Effect of Alloferon on the Survival Rate and Flight Performance of Honey Bees

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Honeybees serve as vital pollinators that contribute to global food security and biodiversity. However, their populations are declining due to various factors, necessitating novel approaches to mitigate bee losses. Addressing such challenges, this study investigated the potential of alloferon, a synthetic peptide with known immunological effects on insects, to enhance honey bee survival and determine the underlying mechanisms responsible for the effect. Two dietary groups were set up: one supplemented with 5 ml sugar solution containing 1 ppm alloferon peptide and the control group with 5 ml 40w% sucrose solution only. Monitored over three weeks, the alloferon-treated group significantly improved 30.7% in survival rates ($p < 0.0001$). Transcriptomic analysis of honey bee tissues revealed upregulated gene expression of seven genes associated with locomotion activity, confirmed by RNA sequencing and RT-qPCR ($p < 0.05$). Furthermore, heightened expression of the Phenol-oxidase gene in the alloferon-treated group indicated a potential enhancement in immunological response ($p < 0.01$). In the flight performance analysis, alloferon-fed bees exhibited significantly faster flight movements and prolonged durations, measured by the flight mill. Additionally, SEM analysis of dorsal longitudinal muscle in honey bees visualized increased muscle fiber bundles for the experimental group ($p < 0.0001$). These results ultimately emphasize the effects of alloferon on honey bees, where alloferon may be a promising candidate for conserving bee populations against environmental stressors. By potentially increasing the survival rate of honey bees and enabling more extensive and efficient pollination, this approach could offer substantial solutions to the agriculture and food industry.

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