

3.2 Pesticide Residues and Transformation Products in Greek Honey, Pollen and Beebread

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Abstract

Apiculture products, to an extent, are considered as environmental pollution markers, since they tend to accumulate a plethora of contaminants. The latter come in contact or enter in bees during nectar and pollen collection and transferred inside the beehives. In addition, residual prevalence in honey, and beebread also reflects the chemical treatments that take place inside the beehives in order to mainly control the parasitic mite of *Varroa destructor*.

In this context, during the period of 2014-2018, 109 samples of honey, pollen, and beebread (63 honey and 46 pollen and beebread), including samples originated also from colonies in which honeybees' death incidents were recorded, were sent by authorities and individuals in Benaki Phytopathological Institute for the determination of pesticides and their transformation products. More than 130 analytes were investigated by applying two multi-residue methods (an HPLC-ESI-MS/MS and a GC-MS/MS), based on modified QuEChERS methodology using for clean-up Z-Sep, PSA, and C18 materials. In particular, the two analytical methods applied were validated according to the SANTE/11945/2015 and 11813/2017 guidelines. More specifically, the recoveries observed for the majority of the analytes ranged between 68 and 117%, while the relative standard deviations were below 19%. The calculated limits of quantification (LOQs) ranged from 1 to 10 ng/g depending on the analyte. Other parameters, such as linearity, selectivity, precision and matrix effect were also validated.

Until the end of 2018, 37 determinations were registered in honey, resulting in a 38% of positive to at least one active substance in honey samples (16 active substances and transformation products were detected in total). The detected concentrations of pesticides and their transformation products ranged between 1.3 and 785 ng/g honey. In some cases, maximum residue limits (MRLs) violations were evidenced. Coumaphos, imidacloprid, acetamiprid, the transformation products of amitraz, DMF-DMPF, tau-fluvalinate and in limited cases metabolites of imidacloprid and coumaphos (its oxon metabolite), were the most predominant compounds detected in honey, while several pyrethroids such as λ -cyhalothrin, cypermethrin, and cyfluthrin were also found. In several honey samples, more than one active substance was detected, while the most common combination comprised of coumaphos, imidacloprid, and DMF. In pollen, and beebread more active substances were identified (21) with a comparative number of determinations (including a higher number of fungicides detected compared to honey), and a higher proportion of positive samples (65%).

Overall, this work aims to provide an overview of the current situation of pesticides and transformation products occurrence in honey, pollen, and beebread during the period of 2014-2018 in Greece.

3.3 Impact of the use of plant protection products harmful to bees on bee colonies during spring: Results of a monitoring programme in apple orchards in South Tyrol (2014-2017)

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Abstract

Especially during Spring 2013 and a few years before different beekeepers observed a reduced colony strength on their honeybee colonies placed near apple orchards and the sudden loss of a lot of foragers in certain moments. It was supposed that these observations could have been caused by an increased use of plant protection products harmful to bees before and after the bloom to reduce the abundance of vectors of the apple proliferation (*Cacopsylla picta* and *C. melanoneura*) in order to limit a further diffusion of this disease. To

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investigate if the observations of beekeepers were caused by the increased use of plant protection products harmful to bees the project "Apistox" was initiated in 2014.

In this project honeybee colonies were monitored for three years (2014-2016) in the vicinity of apple orchards in the time span from march-june including so the periods pre-, during and post bloom. At least 13 sites were considered ranging from 200 and 800 m a.s.l. with different strategies regarding the use of insecticides. The monitoring included observations of the mortality, colony development (method of Liebefeld), the flight activity and the entry of active substances from plant protection products through pollen. The results show a relationship between the time points where plant protection products harmful to bees were applied in the fields and the increasing mortality in front of the hives. In a few cases also a reduced flight activity after an increased mortality was observed. In part, also intensive and repeated mortality could be aligned to a reduced colony development. In addition, collected pollen pellets and stored bee bread was analysed for the plant protection products on a regular basis. It was shown that several residues were detectable in relevant concentrations over a time period of several weeks. The dynamic behind the input of these substances was analysed more in detail in a separate project (Apistox II: 2017-2019) which will be concluded at the end of this year.

Keywords: monitoring, apple orchards, honeybee, colony development, plant protection products harmful to bees

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