Description to the public

Due to intensive industrial activities, significant acreage of land, scattered all over the world has been heavily polluted with metals. As a result, the biodiversity of organisms inhabiting such environments exhibited significant losses. These areas have become a major threat to human health and well-being.

During evolution, a small number of organisms have evolved the ability to inhabit even extremely degraded environments. A good example of such adaptation are plants inhabiting post-mining wastes. The deposition of metals: Pb, Cd and Zn in such environments often exceeds tolerable concentrations by a few orders of magnitude. A plant species commonly present on post-mining waste dumps in the Europe is *Arabidopsis arenosa*. According to our research, symbiotic microorganism: bacteria and fungi play an important role in the adaptation of this species and plants in general to vegetation in metal polluted environments. These microorganisms have evolved tolerance to high concentrations of metals deposited in the substrate and the ability to facilitate plant growth. Recently, the importance of symbiotic microorganisms in the regulation of numerous aspects of not only plant, but all multicellular organisms aspects of physiology and behavior is gaining the recognition of the scientific community. Nevertheless, our knowledge of the role of these symbiotic microbes is scarce. It is assumed that the loss of this biodiversity may be a serious indication of pathology or degradation.

Based on the research conducted in the NCN OPUS 14 project "The role of endophytic fungi in the resistance of *Arabidopsis arenosa* to high levels of toxic metals", we know that the biodiversity of endophytic fungi inhabiting the polluted environment of waste dump decreased. The obtained results clearly indicate the limitation of the biodiversity of endophytic fungi under metal toxicity, but interestingly, the changes in the plant microbiome seem to be caused mainly by changes in the preferences of the plant towards particular groups of fungi. The limitation of the biodiversity of microorganisms in the soil seems to be less important in plant microbiota assembly. The subject of the planned project will be a detailed analysis of changes in the microbiome of plants (bacteria and fungi) inhabiting environments polluted with metals (Zn, Pb, Cd). The research will be carried out on the populations of *A. arenosa* from three countries: Poland, Austria and Slovakia, inhabiting post-industrial heaps and areas unpolluted with metals. The results of the environmental studies will be verified in a laboratory experiment in which the plants will be inoculated with an inoculum of selected, representative microorganisms. Additionally, the ability of plants to preferentially shape their microbiome will be examined. According to my hypotheses, the environment, by interfering with the plant's metabolism, shapes the conditions for symbiotic microorganisms, favoring some species and inhibiting the development of others. The project will investigate how a plant's secondary metabolism changes and whether these changes affect plant-related microorganisms. One of the important mechanisms of plant resistance is the ability to immobilize toxic metals in the substrate (metal toxicity decreases dramatically). This takes place through root secretions, as well as (above all) with the participation of soil microorganisms and those inhabiting the rhizosphere. The project will investigate the ability of selected microorganisms to inactivate metals in the substrate and whether the development of these microorganisms is promoted by the plant.

The results of the planned research will help to better understand the relationship between the plant, the environment and microorganisms. They can also be an important step towards increasing the efficiency of phytoremediation in areas contaminated with heavy metals