Year 4: Developing a Multiple Linear Regression Model to Predict the Specific Effects of Various Lactic Acid Bacteria Dosages on the Overall Honey Bee Gut Microbiota and Nosema ceranae Reduction

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Honeybees are essential to society, performing over 80 percent of worldwide pollination. However, commercial hive populations have been decreasing at an alarming rate in the United States. Multiple studies have shown that deteriorating gut health is one of the major reasons for their maladaptive response to various external stressors. Research throughout the last three years revealed that treating the hives with a Bifidobacterium infantis probiotic significantly reduced the counts of the harmful gut parasite Nosema ceranae. In addition, the treatment significantly improved honeybee midgut bacterium counts and overall hive health. In order to extrapolate these monumental findings to widespread farming practices, the current project aims to configure a method to better define the therapeutic index of the previously proven bacterial treatment. To this end, a multiple linear regression model was developed to predict the percentage reduction in the Nosema counts for any given initial concentration and treatment dosage. After training this model with hundreds of trials from previous research and similar experiments, the output values were periodically compared to experimental cage trials at various dosages. The results showed an extremely significant improvement in output accuracy, as the margin of error in predicted Nosema concentration significantly decreased at every treatment dosage value throughout the experiment. After continuing this model at an even larger scale, farmers will potentially determine the ideal dosage of the bacterial treatment moments after recording their Nosema counts. This probiotic treatment technology has the potential to improve hive immunity and agricultural productivity throughout the world.

Awards Won:

First Award of $5,000

University of Arizona: Renewal Tuition Scholarship