

## **Natural insecticides used in organic farming – multiperspective evaluation of their microbiological safety**

Modern economy consumes extremely large amounts of plant protection products, including insecticides. Currently, the vast majority of them are synthetic compounds, which, although very effective, are also a very heavy burden on the environment. Many studies have shown that they are toxic not only to the insects they are supposed to limit, but also to other organisms, including humans. In order to improve environmental and health safety, more and more attention is being paid to insecticides of natural origin, which are less toxic and degrade faster in the environment. Such compounds include azadirachtin and compounds from the pyrethrin and pyrethroid groups, isolated from various plant species. These compounds have been approved by international organizations, including the European Union, for use also in so-called organic farming.

The increasing scale of use of these compounds, however, raises questions about how they will affect soil and aquatic microflora in the long term in the areas where they will be applied. Research to date has only clarified this question to a limited extent, with often contradictory results. This is why it is so necessary to undertake a cross-sectional, multi-faceted study of the effects of natural insecticides on environmental bacteria.

Within the project, we will undertake research that will allow to conclude how the bacterial microflora of the environment changes qualitatively and quantitatively as a result of its contact with azadirachtin and compounds from the pyrethroid group. This will be made possible by studying the biochemical and genetic profile of complex consortia of microorganisms. In addition, the biodegradation of these compounds will be analysed to indicate how long they persist in the environment and into which compounds they are degraded by microorganisms. It will also be indicated how the presence of insecticides affects the activity of bacterial enzymes, including those responsible for cell life processes.

The final stage of the research will be devoted to determining what processes occur in individual cells of environmental bacteria as a result of their prolonged contact with natural insecticides. In this way, the processes of cell adaptation, including their defence mechanisms, such as production of extracellular compounds, activity of intracellular enzymes, change of cell membrane structure, etc., will be known. It should be emphasized that this type of research has not been conducted on a larger scale before.

The obtained results will have not only an outstanding cognitive value, expanding our knowledge on the impact of compounds, which act toxic on insects, on soil and water microflora cells. The realization of this project will allow, above all, to identify the safest natural insecticides for the environment, which can be used more widely in the future without worrying about the well-being of bacterial microflora, what is very valuable for the entire ecosystem.