Response of Oriental Fruit Moth to Benzaldehyde and Other Plant Volatile Compounds

Ajay P. Giri and Jaime C. Piñero
Stockbridge School of Agriculture, UMass Amherst

Tortricid moths (Order: Lepidoptera) are known for their remarkable olfactory capabilities that allow them to find their host plants. The Oriental fruit moth, *Grapholita molesta*, (OFM) is a worldwide key pest of stone and pome fruits. It produces 3-4 generations per year and has the ability to switch hosts (e.g., from peach to apple) over the growing season. Sex pheromone lures are used to monitor OFM populations. However, sex pheromone lures only attract OFM males and there is a likely chance of mated female immigrating into the orchards. Because one mated female OFM can lay up to 160 eggs over its lifespan, then a few females are enough to maintain a robust population. Therefore, luring females would be more advantageous to monitor moth activity and minimize their impact compared to pheromone-based monitoring systems that target males.

The main goal of this study was to evaluate, under field conditions, the response of OFM males and females to one aromatic compound, benzaldehyde, either alone or in combination with one commercially available 4-component lure (= Megalure 4-K®). Megalure is an attractant produced by Trécé Inc. that targets male and female codling moths. Benzaldehyde is predominantly found in plants of the genus *Prunus* (Rosaceae) some of which are primary hosts of OFM and is found in traces in the flowers of apple early in the season.

Materials and Methods

This study was conducted from 28 April to 25 July, 2022, at the UMass Cold Spring Orchard in Belchertown, MA. Seven lures (= treatments) were evaluated: (1) Benzaldehyde (= BEN) at very low dose (BEN-VL), (2) BEN at low dose (BEN-L), (3) BEN at medium dose (BEN-M), (4) Megalure alone, (5) Megalure + BEN-VL, (6) Megalure + BEN-L and (7) Megalure + BEN-M. Unbaited traps served as negative controls. All lures were placed inside orange colored delta-shaped traps (Pherocon® VI, Trécé Inc., Adair, OK, USA) containing sticky liners. The BEN lures were formulated by Trécé Inc. in a black polyvinyl chloride (PVC) proprietary matrix (Figure 1). At the orchard block, each treatment was replicated 5 times (Figure 2).

Traps were hung on the upper third of the tree canopies and were 15 meters apart. Traps were examined beginning on 5 May and every seven days thereafter until 25 July. All lures were replaced every 6 weeks and sticky liners were replaced whenever the liner became crowded with insects. We also collected data on the

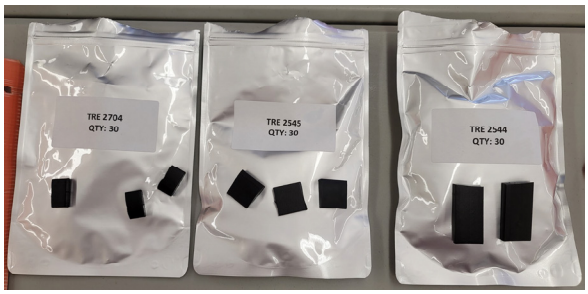

Figure 1. Experimental benzaldehyde lures formulated by Trécé, Inc., in a black polyvinyl chloride (PVC) proprietary matrix.

Figure 2. Trap deployment on the perimeter of a commercial apple orchard block. There were eight treatments replicated four times.

codling moth, but those results are not reported here.

All captured adult moths were identified according to species (i.e., CM, OFM) and examined under dissecting microscope to identify their sex.

Results

Early season captures (28 April – 8 June). OFM populations peaked during this period with 2,618 OFM (males and females) captured across all treatments. During this period, Megalure with benzaldehyde medium dose (MEG + BEN-M) and Megalure with benzaldehyde low dose (MEG + BEN-L) performed best (Figure 3). These two treatments were significantly more attractive than benzaldehyde at very low dose, which also showed to be attractive to males when compared to unbaited traps. OFM males captures in traps baited with benzaldehyde low dose (BEN-L), benzaldehyde medium dose (BEN-M), Megalure alone (MEG), and Megalure with benzaldehyde very low dose (MEG + BEN-VL) were statistically similar.

Seventy-six OFM females were captured in treatments containing Megalure, regardless of the presence or absence of benzaldehyde (Figure 3, female numbers are in red font, in parentheses). Only one female OFM was captured in traps baited with benzaldehyde alone at a low dose.

Mid-season captures (9 June – 25 July). During this period, Megalure with benzaldehyde at medium dose (MEG + BEN-M) continued to be the most attractive lure combination whereas MEG + BEN-L and MEG + BEN-VL showed an intermediate level of attractiveness (Figure 3). Benzaldehyde alone, regardless of its dose, was as attractive to OFM males as Megalure (MEG).

The number of OFM females trapped declined 19-fold during the mid-season. Only four OFM females were captured by traps containing Megalure in this period.

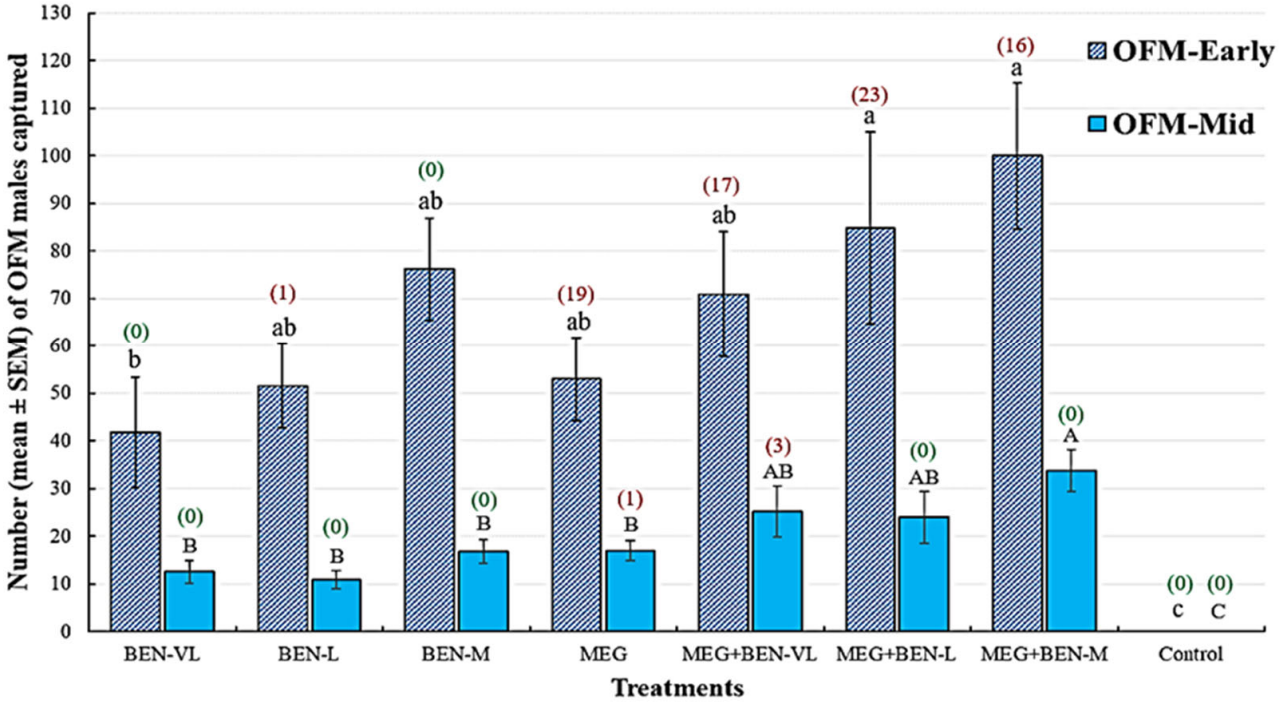

Figure 3. Captures (mean ± SEM) of male OFM in delta traps according to treatment early in the season (dotted blue texture) and in the mid-season (solid blue bar) in 2022. The numbers above the bars inside parentheses denote total number of female moths captured. Bars superscribed with the same letter do not differ significantly among treatments at odds 19:1

Conclusion

Our findings show that benzaldehyde alone is a strong male attractant for OFM and that the addition of benzaldehyde to Megalure increases OFM male captures in traps. These findings indicate that additional research needs to be conducted with benzaldehyde to develop new or improve exiting monitoring and control systems for OFM and potentially other tortricid moths.

Acknowledgements

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Ajay Giri is a graduate student at the UMass Stockbridge School of Agriculture.

Paul Émile Yelle (1953-2022)

Our Friend Paul Emile passed August 29, 2022

Paul was a friend and colleague from Quebec, Canada. His career was spent working with tree fruit growers in Quebec. Paul worked for provincial ministry of agriculture as the fruit pathologist. Many of us knew him from our association and tours with the International Fruit Tree Association. In addition, Jon Clements reminded me he was well remembered as a regular attendee at the Vermont IPM meeting many of us participate in. Tim Petch, apple grower in Quebec, indicated that "Paul did a lot for his fellow fruit growers in Quebec and loved every minute of his job!" He reminisced "Paul loved all corners of fruit production, especially the orchard tours and meetings where he could rub shoulders with all, just like his dad, Bob Petch did."
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