

Behavior of honey bees; a guideline to assess troubles in bee foraging activity under insect-proof tunnels

Hervé Giffard, Olivier Mamet

Testapi, station d'expérimentations apicoles, 464, Sarré, 49350 Gennes
Francegiffard.testapi@wanadoo.fr, tel.+33 241 526 894, fax. +33 241 526 208

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Introduction

The usual guidelines^{1,2} for honey bee risk assessment have been validated for acute effects to honeybees following foliar applications of agro pharmaceuticals during flowering. However the use of coated seeds and soil treatments during the sowing operation are being suspected to induce chronic effects on the bee foraging activity during the time of flowering. These effects had not been investigated before the methodology described below was developed.

This new method addresses chronic effects that can be observed in fields where honeybees forage sunflowers grown from insecticide coated seeds. It does not deal with the acute effects of such chemicals but only aims at identifying any troubles that could be caused by residues remaining in the plant at the time of flowering.

Method development

Inventory of parameters

Apidologists and French beekeepers have listed a series of 'troubles' in bee foraging activity^{3,4}. All of them agree that there are signs of decline of bee colonies. These signs had to be listed and assessed to find out which belong to normal behavior and which not: these are considered as 'troubles'. These troubles would not cause mortality at the short term, but might cause a decline on the long range.

The list of troubles from beekeepers was very long with many parameters difficult to record. First of all it was necessary to define 'normal foraging activity', in order to be sure that other signs could be recorded as 'trouble' in the foraging activity. We selected few parameters easy to observe by technicians, in order to provide reliable data.

Parameters to be observed

The number of forager bees working normally is previously counted. Observed troubles usually affect a few individuals only. Parameters to be observed refer to 3 different levels: presence signs, cleaning signs and clinical intoxication signs.

Presence signs: This parameter refers mainly to motionless bees on the flower and to bees on the whole plant but not on the flower, with agreed definitions of a moving bee and a motionless bee.

Cleaning signs: The staff observes and counts the bees that clean themselves in two ways: (a) limited cleaning of legs and horns (as flies and butterflies do), (b) overall cleaning (the whole body is brushed with middle or hind legs). These observations should be made for at least a few seconds and sometimes for several minutes for one bee.

Clinical intoxication signs: These are at the highest level on the 'trouble' scale. Hanging bees are specially observed. Bees hang from leaves or from flowers by one or two legs. Sometimes bees are motionless, sometimes they clean themselves. Any such honey bee is supposed to fly away when pushed by the technician's finger and is counted as 'hanging bee'. In fact the bee often falls and lays down and is counted as a 'falling bee', which seems a more important trouble. The last kind of sign is close to acute effects with paralysis and disordered wings or legs.

Recording of signs: All parameters are defined beforehand in recording booklets. The staff needs to be trained before the trial for a unequivocal interpretation of observations. The observations are recorded daily in booklets during the whole flowering period. They provide raw data used to compare the treatments. Raw data are used to build up boards and graphs in order to detect potential troubles. However, not all signs observed are ‘troubles’. First trials in 2003 and 2004 showed expected troubles in the control too. Bees clean themselves and some others die daily in all bee colonies. It is the frequency and the number of signs within different modalities which makes the difference.

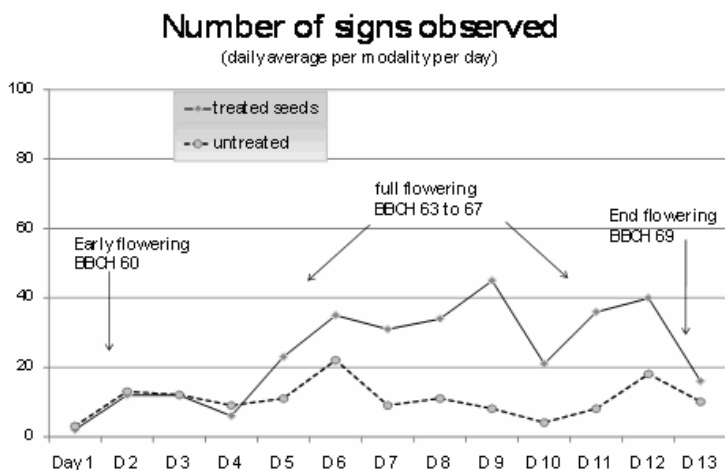
Trial design

The further trial design is the same as for acute toxicity test under insectproof tunnels. There are two modalities, a control (untreated) and a test item (treated). Treatments are use of coated seeds, or sowing operation with a granulator. Replication of these modalities for more consistent data are possible. A toxic reference is neither necessary nor recommended because potential effects are merely compared to a normal activity, the agrochemical industry would not agree to have a seed treatment as a toxic reference, and the use of soil treatments or coated seed treatment are not compared to a worst case. Sunflower appeared to most suitable crop for such observations. Bees have a large place to land on sunflowers, and stay quite a long time foraging nectar and pollen therefore they are easy to count and to observe.

Also regarding equipment the design is similar to acute toxicity tests under insect-proof tunnels of 140 m² each. These tunnels can contain real small colonies. The assessments of daily mortality and quantitative foraging activity are completed with observations of qualitative foraging activity. Usually it is important to prove that there are neither acute effects nor differences in mortality between the modalities.

Results and discussion

Such trials have been conducted with several products and crops over the past five years. Registered data appeared adequate for statistical analysis. The number of observed troubles was usually not very high compared to hundreds of forager bees. When a specific parameter such as ‘presence sign’ gave a very limited number of data in both modalities, it was necessary to cumulate the results of several different signs in order to get sufficient data. In this way the difference can appear to be significant or at least give information on the predominance of certain troubles during the period of high bee activity.



In early flowering as well as in end of flowering the number of observed troubles was not sufficient and differences could be not significant. On the contrary, from early flowering to full flowering the increased number of troubles provided consistent data. The difference in the number of troubles in foraging activity was significant between modalities.

When honeybees forage a tunnel of a limited surface (about 140 m²) for 10 to 15 days, potential effects or troubles can be observed. Extrapolation of such results would therefore suggest a risk of more important troubles when forager bees visit hundreds of hectares during 1 to 2 months.

Conclusion

This methodology was developed as a tool and a guideline in the risk assessment scheme for honey bees. It is now recommended in France⁵ to assess potential troubles of all kinds of coated seed treatments and soil treatments on sunflowers.

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A methodology to assess the impact on bees of dust from coated seeds

Hervé Giffard¹, Thierry Dupont²

¹Testapi, Station d'expérimentations apicoles, 464, Sarré, 49350 Gennes, France, giffard.testapi@wanadoo.fr

²Qualilab, 1121 rue de la Bergeresse, 45160 Olivet, France

Introduction

During springtime of 2000 to 2003 much bee mortality were observed in France when sowing maize and sunflowers.

During 3-4 years beekeepers claim high mortality rates in their apiaries at the time of sowing maize and sunflowers, mainly during April and May. Blossoming crops or bad agricultural practices were not suspected (as there was neither rape seed crops nor other blossoming crops at this time), but only wild plants such as dandelion or flowering trees in the field hedges.

After several meetings with the Agricultural authorities in the South West of France and a review of different hypothesis, it was decided to investigate on dust seed being disseminated when sowing. As coated seeds were mainly used in this area, there was a suspicion of a possible contamination due to dust produced by coated seeds.

By chronological correlation seed dusts from insecticide coated seeds were finally suspected to induce these mortalities.

After a review of different coated cultivars sown in closed conditions it was decided to assess the effects of two modalities in agricultural and laboratory conditions.

The question was: 'Is there a possibility that insecticide dust be disseminated during sowing and contaminate wild flowers that are being foraged by honeybees?'