Drawn by Scent: Effects of ß-Cyclodextrin and Cellulose Fiber Paper-Encapsulated Microbial Volatiles on Insect Olfactory-Mediated Attraction

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In nature, microbial volatiles serve as behavioral cues for insects. Pesticides aim to replicate the behavior-triggering nature of these volatiles; however, with approximately 6 billion pounds of pesticides used annually worldwide, the detrimental effects of these chemicals on environmental and human health are extensive. It is for this reason that this research focuses on observing the behaviors exhibited by insects while exposed to an array of microbial volatiles and assessing the potential of ß-cyclodextrin and cellulose fiber paper as scent delivery methods to mitigate the volatile nature of these compounds. To test the effectiveness of scent release through different substrates, four bacterial species were encapsulated in ß-cyclodextrin and cellulose fiber paper. Then, with an olfactometer, six distinct combinations of the four bacterial scents were tested for both substrate types on Tenebrio molitor beetles and fruit flies. Chi-square and preference index analysis were used to validate the findings. Results of the study indicated that the substrate type did not affect the volatile preferences of the beetles or fruit flies. Cellulose fiber paper, however, tended to produce stronger preference behaviors from insects. Additionally, beetles demonstrated the most attraction to Streptomyces griseus while fruit flies preferred Bacillus megaterium. Chi-square analysis confirmed the statistical significance of the results ($p < 0.00001$). These findings demonstrate the potential of microbial volatiles as eco-friendly alternatives to conventional pest management, as well as effective delivery methods to facilitate the implementation of these volatiles. Key words: Microbial volatiles, pesticides, substrates, preference

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