Description for the general public

Antarctica has one of the harshest climates in the world. The annual temperature cycles have a broad spectrum, in the summer the temperature varies average from about -30°C inside the continent to -4 °C in the regions with sea influence, with a minimum of winter: respectively -70°C and -25°C (Bargagli 2005). The average annual rainfall across Antarctica contrary to popular belief is very low and is about 166 mm, reaching the highest values in the region of the Antarctic Peninsula (600-700 mm) and significantly decreases towards the interior of the continent, even to less than 50 mm (Longton 1988). The presence of ice is not synonymous with the presence of water in the bio-available form to organisms living there. Because of that, Antarctica is often called an ice desert.

Rhizosphere of Antarctic plants is the objective of this project. It is the layer of soil, which is directly adjacent to the roots of plants. Polar zone is the only place on Earth where it is possible to study the rhizosphere of plants in one species context due to very low complexity of Antarctic terrestrial communities. Only two species of flowering plants, among hundreds occurring in Tierra del Fuego (South America), cross the Drake Passage and inhabited maritime Antarctic (grass *Deschampsia antarctica* Desv. (Poaceae) and a representative Caryophyllaceae, *Colobanthus quitensis* Bartl.). List of plant species in the poorest region of the globe has increased lately about a third species of flowering plant, *Poa annua* L. (Poaceae), which initially inhabited the anthropogenic habitat, which is altered by human, and now natural habitats areas recently released from the ice, where it enters the tundra communities.

In the next few years we will attempt to eradicate of invasive species – *P. annua*, so this is the last chance to study and in particular characterize grass's soil microorganisms. Rhizosphere is an area of intense biological activity. It is one of the largest ecosystems in the World, which makes it unique habitat of bacteria, especially in the Antarctica. In order to study the diversity of rhizosphere of three currently growing vascular plants, soil samples will be collected directly from the plant in positions with different environmental conditions, especially high trophic diversity of soil, exposure and water conditions. 8 sites were selected of which will be collected soil samples with different properties. Spots and depth of the soil sampling will depend on physiography, especially the occurrence of solid rock. Bacteria are the most abundant organisms that reside in rhizosphere and a special class of bacteria called as plant growth promoting rhizobacteria influence the plant growth by a variety of direct and indirect mechanisms. They may be therefore, exploited to develop eco-friendly and safe replacement for chemical based fertilizers and pesticides. The results for the bacterial strains isolated from rhizosphere Antarctic plants can be used as a model to study the physiological, biochemical and molecular mechanisms of tolerance to extreme habitat conditions.

On the Polish Antarctic 'H. Arctowski' Station a detailed description of the positions will be carried out, including Phytosociological relevés by Braun-Blanquet method. This is the basic method for the investigation of plant communities. Associated plants and lichens will be also identified. The collected material will be subjected to a preliminary analysis, like weighing, measuring pH and accurately describe. Then the soil will be transported to the laboratory in IBB PAS, Poland. All the collected sample will be stored and transported at -80 °C.

In order to determine the taxonomic composition of the rhizosphere molecular analysis will be conducted. With the new-generation sequencing it will be possible to define, what specific rhizosphere microorganisms inhabit Antarctica.

Differences in LT_{50} (mediana lethal temperature) of *P. annua* from the Antarctic and temperate climates will be investigated by growing under strictly controlled conditions in growth chamber.

Some of the chemical variables will be assess in the soil analysis (aluminum, calcium, magnesium, phosphorous, potassium, sodium, organic carbon, sulfur, iron, copper, zinc, manganese, lead, hydrogen ions, aluminum, lead and pH) using the protocols listed in EMBRAPA (1997).