3.7 Neonicotinoids and honey bee health - The effect of the neonicotinoid clothianidin applied as a seed dressing in *Brassica napus* on pathogen and parasite prevalence and loads in free-foraging adult honeybees (*Apis mellifera*)

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Abstract

Sub-lethal doses of neonicotinoids have been shown to negatively impact the health of honeybees. However, most studies to date have exposed bees only artificially to these pesticides under laboratory conditions. There have been just a few well designed and replicated studies of the impacts of realistic neonicotinoid exposure on honeybees foraging under field conditions.

In order to close this knowledge gap, and test the influence of the neonicotinoid clothianidin on honeybees, we used a study system of 16 paired, spatially separated (>4 km) spring oilseed rape fields in the south of Sweden. The fields were paired according to land use in the surrounding landscape and geographical proximity, using GIS. Eight of the fields were randomly assigned to be sown with clothianidin dressed *Brassica napus* (oilseed rape) seeds and their corresponding pairs with undressed *B. napus* seeds, as controls. Six equally sized *Apis mellifera* colonies, with known queen origin, were placed at each field resulting in a total of 96 colonies. Samples of bees, pollen and nectar taken from the colonies showed that the honeybee colonies at the treated fields were exposed to several orders of magnitude higher clothianidin concentrations than the colonies at the control sites. To determine the effect of this neonicotinoid on pathogen and parasite prevalence and quantities in honeybee colonies, samples of adult bees were taken from each colony both before and after the flowering period in the paired fields. The parasites studied included the ectoparasitic mite *Varroa destructor* and the microsporidian gut parasite *Nosema*. The pathogens studied included eight different honeybee viruses (BQCV, SBV, DWV, KBV, SBPV, CBPV, ABPV, and IAPV)[7]. Both the impact of clothianidin exposure on the prevalence (proportion of positive colonies) and the amount of parasites/pathogens in each colony (infestation rate/titres) were analysed.

The infestation with *V. destructor* was relatively low and the exposure to clothianidin had no significant impact on the *V. destructor* prevalence and infestation rate of the colonies. Furthermore the exposure to clothianidin had no significant influence on the *Nosema* spp. prevalence or the amount of *Nosema* spores in infested colonies. Three out of the eight viruses studied were detected: DWV, SBV and BQCV. Both BQCV and SBV were detected in practically all colonies, both before and after the experiment, with consequently no difference in prevalence due to clothianidin exposure or season. There was also no difference in BQCV and SBV titres due to clothianidin exposure. The DWV prevalence was relatively low; 4% and 36% of colonies infected, before and after the experiment respectively. The clothianidin exposure had no effect on the DWV prevalence or on the titres in DWV positive samples. The higher prevalence of DWV in the control group compared to the treated group can be explained by the different initial conditions.

It can be concluded that in this experiment, clothianidin exposure had no effect on the prevalence or the amount of the studied pathogens and parasites in honeybee colonies.

[7] BQCV = Black Queen Cell Virus, SBV = Sacbrood Virus, DWV = Deformed Wing Virus, KBV = Kashmir Bee Virus, SBPV = Slow Bee Paralysis Virus, CBPV = Chronic Bee Paralysis Virus, ABPV = Acute Bee Paralysis Virus, IAPV = Israeli Acute Paralysis Virus