Heavy metal contamination is a serious global problem affecting environment, economics, public health, and food policy. Toxic elements accumulated in soils can be easily absorbed by microorganisms, animals, and plants, posing a threat to all the organisms, including people. It is a matter of particular importance to minimize the content of toxic ions in plants that are consumed by people. Understanding of the plant-microbiome interactions in heavy metal-contaminated soils can help develop new techniques of cleaner food production.

Plants growing in heavy metal-contaminated soils (so-called metallophytes) have developed a range of adaptations that help them survive in the inhospitable environment. In addition, they benefit from the activity of metal-resistant bacteria living in soil and in the plant tissues. Studies concerning bacteria related to metallophytes broaden our knowledge about the role of microorganisms in the detoxification of noxious ions.

The aim of the project is to characterise the bacterial communities colonising the seeds of a metallophyte species *Silene vulgaris* and to explore their potential in the detoxification of heavy metals. It has been shown that *S. vulgaris* plants from the zinc-lead waste heaps retain the heavy metal resistance traits when grown under laboratory conditions, in at least three consecutive generations. It is possible that these abilities are be associated with symbiotic bacteria, which are selected and transferred to the next generation through seeds. In such a case seeds of metallophyte species may be the best source of beneficial microorganisms, useful for reducing metal concentrations in crops.

The project implies a comparison of plant-associated microbiome in two *Silene* species (*S. vulgaris* and *S. latifolia*), derived from two different study sites (a zinc-lead waste heap and an uncontaminated reference area), in three consecutive plant generations. The study will be conducted using a range of laboratory methods, such as plant pot culture, chemical analysis, bacterial isolation and culture, characterisation of plant growth-promoting properties of selected bacteria, and molecular identification of microorganisms and heavy metal-resistance genes. A searching analysis of metallophyte-associated bacteria will provide an overall insight on the plant-microbiome interactions in heavy metal contaminated environment. It will be possible to correlate the impact of bacterial activity on metal uptake by plant, and the influence of plant host on microbial community.

The role of seed colonising bacteria in plant adaptation to heavy metal stress is a novel and poorly studied area. Most studies concerning plant-microbial interactions in heavy metal-contaminated environments provide plain description of bacterial community, accounting its composition, abundance, and plant growth-promoting properties. Some of them compare the microbiomes associated to poorly related, though co-occurring metallophyte species. At the same time, research on the inheritance of symbiotic bacteria through seeds have only recently begun to emerge.

Thus, the planned research is both novel and important. Looking further ahead, understanding of the interactions between metallophytes and plant-associated microbiome may contribute to the development of new methods of reducing heavy metal transfer into the food chain.