DESCRIPTION FOR THE GENERAL PUBLIC

Modern agriculture has become one of the most important threats to so-called "non-target arthropods", i.e., organisms which inhabit areas treated with pesticides not directed against them on purpose. The pollinators are the prime examples. Bees, including the wild solitary bees, are economically most important group of pollinators in the world. They have considerable economic value by pollinating a variety of crops. Thus, besides rather obvious moral arguments for protecting bees, there are also important economic reasons for maintaining their high biodiversity and abundance in agricultural landscapes. Unfortunately, the global trend of pollinator decline has been observed in the recent decades, especially in areas used for intensive agriculture. This applies to both managed bee species, such as honey bee, *Apis melifera*, and many wild bee species, including the red mason bee *Osmia bicornis (=rufa*). However, we still do not fully understand processes that affect bees living in the agricultural landscape. The extensive pesticide use and changes in land use, such as the disappearance of field margins, increasing surface area of agricultural fields and the decrease in habitat diversity are certainly some of the main factors responsible for the observed bee decline. It is not clear, however, what is the relative importance of each of these factors and possible interactions between them.

The main aims of the project are to assess the relative importance of pesticides and landscape structure to the status of *O. bicornis* populations, evaluate the sensitivity of this species towards commonly used insecticides and finding out if heritable resistance to insecticides has occurred in insecticide-exposed populations. Although inheritable resistance to pesticides has been found in many pest species, it is not known if, and to what extent, this process happens also in beneficial insects like bees. While in case of pest species the increase in resistance to pesticides is a highly undesired phenomenon, in bees it would be a positive process, allowing them to survive in agricultural land. Many different plant protection products are used in agriculture during the growing season as tank mixtures (i.e., in the form of one spray) or applied in short time intervals. Effects of pesticide mixtures may be more harmful for an organism than those caused by pesticides when applied alone – an increase in toxicity may occur as a result of synergistic interactions between the pesticides. On the other hand, interactions include also antagonism, that is a decrease in mixture toxicity compared to the summation of singe effects. Surprisingly, the knowledge on combined toxicity of pesticides to bees are still poorly recognized. To fill these gaps the project will focus on testing the effects of both combined and sequential treatments with pesticides on *O. bicornis*. Not only mortality, but also sublethal endpoints (apoptosis, detoxification and target enzymes activity) will be measured in mixture experiments. Thus, the obtained results will have a direct impact on the pesticide risk assessment and, if significant and meaningful interactions are found, will facilitate proposing specific solutions in the ecological risk assessment which currently focuses exclusively on the assessment of individual chemicals.

The project is of great importance for the development of fundamental science as it addresses the issues widely discussed in the scientific community for the last several years. The results will help in recognizing the mechanisms responsible for the global trend of pollinator decline, including a better quantitative understanding of insecticide effects on bees and the roles of landscape structure and mixture toxicity.