Section 3 – Laboratory/Semi-field/Field

3.1.P Do pollen foragers represent a more homogenous test unit for the RFID homing test, when using group-feeding?

Michael Eyer, Daniela Grossar, Lukas Jeker

Agroscope, Swiss Bee Research Center, 3003 Bern, Switzerland

DOI 10.5073/jka.2020.465.045

Abstract

The RFID homing ring test aims at developing a method, which can assess sublethal effects of xenobiotic substances on the navigation of foraging bees. Thereby, bee biology and corresponding behavioral processes might strongly influence the output of this test method. Accordingly, previous experiments demonstrated that the homing ability of nectar foragers differed between group- and single-bee-feeding, based on uneven crop content of returning bees and/or due to uneven food distribution via trophallaxis. Therefore, we here evaluated if pollen foragers represent a more homogenous test unit, when test item solutions are administered to groups of bees and thus are distributed between each other via trophallaxis. For this, we tested thiamethoxam and thiacloprid (both neonicotinoid insecticides) at field realistic doses by orally exposing tagged pollen foragers, either in groups of ten bees, or in single cages.

Our results demonstrate that the homing ability of thiamethoxam-exposed pollen foragers was significantly different from the non-exposed control in the single-bee feeding approach, but not in the ten-bee feeding approach (using conservative bonferroni correction in nominal pairwise matrices). Similar tests with thiacloprid, revealed not such clear differences between the two feeding approaches. Thus, it seems that the effect of group size on the homing ability of pollen foragers seems to be compound/dose specific. Nevertheless, our results suggest that single-bee-feeding reveal biologically more robust results in context of homing ability compared to group feeding, which should be considered in the development of this new test guideline by ideally performing such tests with single-bee feeding. Moreover, pollen- instead of nectar foragers should be preferentially chosen, since they consumed the feeding solution quicker and more reliable compared to previous trials with nectar foragers.

3.2.P Digital Farming & evaluation of side effects on honey bees – first experiences within the Digital Beehive project

Catherine Borrek, Simon Hoff, Ulrich Krieg, Volkmar Krieg, Philipp Senger, Marc Schwering, Silke Andree-Labsch

Bayer AG Division Crop Science, Versuchsgut Höfchen, 51399 Burscheid, Germany

E-Mail: catherine.borrek@bayer.com

DOI 10.5073/jka.2020.465.046

Abstract

Within the framework of the bee pollinators risk assessment of plant protection products, like honey bees (Apis mellifera), semi-field studies (in net houses) are conducted under worst-case exposure conditions to evaluate potential side-effects on the colony level.

Therefore, several parameters concerning the bees' health status, activity and behavior on the level of individual bees and the entire colony have to be assessed. These *in situ* observations and evaluations are necessary conducted by skilled investigators, who are experienced in both bee management and plant protection practices.

Furthermore, digital sensor technologies around the beehive can provide additional valuable information to better understand the assessed parameters. A clear advantage of such a digital monitoring system is a continuous data acquisition, whereas the required manual assessments represent only short snapshots in time. Especially within the first hours after the application, when observations and assessments are limited for reasons of time and health protection, sensor technology can be utilized for observation of the bees' reaction to a test compound and thereby allows the detection of a potential repellent effect or similar. Additionally, digital sensors can be calibrated to ensure the accuracy of the measurements.

In several semi-field trials according to EPPO guideline No. 170 we compared two different digital monitoring systems (ApiSCAN® and Arnia™ remote hive monitoring) and related the sensor-derived data with usual manual assessments. Based on our findings we want to highlight benefits and limitations of a digital beehive in context of the assessment of potential side-effects of plant protection products on pollinators.

3.3.P Bee colony assessments with the Liebefeld method: How do individual beekeepers influence results and are photo assessments an option to reduce variability?

Holger Bargen, Aline Fauser, Heike Gätschenberger, Gundula Gonsior, Silvio Knäbe

Eurofins Agroscience Services Ecotox GmbH

Eutinger Strasse 24, 75223 Niefern-Öschelbronn

E-Mail: Holger Bargen@eurofins.com

DOI 10.5073/jka.2020.465.047

Abstract

Colony strength, food storage and brood development are a fundamental part of each honeybee field study. Colony assessments are used to compare and assess those for beehive over time. At present, most colony assessments are made by experienced beekeepers according to Liebefeld method. This method is based on an estimation of areas covered by honeybees, food and brood stages on each side of a comb. Areas are counted from a grid separating the comb side into 8 sections which are protocolled with an accuracy of 0.5 sections. An assessment for a hive takes up to 20 min and even with two field locations, it is necessary to split assessments between beekeepers.

So, it is important to make estimates as comparable as possible. For this purpose, beekeepers practice the assessments on pre-determined photographs to "calibrate themselves". The advantage of the Liebefeld assessment is that the condition of bee hive is estimated with minimum disturbance of the bees. Digital photography is under discussion to gain data with high precision and accuracy with one major disadvantage. To be able to see food and brood stages in photographs, bees have to be removed from combs. This, however, results in a disturbance of the colony – especially if the assessments take place in short time intervals of 7 ± 1 days.

An experiment was performed to evaluate the variation between individual beekeepers and to compare the results to data generated with photographs. For the experiment, five colonies were assessed each by four beekeepers independently according to Liebefeld method. Each comb side of the five colonies was photographed with and without honeybees sitting on it for precise analysis at the computer for a number of bees, nectar cells, pollen cells, eggs, open brood and capped brood. The number of bees and cells with the different contents were generated by an area-based assessment in ImageJ as well as a detailed counting with help of HiveAnalyzer® Software. Data from beekeeper estimations were then compared with assessments based on digital photography. With the results of the experiment, we tried to answer several questions. With the study, we wanted to determine the level of variation between the beekeepers for the live stages and food stores estimated.

Honeybee: Colony assessment; Liebefeld method; digital photography; HiveAnalyzer®

Introduction

In 1983 Gerig introduced a method to assess strength, brood and food of a honeybee colony using a pattern of 8 square decimeters (with ½ square being smallest recorded unit) to assess the content of cells and the number of honeybees on a single comb side.

Our intention was to compare this method in terms of accuracy and precision against methods using weighing and photographs as digital photography offers new technical options that were not available when Imdorf *et al.* (1987) did their study on the reliability of Liebefelder method for honeybee colony assessment.

Improvements and key points need to be taken into consideration to compare the methods such as health of colonies and assessments workload.