

## 2.12 The impact of imidacloprid and the interaction between imidacloprid and pollen scarcity on vitality and hibernation of honey bee colonies

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### Abstract

In the Netherlands there is an increased winter mortality of honey bee colonies. The causes of winter mortality are multifactorial. The honey bee parasite *Varroa destructor*, bee diseases like *Nosema* spp. and viral infections, poor pollen sources, exposure to pesticides and beekeeping practice are factors involved. The relative impact of these factors is not clear and besides that, also circumstantial. This study focussed on in the factor pesticide, in this study imidacloprid and feed scarcity of feed, in this study pollen scarcity, on the vitality and overwintering of honey bee colonies.

The impact of imidacloprid on the vitality and overwintering of honeybee colonies was studied by in-hive feeding of the colonies during 12 weeks with 400 gram sugar solution 50% containing imidacloprid twice a week. The sugar solution containing on average 5.1 (sd 0.5) ng imidacloprid.g<sup>-1</sup> (study I, 2011) and 6.1 (sd 2.1) ng imidacloprid.g<sup>-1</sup> (study II, 2012) exposed honeybee colonies effectively to imidacloprid. The concentrations imidacloprid administered are approximately 2 to 3 times the concentrations that can be detected in the nectar of treated crops. The 12-weeks exposure period simulates a worst case scenario; most crops flower for some weeks. The study consisted of two independent studies, performed in 2011 and 2012. The 2011 study focussed on the impact of imidacloprid and reduced pollen income and the interaction between both factors on the vitality of honey bee colonies from spring till start of hibernation. In the 2012 study the impact of imidacloprid on vitality parameters and overwintering was investigated.

The impact of imidacloprid and pollen scarcity on the vitality parameters and hibernation in the 2011 and 2012 studies is summarized in the table below.

Vitality parameters	2011 pollen scarcity	2011 imidacloprid	2012 imidacloprid
Number of bees	effect	effect	no effect
Number of capped brood cells	effect	effect	no effect
Number of beebread cells	effect	no effect	no effect
Total hemolymph protein	effect	no effect	no effect
Fraction vitellogenin	no effect	no effect	no effect
Number of swarm cells	not determined	not determined	effect
Hibernation	not determined	not determined	no effect

### Conclusions

- Pollen scarcity results in a decreased development of honey bee colonies
- No interaction between pollen scarcity and imidacloprid has been observed except for the parameter 'total hemolymph protein'
- Imidacloprid may, at the chosen amount and exposure method, decrease the number of capped brood cells, the number of bees and the number of swarm cells
- There is no effect of imidacloprid on winter mortality