Competition Between the Effects of Pesticides and Immune-activation on the Expression of Toll Pathway Genes

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Abstract : The honeybees' immune system is challenged by different risk factors that induce various responses. However, complex scenarios where bees are exposed to different pesticides simultaneously with immune activation are not well evaluated. The Toll pathway is one of the main signaling pathways studied in invertebrate immune responses, and it is a good indicator of the effect of such complex interactions in addition to key signaling elements of other pathways like Relish of the immune deficiency (IMD) pathway or Eater, the phagocytosis receptor or vitellogenin levels. Honeybee hemocytes extracted from 5th instar larvae were exposed to imidacloprid and/or amitraz with or without the presence of the zymosan a as an immune activator. The gene expression of multiple immune related genes were studied, including spaetzle, Toll, myD88, relish, eater and vitellogenin, by real-time polymerase chain reaction after RNA extraction. The results demonstrated that the Toll pathway is mainly affected by the pesticides; imidacloprid and amitraz, especially by their different combinations. Furthermore, immune activation by zymosan A, a fungal cell-wall component, acts to mitigate to some extent the effect of pesticides on the different levels of the Toll pathway. In addition, imidacloprid, amitraz, and zymosan A have complex and context-specific interactions depending on the levels of immune activation and the pathway evaluated affecting immune-gene expression differently.

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Keywords : toll pathway, immune modulation, β -glucan, imidacloprid, amitraz, honeybees, immune genes

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