Response of Tarnished Plant Bug to Synthetic Aromatic Plant Volatiles

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Many insect species utilize plant volatiles to locate food, oviposition sites, and potential mates. Based on the existing knowledge in plant-insect interactions, commercial lures based on plant volatiles have been developed to monitor some tree fruit pests. Some aromatic plant volatiles (group of related compounds that share some characteristics including strong, pleasant aroma) such as methyl salicylate and benzaldehyde are emitted by trees at various phenological stages and they may be attractive to some insect herbivores. For example, when used in combination with the aggregation pheromone, benzaldehyde has demonstrated to be attractive to plum curculio, *Conotrachelus nenuphar*. However, no lures have been developed to monitor populations of some insects like tarnished plant bug (TPB), *Lygus lineolaris*, and European apple sawfly, *Hoplocampa testudinea*, two early-season apple pests.

Here, we evaluated the response of adult TPB to four synthetic aromatic plant volatiles (methyl salicylate, benzyl alcohol, benzonitrile, and benzaldehyde) assessed alone and in combination. Additionally, we also evaluated the attractiveness of the commercial lure PredaLure® (methyl salicylate-containing lure) to TPB adults.

Materials & Methods

We conducted four different field experiments. The first and second experiments were conducted at the University of Massachusetts Cold Spring Orchard (CSO) in Belchertown. The plant volatiles were formulated in the laboratory using low-density white polyethylene vials (one vial per plant volatile) and were diluted in mineral oil. White sticky cards (Fig. 1A), purchased from Great Lakes IPM, were used for these experiments. Tomato stakes (5 feet tall) were fixed on the ground to place the white sticky cards and the volatile-containing vials. In total, 46 stakes were deployed. The distance between stakes was 2 yards. Each vial was placed inside an inverted red plastic cup to provide additional protection from rainfall and degradation by UV light. Vials were attached to the tomato stakes using wire. The white

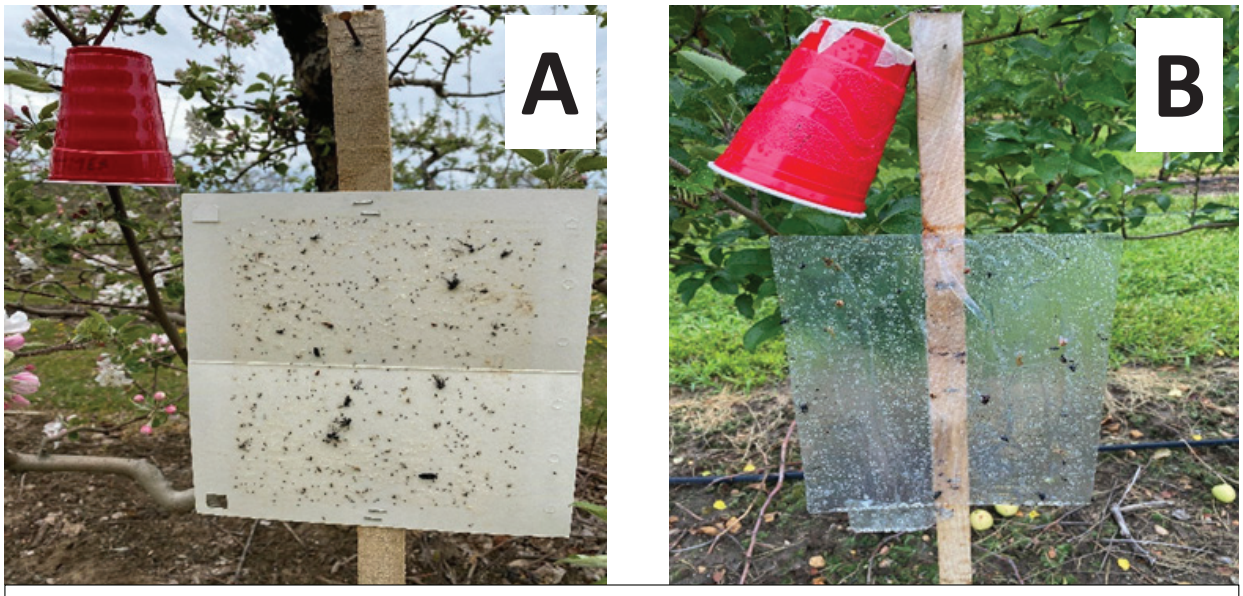

Figure 1. Traps used for the experiments with tarnished plant bug: (A) white sticky card, (B) clear sticky card. Lures were placed inside the inverted red plastic cups to minimize effects of rainfall and UV light degradation.

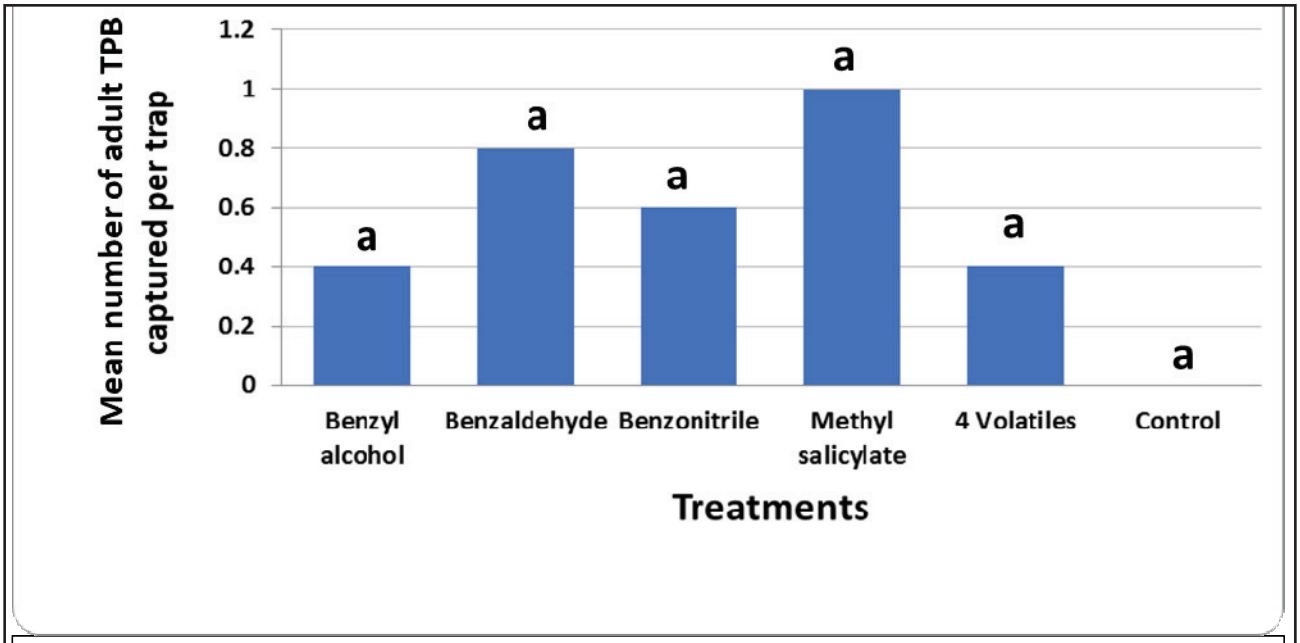

Figure 2. Captures of tarnished plant bug on white sticky cards baited with different plant volatiles. Bars superscribed by the same letter are not significantly different at odds of 19:1.

sticky cards were inspected once a week. To minimize the influence of trap location on TPB capture, we rotated the plastic cups attached with lures in clockwise direction within each replication. We replaced all lures every 3 weeks.

For Experiment 1, we evaluated (1) benzaldehyde, (2) methyl salicylate, (3) benzonitrile, (4) benzyl alcohol, (5) all 4 plant volatiles combined, and (6) unbaited traps (only mineral oil) as control. All treatments were replicated 5 times in a complete randomized block design. For Experiment 2, we tested (1) methyl salicylate single lure, (2) combination of four methyl salicylate

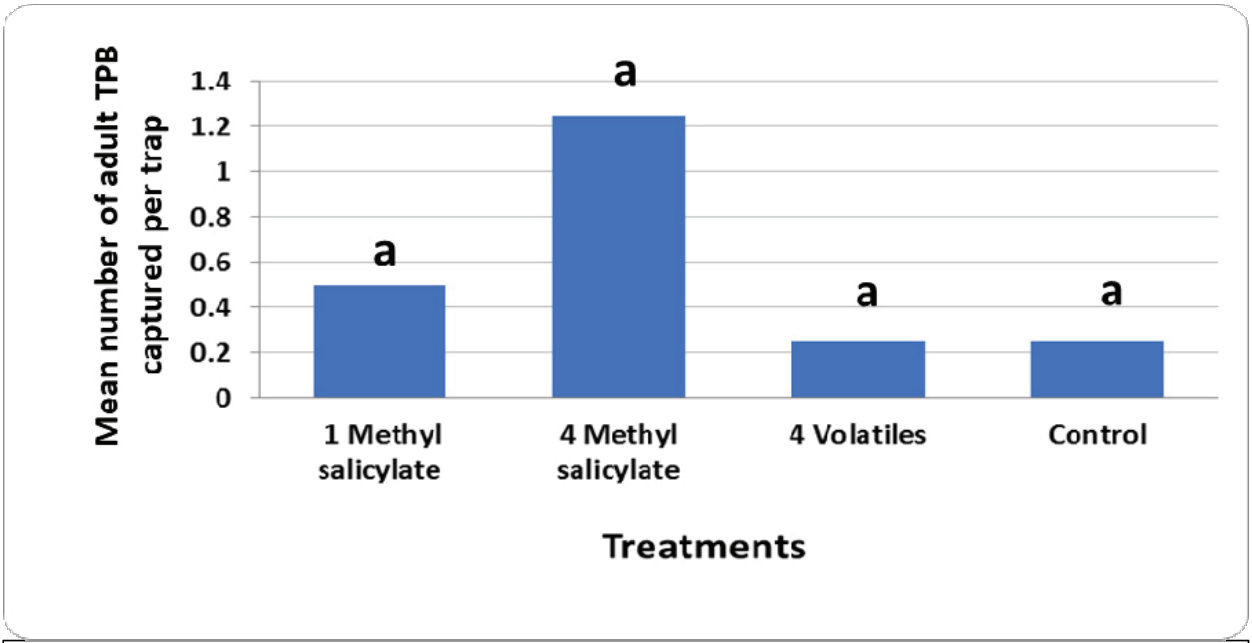

Figure 3. Captures (May 1 – June 29, 2020) of tarnished plant bug on white sticky cards baited with different concentrations of methyl salicylate. Bars superscribed by the same letter are not significantly different at odds of 19:1.

dispensers, (3) combination of methyl salicylate, benzaldehyde, benzonitrile and benzyl alcohol, and (4) unbaited traps as control. All the treatments were replicated 4 times and were arranged in complete randomized block design.

The third experiment was conducted at six commercial orchards in Massachusetts from April to June 2020. We compared captures of adult TPB in PredaLure®, which is a commercial lure that contains methyl salicylate (purchased from AgBio, Inc.) versus unbaited cards. Five pairs of cards (one was baited with PredaLure® and the other was unbaited) were deployed in each orchard. Traps were deployed on the lower branches of perimeter-row trees.

The fourth experiment was conducted at the UMass CSO in Belchertown, MA, from July to September 2020 using clear sticky cards baited with PredaLure® and unbaited clear sticky cards. Clear sticky cards (Fig. 1B) were used to quantify the olfactory response of TPB to the lures in the absence of visual cues. The clear sticky cards were prepared in the lab using laminated sheets coated with Tangletrap®. The lure-containing vials and clear sticky cards were placed on the tomato stakes at the height of about 4 feet above ground. Traps in all experiments were checked once a week and all PredaLures® used in experiments 3 and 4 were replaced every 4 weeks.

Results

Results from the first experiment showed that, among four aromatic plant volatiles tested singly or the 4-volatiles combined, TPB captures were highest in white sticky cards baited with methyl salicylate, followed by cards baited with benzaldehyde. The 4-volatile lure seemed to have decreased TPB captures (Fig. 2).

Fig. 3. (experiment 2) shows that white sticky cards baited with the combination of four methyl salicylate dispensers captured about five times more TPB than unbaited control cards, and 2.5 times more than cards baited with one methyl salicylate dispenser. The 4-compound lure seemed to have decreased TPB captures (Fig. 3).

Results from the third experiment revealed that white sticky cards baited with PredaLure® captured 3 times more TPB adults than unbaited sticky cards (Fig. 4A). In the fourth and last field experiment, clear sticky cards baited with PredaLure® captured nearly twice as many TPB than unbaited sticky cards (Fig. 4B).

Conclusion

Based on our combined results, we gathered evidence suggesting that methyl salicylate is an attractive plant volatile to adult TPB. Yet, further research needs to be done to determine the potentiality of methyl salicylate as a lure to monitor TPB populations.

Acknowledgments

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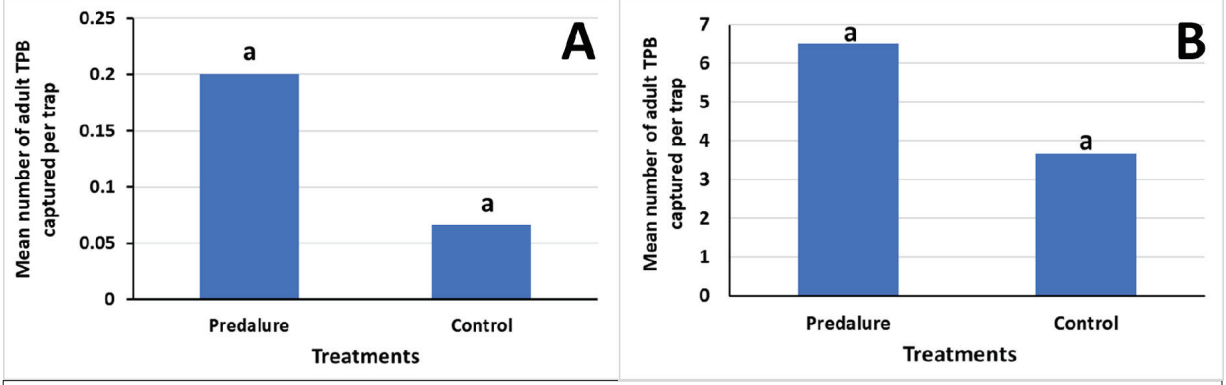

Figure 4. Captures of tarnished plant bugs on cards baited with PredaLure versus unbaited using **(A)** White sticky cards (experiment 3) and **(B)** Clear sticky cards (experiment 4). Bars superscribed by the same letter are not significantly different at odds of 19:1.