Effects of Two Pesticides on Expression of Genes Related to Energy Metabolism in Honey Bees (Apis mellifera)

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Honey bees (Apis mellifera) are an essential part of agriculture, pollinating 90 commercially grown crops accounting for $15 billion of the US economy in 2014. Honey bee populations are declining due to factors including pesticides, malnutrition, habitat loss, parasites and pathogens. This project explored whether exposure of honey bees to pesticides affects transcription of CBQ1P and NADHD, two genes in the energy metabolism pathway. I hypothesized that an increase in transcription of these genes may indicate an increase in the energy required for bees to perform their normal functions. mRNA levels of CBQ1P and NADHD were measured using RNA extracted from the fat bodies of newly emerged bees from hives treated with imidacloprid, hives treated with thymol, and from untreated hives. The RNA was run through RT-PCR to quantify the relative amount of RNA transcribed from two oxidative phosphorylation genes. The data were analyzed using a student t-test. The control hives' average relative level of expression of CBQ1P was 221, while it was 2.95 for hives treated with imidacloprid ($p=0.15$) and 10.0 for hives treated with thymol ($p=0.15$). The control hives' average relative level of expression of NADHD was 187, while it was 3.13 for hives treated with imidacloprid ($p=0.1$) and 9.25 for hives treated with thymol ($p=0.1$). While the p values obtained in this study were too large to suggest that the observed changes in transcription of either gene were statistically significant, this could have been a result of limited sample size ($n=3$ in each case). Nonetheless, a substantial decrease in transcriptional levels of these important genes was observed suggesting further study into the question of the impact of pesticides on energy metabolism in honey bees is warranted.