DESCRIPTION FOR THE GENERAL PUBLIC

Just as humans and animals have their microbiota, plants are also not alone and would not be able to survive in ecosystems if they did not live in symbiosis with numerous bacteria and fungi. One of the most abundant fungal root inhabitants are arbuscular mycorrhizal fungi (AMF) and dark septate endophytic fungi (DSE). AMF, commonly known as endomycorrhiza, are obligatory plant symbionts, which colonize the interior of root cells. Inside the root cells, they develop special structures responsible for the transfer of nutrients called arbuscules. A plant provide AMF with carbon, whereas AMF nourish a plant symbiont with phosphorus and nitrogen. AMF frequently coexist with DSE, which are facultative plant colonizers of characteristic dark pigmented hyphae. They do not develop special structures responsible for the transfer of nutrients between both symbionts, but efficiently mineralize soil organic matter increasing the bioavailability of organic phosphorus to plants, whereas AMF provide plants with inorganic phosphorous. These AMF and DSE features cause that they present a great potential in plant growth promotion in many stressful habitats, also those affected by a human activity and industry. Nevertheless, our knowledge of the nature of their interactions with plants in the anthropogenic environments and their tolerance to the presence of soil pollutants is still very limited. We do not know much about AMF and DSE cooperation with so-called bacteria associated with mycorrhiza (BAM), which use the compounds delivered by the AMF hyphae as a source of carbon. The main goals of the project are: (1) to characterize the biodiversity of DSE and AMF, which live inside the roots and rhizosphere soil of plants growing in the environment contaminated with toxic organic pollutants and in the non-polluted control environment, (2) to isolate these fungi and bacteria and BAM from both environments, (3) to check if they are tolerant to the presence of phenol and polynuclear aromatic hydrocarbons (PAHs), (4) to evaluate if they can support the plant growth in a medium contaminated with these toxic organic pollutants. It has been hypothesized that microorganisms isolated from the contaminated environment will show higher tolerance to the contamination with organic compounds and effectiveness in plant growth promotion than those originated from the control site.

Study on the biodiversity of AMF and DSE will be based on the next generation sequencing (NGS) of specific DNA fragments, which will enable to quantify these organisms in the root and soil samples collected from the contaminated and uncontaminated environment, as well as to assess the number of species in both environments. It will also unravel which species show the dominance and are the most active plant root colonizers. These AMF and DSE species, as well as BAM associated with AMF hyphae will be further isolated from the collected root and soil samples and tested for their tolerance to the presence of phenol and PAHs in a growth medium. Strains most resistant to the toxic influence of these pollutants will be introduced to the cultures with plants treated with PAHs and phenol in order to evaluate if they can enhance the plant growth in such unfavorable conditions. Plant and fungal tolerance to the presence of these contaminants will be estimated on the basis of the fugal root colonization, the development of the external fungal hyphae, the level of oxidative stress, genotoxicity and activity of antioxidative enzymes. Aforementioned parameters will be compared between plants inoculated and non-inoculated with AMF or DSE. The final result of this research will be the collection of AMF, DSE and BAM strains, which can grow in the presence of PAHs and phenol and protect plants from their negative influence.

The results of the presented project will be a new source of knowledge about the development of AMF and DSE in the environment contaminated with toxic organic pollutants and their interactions with plants in such conditions. The established collection of microorganisms will constitute a basis for further research on DSE-AMF-BAM synergism in plant growth promotion in the presence of toxic organic pollutants and on their role as a tool in their biodegradation.