

## **Neonicotinoids and bees: an overview on concentrations, side effects and risk assessment**

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### **Abstract**

The concern about bee mortalities, honey bee colony losses and CCD includes pesticides as potentially contributing factor. Especially systemic insecticides, in particular the neonicotinoids and fipronil, are pointed at. We give an overview of the literature about neonicotinoids and bees from the introduction of imidacloprid in 1991 to date.

The systemic nature, together with their relative specificity, determine the ways of use (spray, soil application, seed coating) as well as the potential routes by which honey bees may be exposed: directly (topically through sprays, dust), and orally through residues in surface water, guttation water, pollen and nectar, as well as honey dew.

Residues of neonicotinoids as well as their metabolites have been found in the above mentioned matrices, generally in the low µg/kg range but for guttation water in the mg/L range. Residues have also been found in bees, in bees wax, honey and bee bread (pollen stores) in the hive. The data available in the open, peer-reviewed literature is limited, especially for nectar, and confined to only few plant (crop) species.

The toxicity for bees has been assessed in many laboratory and (semi-) field tests: acute and chronic lethal concentrations as well as sub-lethal effect concentrations for effects on behaviour, reproduction, disease resistance and overwintering. Calculation of 'worst case' exposures based on residues found in pollen and nectar and the probable food consumption point to serious risks in some cases.

(Semi-) field tests using field-realistic concentrations did not reveal measurable lethal and sub-lethal effects on bees and bee colonies. Similarly no conclusive evidence for the involvement of neonicotinoids in colony mortality was obtained in bee monitoring studies, despite the found residues.

The proposed risk assessment scheme of Alix et al. (2009, JK Archive Ch. 10) is adequate and applicable for the risk assessment of neonicotinoid insecticides. Nevertheless, the lack of data on residues in nectar and pollen should be covered by future research (or by publication of already carried-out field experiments). Field experiments should be done with field-realistic concentrations, at a reliable scale (number of colonies, power analyses) and duration (including wintering and spring development).

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