

The Effects of Heavy Metal and Aromatic Hydrocarbon Pollution on Bees

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Abstract : Bees are effective pollinators of plants using by humans. However, there is a concern about the fate different species due to their recently decline. Pollution of the environment is described in the literature as one of the causes of this phenomenon. Due to human activities, heavy metals and aromatic hydrocarbons can occur in bee organisms in high concentrations. The presented study aims to provide information on how pollution affects bee quality, taking into account, also the biological differences between various groups of bees. Understanding the consequences of environmental pollution on bees can help to create and promote bee friendly habitats and actions. The analyses were carried out using two contamination gradients with 5 sites on each. The first, mainly heavy metal polluted gradient is stretching approx. 30km from the Bukowno Zinc smelter near Olkusz in the Lesser Poland Voivodship, to the north. The second cuts through the agglomeration of Kraków up to the southern borders of the Ojców National Park. The gradient near Olkusz is a well-described pollution gradient contaminated mainly by zinc, lead, and cadmium. The second gradient cut through the agglomeration of Kraków and end below the Ojców National Park. On each gradient, two bee species were installed: red mason bees (*Osmia bicornis*) and honey bees (*Apis mellifera*). Red mason bee is a polylectic, solitary bee species, widely distributed in Poland. Honey bees are a highly social species of bees, with clearly defined casts and roles in the colony. Before installing the bees in the field, samples of imagos of red mason bees and samples of pollen and imagos from each honey bee colony were analysed for zinc, lead cadmium, polycyclic and monocyclic hydrocarbons levels. After collecting the bees from the field, samples of bees and pollen samples for each site were prepared for heavy metal, monocyclic hydrocarbon, and polycyclic hydrocarbon analysis. Analyses of aromatic hydrocarbons were performed with gas chromatography coupled with a headspace sampler (HP 7694E) and mass spectrometer (MS) as detector. Monocyclic compounds were injected into column with headspace sampler while polycyclic ones with manual injector (after solid-liquid extraction with hexane). The heavy metal content (zinc, lead and cadmium) was assessed with flame atomic absorption spectroscopy (FAAS AAnalyst 300 Perkin Elmer spectrometer) according to the methods for honey and bee products described in the literature. Pollution levels found in bee bodies and imago body masses in both species, and proportion of sex in case of red mason bees were correlated with pollution levels found in pollen for each site and colony or trap nest. An attempt to pinpoint the most important form of contamination regarding bee health was also be undertaken based on the achieved results.

Keywords : heavy metals, aromatic hydrocarbons, bees, pollution

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