-target insects
May	0	1	1,980
June	10	14	5,884
July	343	431	12,986
August	1,392	1,743	7,487
TOTAL	1,745	2,189	28,337

Table 2. Captures of spotted-wing drosophila (males and females combined) and non-target insects (mostly other drosophilids) in traps baited with commercial lures and diluted Concord grape juice (= DGJ) laced with 2% table salt added prior to fermentation, according to month. Ratio of non-targets to SWD: the lower the value, the more selective the material given that fewer non-targets need to be counted to find SWD.

Month	Bait treatment	Mean number of SWD captured per trap	Mean number of non-targets captured per trap	Ratio of non-targets to SWD
June	1 week-old DGJ with 2% salt added	0.5	7.1	14.2
	Scentry	0.4	203.2	508.0
	Trécé	0.1	34.8	348.0
July	1 week-old DGJ with 2% salt added	8.2	32.7	4.0
	Scentry	7.4	479.8	64.8
	Trécé	0.5	28.5	57.0
August	1 week-old DGJ with 2% salt added	53.3	44.5	0.8
	Scentry	31.0	350.2	11.3
	Trécé	2.8	21.2	7.6

non-targets to SWD for the Scentry lure was 508, meaning that one person would need to count 508 insects for each single SWD, whereas for the Trécé lure the ratio was 348. In contrast, for the 1-week old DGJ with 2% salt treatment, only 14 non-targets were captured for each SWD. Interestingly, the much higher specificity of the 1-week old DGJ with 2% salt treatment became evident (the ratio of SWD to non-targets was nearly 1:1) when the overall number of trapped SWD and other insects increased in August.

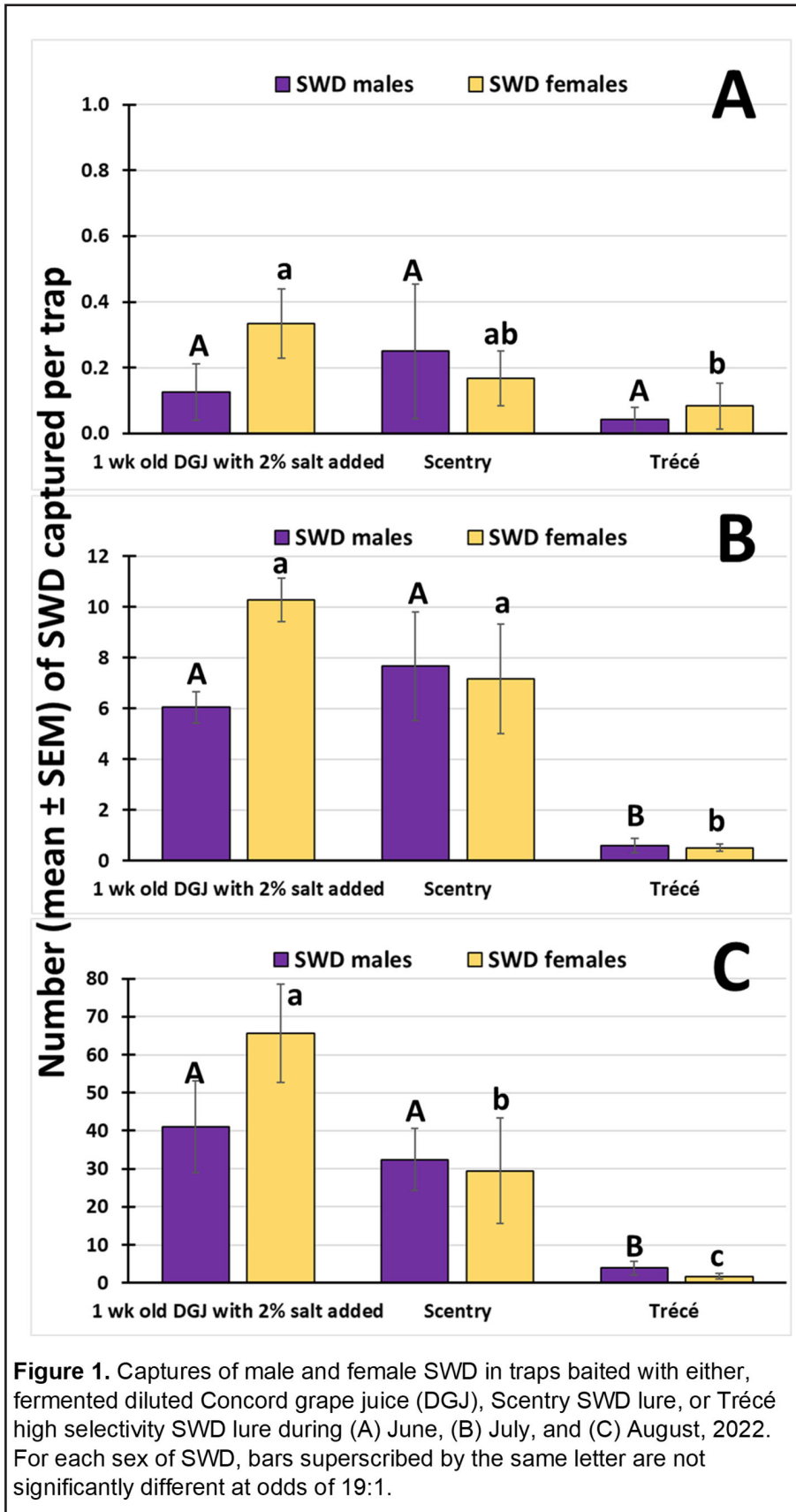


Figure 1. Captures of male and female SWD in traps baited with either, fermented diluted Concord grape juice (DGJ), Scentry SWD lure, or Trécé high selectivity SWD lure during (A) June, (B) July, and (C) August, 2022. For each sex of SWD, bars superscribed by the same letter are not significantly different at odds of 19:1.

Conclusion

Our combined findings validated the notion that 1-week old DGJ with 2% table salt is an effective and inexpensive bait that in terms of female SWD captures outcompetes the performance of commercial lures and greatly reduces captures of non-target insects, thereby increasing bait selectivity.

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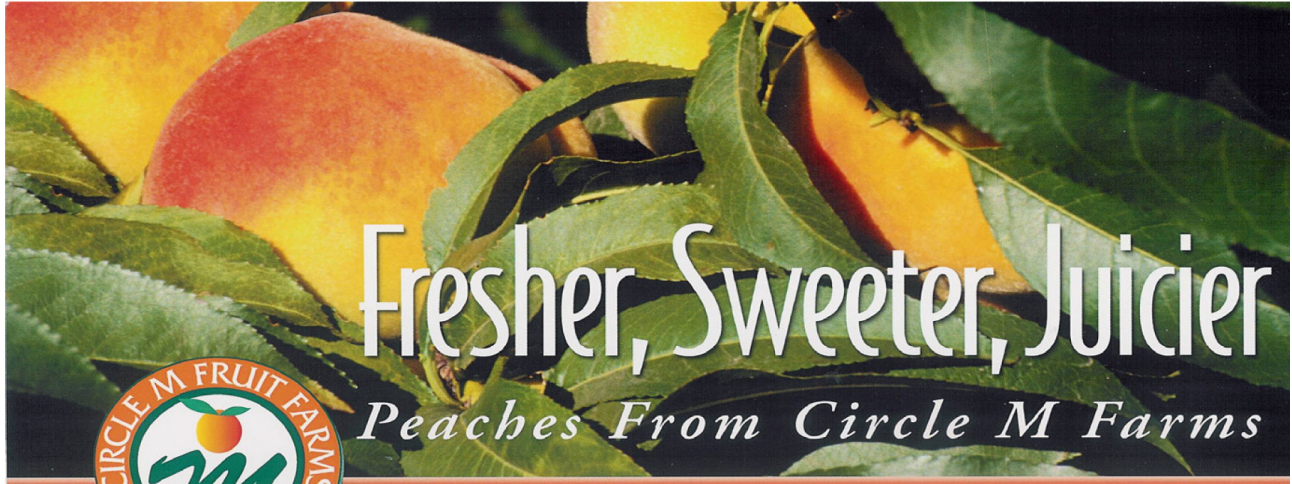
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