Bees and Pesticides

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Honey bees (Apis mellifera L.) are the main pollinating agents for numerous plants and fruit trees and hence, play a key role in agriculture and more generally in the maintenance of ecological biodiversity. They are mostly affected farm animals by pesticides. Indeed, pesticides work in two ways to reduce bee populations. First, many pesticides used in crop production are highly toxic to these social insects. Second, the use of herbicides can reduce the acreages of useful plants for the bee activity. Pesticides damages to honey bee colonies take different forms. Honey bees may be poisoned when they feed on nectar or pollen contaminated by pesticides. Bees may also be poisoned when they fly through a cloud of pesticide dust or spray or walk on treated parts of plant. Sometimes, colonies in the hives can be directly affected, but most commonly only field bees are killed or have their physiological functions altered. Toxicity and hazards of 158 pesticides to Apis and non-Apis bees are well reviewed in a study of Devillers et al. (2003).

Honey and bee products have the image of being natural, healthy and clean. However, today bee products are produced in a environment, polluted by different sources of contamination. The contamination sources can be roughly divided into environmental and apicultural ones. Environmental contaminants are pesticides, heavy metals, bacteria, GMO and radioactivity, contaminants from beekeeping practice includes acaricides used for parasitic mites (mainly Varroa) control, bee repellents used at honey harvest, pesticides for wax moth and small hive beetle control and antibiotics used against foul brood disease. There are very few special residue limits for honey, making it difficult to discuss the toxicological importance of residues. Honey makes a minimal contribution to the acceptable daily intake (ADI) of pesticides.

The most common insecticides that have been examined in European honeys include organochlorines, organophosphorous pesicides and carbamates. In a recent study using 50 honey samples from Spain and Portugal, residues of 42 different pesticides were examined (Blasco et al., 2003). Most of the pesticides found in honey were organochlorines. Among them, gamma-HCH was found in 50% of the samples and was the most frequently detected substance, followed by HCB in 32% of the samples and other isomers of HCH. The values found varied between 0,03 and 4,31 mg/kg, but most of them were bellow 0,5 mg/kg.

There are several other European studies with no measurable residues of insecticides in honey found above the detection limit, which varied between 0,005 and 0,050 mg/kg. (Bogdanov, 2006). Similar situation is in Slovakia, monitoring of 20 honey samples for the presence of 14 insecticides showed no detectable residues of insecticides (see the presentation). The effect of imidacloprid (known under the name of Gaucho) on bee health is highly controversial, even just very small residues were found in honey. (Bogdanov, 2006).

Other pesticides, especially herbicides, seem to contaminated mostly bees and pollen, and only rarely honey. Fléché et al (1997) have found positive results of pesticide residues in 36% samples of bees (n=148), 61% samples of pollen (n=61) and only in 3% of honey samples (n=683).

Another class of pesticides are antibiotics used against bacterial plant pests. The fire blight on fruit trees is caused by the bacteria Erwinia amylovora. This bacterium can be controlled by streptomycin and honey can be thus contamined by streptomycin residues with zero limits in honey. Also herbicide asulam and its breakdown product sulphanilamide were found in honey (Bogdanov, 2006).

Acaricides used for Varroa control within the hives are in the EU mainly cymiazol, fluvalinate, amitraz, flumethrin and coumaphos. In Slovakia is widely used amitraz and residues of this control agent are detectable also in honey (see the presentation).

Bees, more than bee products, have been used as biological monitors for pesticide contamination of geographic regions. The relatively low concentrations of pesticides in honey seem to be due to a filtering effect of bees. Indeed, bees decrease initially high pesticide nectar concentrations, so that the final concentration in honey was much lower, mostly by factor of about 1000 (Schur and Wallner, 1998). Generally, there are no MRLs for pesticides in honey. In the EU an action level of 0,01 mg/kg is often considered for pesticides with no fixed MRL. To avoid residues pesticides should be used outside the bloom period or at least, not during the foraging time of bees. Beekeepers can also avoid residues by placing their hives more than 3 km from agricultural plants treated with pesticides.

1 References

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