

Analysis of Veterinary Drug Residues and Pesticide Residues in Beehive Products

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Abstract : The administration of veterinary treatments at higher doses than the recommended Varroa mite control in beehive matrices has the potential to generate residues in the honeybee colony and in the derived products for consumption. Honeybee colonies can also be indirectly exposed to residues of plant protection products when foraging in crops, wildflowers near the crops, or in urban gardens just after spraying. The study evaluates the presence of both types of residues, veterinary treatments, and pesticides in beeswax, bee bread, and honey. The study was carried out in apiaries located in agricultural zones and forest areas in Andalusia, Spain. Up to nineteen residues were identified above LOQ using gas chromatography-triple quadrupole-mass spectrometry analysis (GC-MS/MS). Samples were extracted by a modified QuEChERS method. Chlorfenvinphos was detected in beeswax and bee bread despite its use is not authorized for Varroa mite control. Residues of fluvalinate-tau, authorized as veterinary treatment, were detected in most of the samples of beeswax and bee bread, presumably due to overdose or also to its potential for accumulation associated with its marked liposolubility. Residues of plant protection products were also detected in samples of beeswax and bee bread. Pesticide residues were detected above the LOQ that was established at $5 \mu\text{g.kg}^{-1}$, which is the minimum concentration that can be quantified with acceptable accuracy and precision, as described in the European guidelines for pesticide residue analysis SANTE/11945/2015. No residues of phytosanitary treatments used in agriculture were detected in honey.

Keywords : honeybee colony, mass spectrometry analysis, pesticide residues, Varroa destructor, veterinary treatment

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