Ketones Produced by Bacillus subtilis Bacteria: Assessing Inhibition and Morphological Changes on Deadly Bat Fungus, Pseudogymnoascus destructans (Year 9)

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Bats, like bees, are a keystone species benefiting the environment and saving farmers billions of dollars in chemicals. However, since 2006, millions of bats in North America have died of a disease called White-Nose Syndrome (WNS) caused by a deadly fungus, Pseudogymnoascus destructans (Pd). This cold-loving fungus wakes bats in wintertime. With little food available, the bats become weak, starve, and die. It was confirmed that naturally occurring soil bacteria, Bacillus subtilis, found in bat habitats, produce Volatile Organic Compounds (VOCs) that inhibit Pd. In early 2023, five categories of VOCs produced by Bacillus subtilis with antifungal properties were identified: Alcohols, Acids, Ketones, Benzothiazoles, and Sulfurs, but not tested on Pd. The purpose of this study tests four VOCs from the ketone category for antifungal properties against Pd: A) 3-Hydroxy-2-butanone, B) 2-Nonanone, C) 2-Heptanone, and D) 2-Undecanone. Two inhibition assay tests, five replicates each, were performed with each ketone against Pd. ImageJ was used to analyze and calculate the change in fungal growth after fourteen days. Inhibition from two ketones was statistically significant at $p<0.001$. A third ketone caused weak inhibition, but not significant at $p<0.01$. The final ketone caused no inhibition; thus no significance. Additionally, structural and morphological changes were observed in the treated Pd. Chitin, the polymer structure of the fungal wall, was examined for effects after exposure to each ketone. These results show that the use of organically-produced chemicals, ketones, found in natural bat habitats, can provide a treatment to mitigate the fungus.

Awards Won:
Fourth Award of $500