The effect of heavy metal and aromatic hydrocarbon pollution of the environment on the quality of honey bees and red mason bees

Objectives

The aim of our study is to compare the quality of bees developing in environment polluted by heavy metals (zinc, lead, cadmium) and aromatic hydrocarbons (like benzene, toluene, or benzo(a)pyren) in two bee species with clearly differing social system: the solitary red mason bee (*Osmia bicornis*) and the social honey bee (*Apis mellifera*). Tests will be carried out on two pollution gradients in Southern Poland: one, mainly polluted by heavy metals due to the proximity of a zinc smelter (surroundings of Olkusz), the other, cutting through city agglomeration (Kraków), polluted mainly by aromatic hydrocarbons due to fuel combustion.

Methodology

The quality of bees in case of both species can be assessed based on their body mass after emergence. Environmental contamination levels, on the other hand, correlate well with pollution levels found in pollen gathered by bees and can be used as a measure of the quality of the environment. Both bees species will be installed on two, 5-site gradients. Bees will be moved to the field depending on the weather conditions at the end of March or beginning of April. Honey bee colonies will be collected in June, while red mason bee colonies will be collected in September/October, when the developing pupa safely reaches adulthood (imago) in the cocoons and prepare for overwintering. Samples of bee bodies (imago or emerging bees) will be taken before the start of the bee exposure to pollution and after collecting the bees. All samples will be analysed for lead, zinc, cadmium, aromatic hydrocarbons content.

Reasons for choosing the topic and expected impact

There is growing concern about the fate of bees to the observed pollinator declines in the last two decades, therefore studies of environmental factors possibly causing such decline are becoming important. Especially, when it concerns crop pollination and the safety of human food production. Although, a number of studies assessed the level of pollution (mostly heavy metals) in bee bodies (mainly honey bees) and bee products, there are only few studies showing, how pollution of the environment directly effects bee biology and reproduction. Bees are also a variable group containing tens of thousands of species both highly social, like the honey bee, but also numerous solitary ones, like the red mason bee. A study on ants showed, that differences in sociality can change the tolerance to contamination and can partially protect insects from environmental pollution, while solitary species are more susceptible to contamination of their environment.

Our results will help to assess the impact of environmental pollution on the quality of bees developing in environment polluted with heavy metals and aromatic hydrocarbons, being an essential part of the pollution found in smog. The results will also allow to compare the susceptibly of bees with various social systems to pollution. In a wider context, the results can serve to better assess the drivers of pollinator decline connected with environmental pollution.