

4.17 Effects of the agrochemicals trinexapac-ethyl and lambda-cyhalothrin on the pollinator *Bombus terrestris*

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Abstract

Bumblebees are important pollinators for horticultural and agricultural crops, though during the last decennia natural bee populations suffer from serious declines. The use of insecticides in agriculture is considered one of the major possible causes. We have investigated the effects of two frequently used agrochemicals in red clover agricultural systems on the model pollinator *Bombus terrestris* by focusing on potential lethal and sublethal effects. The agrochemicals of interest were trinexapac-ethyl and λ -cyhalothrin, the key components of the commercially available plant growth regulator Moddus and the insecticide Karate respectively.

In laboratory toxicity experiments *B. terrestris* pseudocolonies were exposed for 9 weeks to a series of field realistic concentrations of trinexapac-ethyl and λ -cyhalothrin ranging from 25ppm to 1000ppm and 375ppb to 3750ppb respectively. Thereby toxicity experiments including foraging behavior were conducted wherein the bees had to forage 20 cm from a nest compartment to a feeding compartment in the dark to collect contaminated sugar water. Lethal effects on worker survival and sublethal effects concerning foraging behavior, reproduction and drone weight were monitored for each agrochemical separately.

The tested bumblebee colonies showed no adverse lethal and sublethal effects of the plant growth regulator trinexapac-ethyl after a continuous exposure of 9 weeks. λ -cyhalothrin on the contrary had significant negative lethal and sublethal effects: 3750ppb and 1875ppb caused a significant increase in worker mortality, and decreases in reproduction performance and sugar water consumption. Also drone weight was negatively affected but this was only significant for the highest concentration of λ -cyhalothrin tested.

Our results indicate the significance of long-term laboratory toxicity exposure which increases the susceptibility of bumblebee colonies to some frequently used insecticides. λ -cyhalothrin clearly affects bumblebee behavior and performance and poses a risk to reproduction, while trinexapac-ethyl seems to be harmless for pollinating insects. These findings are useful to improve risk assessment practices, though studies that include semi-field and field situations, in combination with determination of the residue concentrations, are necessary to quantify effects under more realistic conditions of exposure.