

PESTICIDE CONCENTRATIONS IN BEE POLLEN COLLECTED BY HONEY BEES NEAR CROPLANDS

Christina Kast, Marion Fracheboud

Agroscope, Bern, Switzerland

Abstract

Honey bees are important pollinators for wild plants and crops. While foraging, they may be exposed to a variety of pollutants, including agricultural pesticides. The aim of this study was to investigate the exposure risk for honey bees when beehives are located near croplands. Ten study sites with varying proportions of oilseed rape (OSR), grain, and vegetable crops were included, and the proportion of each crop was determined within a two-kilometer radius around each apiary. From April to August, pollen samples were collected from four bee colonies per apiary one day a week over two consecutive years (2024 and 2025). Ultra-high-performance liquid chromatography coupled with mass spectroscopy allowed identifying 33 pesticides (out of 55 analysed pesticides), which included 18 fungicides, nine insecticides, five herbicides and a synergist. Frequently detected fungicides included azoxystrobin (max. 217 µg/kg), cyprodinil (max. 3370 µg/kg), difenoconazole (max. 154 µg/kg) and mandipropamid (max. 276 µg/kg). Herbicide levels were up to 202 µg/kg (pendimethalin). Acetamiprid, a neonicotinoid insecticide, was the most frequently detected pesticide (prevalence of 39%). The correlation ($R = 0.75$) between acetamiprid concentrations in pollen collected in April and the proportion of OSR near the apiary suggests that this insecticide being used to control pollen beetles in OSR fields, while detections in pollen collected later in the season might reflect applications on vegetables. The toxic exposure ratios (TER) were calculated for insecticides, such as spinosad (max: 33 µg/kg, TER 143), permethrin (max: 13 µg/kg, TER 843), lambda-cyhalothrin (max: 54 µg/kg, TER 1411), acetamiprid (max: 625 µg/kg, TER 1937), and indoxacarb (max: 5 µg/kg, TER 4275). The maximum concentrations of the pesticides in pollen were considered of low concern with regard to acute oral toxicity for adult honey bees; however, synergistic and sublethal effects were not evaluated.