

## **Pesticide residues in larval food jelly of the Western honey bee *Apis mellifera* – a review**

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Plant protection products like insecticides, fungicides, or herbicides are applied onto plants to protect them against pest insects or plant diseases. The collected and stored pollen and nectar serve as the nutritional resources of honey bees to produce the larval food which is fed to the larvae. Thus, contaminants could be transferred from plants, via nectar and pollen, to honey bees and further to larvae, and may lead to harmful risks. It has been proven in different studies that pesticide residues can be found in bee related products like wax, honey, and bee bread. We aimed to review and assess the amount of contaminants remaining in jelly, to evaluate factors influencing their occurrences as well as to deduce risk for larvae. Therefore, the current literature dealing with residue analysis of pesticides in larval food jelly was summarized and analyzed. Most of the studies focused on the detection of residues in royal jelly samples and found that 30 out of 176 analyzed pesticides remain detectable. They detected concentrations in a range of 0.005 to 3860.25 ng/g, which correspond to 0.00001% to 58% pesticide transfer into royal jelly. Only one study analyzed residues in worker jelly. The main factors influencing if residues remain detectable in jellies are the application and exposure methods. All detected concentrations were predominantly below the toxicological values for bee larvae. Nevertheless, there are no information about an impact on larval physiology and thus sub-lethal effects should not be neglected. The literature screening revealed that there are still knowledge gaps about the contamination pathway of pesticides, dilution or accumulation factors within hive, and degradation time in bee-related matrices. Those gaps should be filled to allow for sufficient protection levels of honey bees.