Does the Presence of Trap-crop Plants Enhance the Response of the Invasive Brown Marmorated Stink Bug to Its Synthetic Pheromone?

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In Massachusetts and other New England states, the invasive pest brown marmorated stink bug (BMSB), *Halyomorpha halys*, is threatening the specialty crops industry. The highest BMSB populations in Massachusetts were recorded in 2019 and 2020. In 2020, we increased monitoring efforts to include farms located in the southwest, northwest, and southeast areas of the state, where no BMSB monitoring had been done before. We found BMSB at every single farm and fruit growers expressed big concerns about future crop damage potentially caused by this pest. Small-scale growers face tough choices about protecting crops from BMSB near harvest, when pest populations are high. Broad-spectrum insecticides are effective but also kill beneficial insects and some materials cannot be applied near harvest. Thus, the threat posed by BMSB to retail and pick-your-own operations is very high.

Recent trap-cropping research has revealed that sunflower and sorghum are effective trap crop plants for BMSB in vegetable production systems. In Florida, buckwheat and millet are additional suggested trap crops for leaf-footed bugs and various stink bug species. The BMSB synthetic pheromone is being used by some growers to monitor BMSB populations. Whether the combination of trap crop plants and BMSB pheromone lures attract more BMSB than either, trap crops alone or the pheromone alone, has to our knowledge not been evaluated in fruit orchards.

Here, we present the results of a 2020 study that compared the extent to which the presence of trap crop plants (dwarf sunflower, buckwheat, sorghum, and pearl millet) increases BMSB captures in pheromone-baited clear sticky cards when compared to pheromone-baited cards in the absence of trap crops.

Materials & Methods

This study was conducted at the University of Massachusetts Cold spring Orchard, in an open area adjacent (about 100 yards apart) to an apple block. In early June, 2020, an area of 5 x 45 yards was plowed and rototilled. This area was then sub-divided into 10 plots of 4 x 4 yards each. The first four plots received one of four trap crop seeds: dwarf sunflower, buckwheat, pearl millet, and sorghum (WGF-type). The four adjacent plots received the same four trap crops. The ninth and the tenth plots were left as bare soil, and they eventually became grassy areas. On July 6th, each of the 10 plots received one clear sticky card (8 x 6 inches). All sticky cards were stapled to tomato stakes that were buried into the ground. The first four plots received BMSB pheromone lures (one per plot), which were attached

Figure 1. Layout of the 10 experimental plots (4 x 4 yards each) used for the trap crop study at the University of Massachusetts Cold Spring Orchard. Each experimental plot received one baited (plots 1-4 and 9) or one unbaited (plots 5-8 and 10) clear sticky card to quantify BMSB captures.

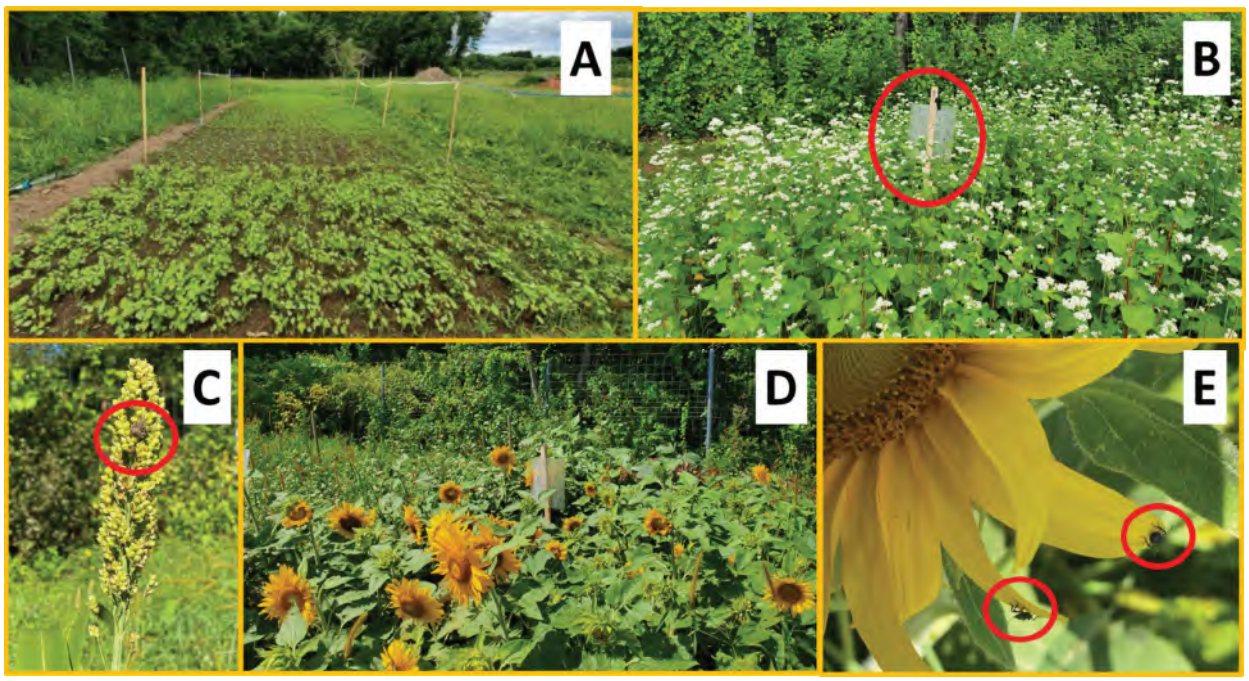

Figure 2. Progression of the trap crop study: (A) View of the experimental plots on June 15, 2020, (B) Buckwheat plants in bloom (picture taken on July 20) with pheromone-baited clear sticky card (encircled), (C) Adult BMSB (encircled) on sorghum panicle (head), (D) Dwarf sunflower plants in bloom (picture taken on August 17), (E) view of two BMSB nymphs (encircled) on sunflower.

to the tomato stake, above the sticky cards. Plots 5-8 did not receive pheromone lures; therefore, these plots only tested the effects of the trap crops alone. Plot 9 received one BMSB pheromone lure, so this treatment represented the pheromone in the absence of trap crop plants. The 10th plot received an unbaited clear sticky card, so this plot served as a negative control (Figure 1).

Once a week thereafter, all sticky cards were inspected and the number of adults and nymphs of BMSB were recorded (and removed) until September 21, 2020. Figure 2 depicts the experimental plots with trap crop plants at various stages of development.

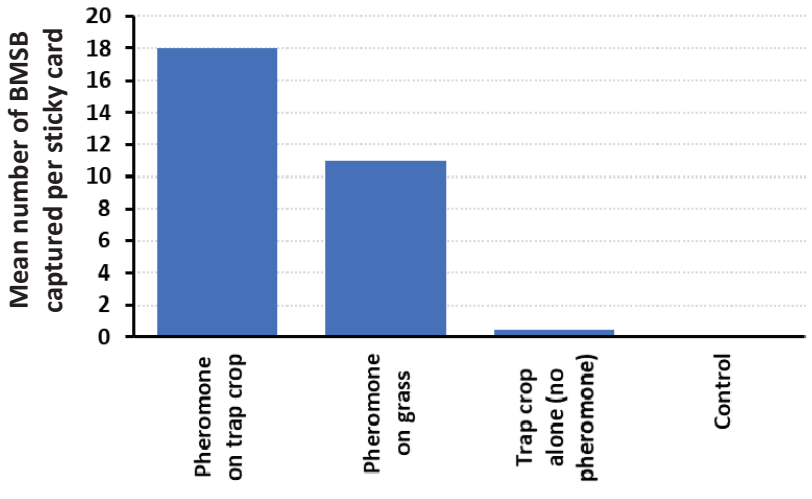

Figure 3. Mean number of BMSB captured per clear sticky card, according to treatment. BMSB captures were pulled across the four trap crop species (first and third bars).

Results

From July 13 to September 21, 2020, 10 sticky cards captured 84 BMSB (combining adults and nymphs). Similar BMSB captures were recorded among the four trap crop plant species. Figure 3 shows that BMSB captures in pheromone-baited clear sticky cards deployed in association with trap crop plants attracted 60% more BMSBs than pheromone-baited sticky cards de-

ployed in the absence of trap crop plants. Sticky cards deployed in trap crop areas in the absence of BMSB pheromone only captured 2 BMSB (average of 0.25 per card) across the entire period of investigation.

Conclusions

Based on the results of this single-location, single-season study, it appears that deploying the BMSB pheromone in areas planted with trap crops results in increased numbers of BMSB visiting those areas when compared to the BMSB pheromone deployed alone. Plans are underway to continue with this research at multiple locations throughout Massachusetts to validate the findings of this study.

Acknowledgments

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