Effects of Calcium hydroxide and Quassia extract on Honey bees (*Apis mellifera*)

J. Slave[1]

Abstract

In July 2017, a study was conducted to investigate the effects of calcium hydroxide and Quassia extract on honey bees. Mortality, pollen incorporation, brood development and flight of foraging bees in the field before and after the pesticide treatments were assessed in a field study. Additionally, a feeding assay was carried out to investigate the reduction of active substances in the honey stomach. Mortality and brood development in the pesticide treatments did not differ significantly from the control. Bee flight in the field decreased significantly, immediately after the spray with calcium hydroxide. In this treatment, bees also switched from phacelia pollen collection to maize pollen. The feeding assays revealed that bees are able to reduce calcium hydroxide in their honey stomachs but not quassin, the active substance of Quassia extract.

Keywords: Honey bees, calcium hydroxide, Quassia extract, field study

Introduction

Synthetic pesticides may pose risks to honey bees and other beneficial organisms and the need for alternatives is great. The use of botanical insecticides and natural substances may reduce side-effects on bees. Two substances, which may be comparatively low risk for honey bees are calcium hydroxide and Quassia extract but no reliable studies about the effects of these pesticides on honey bees exist. Thus, in 2017 a study was conducted and the following hypotheses were made:

1. Calcium hydroxide and Quassia extract do not increase mortality in bee colonies.
2. The two pesticides have no effect on brood development, measured by brood termination rates before capping of cells.
3. Calcium hydroxide and Quassia extract have a certain repellent effect on foraging honey bees in the field. Calcium hydroxide due to its friable texture and Quassia extract due to its extreme bitter taste.
4. Honey bees are able to filter calcium hydroxide particles from their honey stomachs through their provetriculus. The same is assumed for quassin, the active substance of Quassia extract.

Material and Methods

For each treatment (control, calcium hydroxide and Quassia extract), four bee hives (replications) were used, respectively. Daily mortality before and after the spray was recorded with dead bee traps. Pollen was collected in a pollen trap. Brood development was assessed photographically. Bee flight in the field before and after the spray was counted at eight randomized spots in the field. To investigate the reduction of active substances in the honey stomach, caged bees were fed with sugar solutions containing the substances and shock frozen in certain time intervals. Honey stomach content was analysed microscopically for calcium hydroxide and with HPLC for quassin.

[1] J. Slave, Apicultural State Institute, University of Hohenheim, Germany-70599, slave.jana@googlemail.com

Results and Discussion

Mortality was highest in the calcium hydroxide treatment and significantly lower in the treatment with Quassia extract. However, both treatments did not differ significantly from the control nor was mortality higher after the pesticide treatments for each treatment separately. There were no significant differences in brood development between the treatments. Thus, any negative effects on bee mortality and brood development are very unlikely. The number of foraging bees in the field did not differ before and after the spray with Quassia extract but decreased significantly immediately after the spray with calcium hydroxide. Bees in the latter treatment also switched from phacelia pollen collection to maize pollen after the spray. Thus, a certain repellent effect is assumed for calcium hydroxide. The feeding assay revealed that bees are able to filter calcium hydroxide particles from their honey stomach due to their particle size. However, no or only a minimal reduction of quassin in the honey stomach was reached, possibly because bees try to concentrate the solid phase in their honey stomachs. Thus, quassin residues in honey may be possible. However, Quassia extract is not frequently applied in highly attractive bee flowers and the substance is presumably quickly degraded under the field conditions (Zijp & Blommers, 2002). In summary, negative effects of the two substances on honey bees are unlikely despite a possible repellent effect of calcium hydroxide. Further studies on other pollinators and non-target organisms are necessary.

Acknowledgements

I would like to thank my mentor Dr. Klaus Wallner for the much appreciated help in the implementation of this study and PD Dr. Peter Rosenkranz for supervision of the thesis.

References

Zijp, J.P. & Blommers, L. H. M. (2002) Apple sawfly *Hoplocampa testudinea* (Hym., Tenthredinidae) and its parasitoid *Lathrolestes ensator* in Dutch apple orchards (Hym., Ichneumonidae, Ctenopelmatinae) *Journal of Applied Entomology* **126**: 265–274.

Citation of the full publication

Slave, J. (2017) Effects of calcium hydroxide and Quassia extract on honey bees (*Apis mellifera*). Master thesis. University of Hohenheim.