The Effect of Neonicotinoids on the Positive Transfer of Learning in Honeybees

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Honeybees serve as the world's most crucial pollinators and have a monumental impact on the agricultural industry of up to $577 billion. However, their population is declining due to various factors, with pesticides being one of the most detrimental. This project investigated the effect of neonicotinoids imidacloprid and clothianidin on the positive transfer of learning in the visual domain of honeybees. Additionally, the project identified differences between varying dosages of these insecticides. Employing a self-constructed y-maze paradigm, three experiments were systematically designed including the control, imidacloprid, and clothianidin group. Experiments were conducted in a free-flying setting, simulating a real-world environment and eliminating external stressors. Each experiment consisted of training, in which bees were conditioned with the rule of delayed matching to sample, followed by a positive transfer test from pattern to color stimuli. Results of the control experiment indicated that positive transfer was successfully completed, as there were no significant differences in performance between training and testing ($p=0.1453>0.05$). In imidacloprid experiments, it was concluded that medium-term memory was negatively impacted due to decreased transfer test performance ($p<0.05$), while short and long-term memory remained intact. However, clothianidin experiments impacted both training and transfer tests ($p<0.0001$). It had stronger effects than imidacloprid and it was concluded that long and likely short and medium-term memory were negatively impacted. The project emphasized the destructive effects of neonicotinoids on honeybees and stresses the need for change to avoid tremendous loss in the agricultural industry and environment.

Awards Won:
Third Award of $1,000
Missouri University of Science and Technology: Summer Camp scholarships (camp tuition and travel expenses, valued at up to $1,500)