

The role of alcohol in self-medication of the honeybee (*Apis mellifera*)

It is well known that disease is an undesirable condition that not only disrupts normal functioning of the body, but also often shortens life. Therefore, when an organism becomes infected, a whole cascade of biochemical and physiological reactions to fight the disease is immediately triggered. However, as we know from our lives as humans, organisms are not only dependent on their internal immunological processes, but they can change behavior to actively support the fight against the disease and the recovery process. Just like sick humans, willingly using the benefits of medicine, so animals can benefit from what the environment has to offer. The phenomenon of self-medication, i.e. the use of a substance from the environment for therapeutic purposes, has been shown in many animals, including several species of insects. Social insects such as the honeybee seem to have numerous reasons to actively seek and use therapeutic substances. Bees live in large colonies, in which thousands of individuals meet each other in one nest every day, thus the rate of spreading diseases among bees is very high. Sickness of one individual may therefore mean sickness of the entire colony. Bees are also subject to many dangerous infectious agents, especially parasites. A substance that bees most likely encounter in the environment (in fermenting nectar or fruits) and that very likely possesses medicinal properties, is alcohol. There is much research devoted to the study of alcohol consumption in bees, yet so far the significance of this substance in the context of self-medication in bees has not been studied. However, to talk about the phenomenon of self-medication, 4 basic criteria must be met: [1] the animal must actively use a given substance [2] the substance must have a negative effect on the infectious agent [3] consumption of this substance when infected must improve health, while [4] consumption of this substance by healthy individuals must affect them negatively.

The main goal of my research is to investigate whether bees use alcohol as mean of self-medication. For this purpose, to address the issue fully, I will conduct a series of experiments to test each of the above mentioned self-medication criteria. The first experiment aims to check whether bees suffering from nosemosis (a dangerous and common bee disease) are more likely to consume food with an addition of alcohol than healthy individuals. In another experiment, I will evaluate whether mortality of spores of the fungi that causes nosemosis increases when these spores are incubated in an alcohol-containing solution, and whether such spores have a reduced ability to infect bees. In yet another experiment, I will test whether, in sick bees, consumption of food with an addition of alcohol results in slower disease development and lower mortality, and whether alcohol consumption increases mortality in healthy individuals.

The results of the planned experiments will allow for a comprehensive understanding of the usefulness of alcohol in the context of self-medication in bees. As the phenomenon of self-medication in animals is still relatively poorly understood, research conducted in the project will make a significant contribution to the current state of knowledge as well as bring us closer to answers to more general questions, such as those about the evolution of self-medication and the conditions under which such evolution may occur. Moreover, as it is known that the honeybee willingly consumes alcohol and that its excessive consumption leads to many negative effects, an important aspect of the project will be to understand the potential benefits of alcohol consumption. Therefore, the results of my project will provide a new and significant information on issues of interest in such fields as ecological immunology and behavioral ecology.