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Dissertation topic: Sublethal pesticide risks to solitary bees from egg laying to the emergence of the new generation

Brief description of the dissertation: Solitary bees are indispensable helpers in pollinating agricultural crops and wild plants. Solitary bees are threatened by a number of factors, foremost among which are pesticides. Solitary bees are susceptible to pesticides to a different degree than eusocial honey bees or bumblebees. This is due to differences in lifestyle, protein composition, microbiome, and the short period of time during the year when adults are active. Adult bees foraging for food may be at risk from pesticides, but there is also a significant risk to the next generation. The sublethal effects of pesticides can manifest themselves at different stages of the life cycle, which needs to be taken into account. The work will focus on assessing the risk of pesticides used primarily in orchards. The effect of individual pesticides and their mixtures will be taken into account. Manipulative laboratory experiments will be carried out, but field samples will also be used. A key factor is pollen/nectar reserves, which, from the moment the larva hatches from the egg in a closed chamber, constitute the only food the larva feeds on. Changes in diet, especially the microbiome (prokaryotic and eukaryotic), will be monitored. The focus will be on evaluating the impact of specific pesticide exposures on larvae, pupae, and adults. Special attention will be paid to the hibernation stage and the moment of hatching of the new generation. Biological methods will be used in the dissertation, working with solitary bees of the genus *Osmia* throughout their life cycle. The impact on bee development will be monitored. Changes in selected stages will be analyzed using high-capacity methods – proteomics and transcriptomics. Overall, the work will focus on finding answers to how pesticides and their realistic doses and combinations threaten solitary bees, especially through sublethal chronic effects. The research is closely related to the "New Deal for Pollinators," which is currently resonating throughout the European Union. The solution will be linked to the research plan, the existing project "Assessment of the risks of realistic sublethal doses of pesticides in food sources of solitary bees for the stabilization of the natural pollinator ecosystem with a focus on fruit production" (until 2028).

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