A Novel Approach to Increase Honey Bee Immune Response: The Effect of Amino Acid Supplementation on the Longevity of Nosema Infected Honeybees

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Colony collapse is at an all time high devastating ecosystems and this project discovered a means to help the survival of honey bees through the supplementation of cysteine, which significantly increased immune response of the honey bee against nosema; a prominent & deadly fungal pathogen. In order to test the supplement diet and demonstrate optimal health of the honey bee, the spread of spore infection rate, longevity, and hypopharyngeal gland measurements (nutritional storage) were measured. Control and nosema-infected bees were tested for each of the supplement diets: serine, cysteine, and threonine. Cysteine was most successful in repairing free radical damage effectively against this fast replicating gut pathogen and raising immune response capability by 7 times as compared to the control ($p<.0233$*). Cysteine treatment also increased longevity, as on day 20, nosema control was only at 23% alive, whereas cysteine (day 1) treatment had 85% of their population alive ($p<.0001$*). Cysteine also increased health enough for their bodies to store a noteworthy amount of nutrition in their hypopharyngeal gland with an average area of (.02104 mm^2) on day 7, as compared to control nosema (.01132 mm^2) ($p<.0001$*). This novel approach to increase immune response using cysteine supplementation, assisted at the cellular level in creating an important antioxidant called glutathione which repairs cellular damage as well as regulating oxide which promotes cell division & growth. This supplemental diet can be used by beekeepers across the world, ensuring these pollinators prevail long into the future when facing this deadly pathogen.

Awards Won:

Second Award of $2,000

University of Arizona: Tuition Scholarship Award