See the Bees Speak: Confined Direct Analysis in Real Time and SPME-GC-MS for B. impatiens and A. mellifera Alarm Pheromone Detection

Brodowski, Skylar (School: Washington-Lee High School)

Both honey bees and bumble bees are frequently used as pollinators for crops around the world. Bumble bees are active at lower temperatures and have smaller hives, increasing their use over honey bees in greenhouses. The goal of this experiment was to learn more about bumble bee behavior, in hopes that they can be more efficiently implemented into greenhouses. Alarm pheromones present a way to compare and contrast behavior between the two species of bee. This specific type of pheromone lack species specificity more than other pheromones such as sex pheromone, raising the chance of similarities between pheromone release and thus new insights on similarities and differences in behavior of different bee species. To accomplish this goal, two analytical methods were used. A modified version of Direct Analysis in Real Time (DART) ion source, Confined Direct Analysis in Real Time (cDART), was used. This is an extremely new technique, and this is the first study to implement this modified technique to bee behavior. Solid Phase Microextraction-Gas Chromatography-Mass Spectrometry (SPME-GC-MS) was used to further confirm the results of cDART and to further analyze the found compounds. Alarm pheromone compounds found for honey bees were 1-pentanol, 2-nonanol, isopentyl alchohol, butyl acetate, and 3-methyl-3-buten-1-ol. Alarm pheromone compounds found for bumble bees were 1-pentanol, 2-heptanone, and dihydroxyacetone. Bumble bees have been recently hypothesized to have alarm pheromones, but little to no research has been done to identify specific compounds, until this study.