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Congress — Exhibition

Institute of Soil Science and Plant Cultivation State Research Institute

HR EXCELLENCE IN RESEARCH

National Centre for Research and Development

OSMO-PROTECT

Little big heroes - the potential of soil bacteria against osmotic stress

- *Who are you?*
- *Bacteria.*
- *Where you live?*
- *In the soil.*
- *What can you do?*
- *Produce osmoprotectants, exopolymers, phytohormones, antifungal compounds, and various enzymes.*
- *What do you do?*
- *We participate in the nutrient cycle, protect and support plant growth.*
- *Where do you serve?*
- *In agriculture, biotechnology, industry.*
- *What actions do you participate in?*
- *Against osmotic and hydrological stress.*
- *Who do you serve?*
- *Plants, soil, and other microorganisms.*
- *Who are you?*
- ***Little heroes!***

Introduction

Osmotic stress is one of the main abiotic stresses and directly affects plant growth and yield. Progressive climate change is causing prolonged periods of drought and the occurrence of floods. At the same time, there is an excessive use of mineral fertilisers as salts. As a result, the phenomenon of osmotic stress is occurring more and more frequently as a direct consequence of drought and salinity.

The main objective of the OSMO-PROTECT project is to develop an innovative biopreparation aimed at counteracting the effects of osmotic stress occurring in the soil environment as a consequence of climate change and human activity. The main objective of the project will be realised through specific objectives, which include:
The main objective of the project will be achieved through specific objectives, which include:

- Determination of the full biotechnological potential of the selected bacteria;
- Selection of the most effective composition of the bacterial inoculum;
- Development and optimisation of the full formulation of the biopreparation.
- Determination of the application efficiency of the formulation depending on the application model used;
- Determination of the effectiveness of the biopreparation under field conditions.

The large area of agricultural land in Poland, with the simultaneous increase in farmers' awareness of biological crop support methods, indicate that the need for biopreparations is timely. The significant potential for the use of such a biopreparation is primarily due to agriculture's need for crop support measures in the face of increasingly frequent periods of drought. The formulation will be able to be used on saline soils where stress limits plant growth

The aim of the first stage of the research was to characterise bacterial strains isolated from soils subjected to excessive moisture stress and to assess their usefulness in agrobiotechnology.

Materials & methods

Bacteria were isolated from soils subjected to simulated flood conditions. More than 80 strains were obtained.
Selected strains were tested to determine their properties, *i.a.* ability to ammonification, solubilise phosphorus, produce osmoprotectants, exopolymers, indolyl-3-acetic acid, enzymatic activity, and metabolic potential.
The sequencing was performed for taxonomic classification.
The bacteria with the highest number of positive results were used in a pilot experiment with spring wheat to determine whether they can promote plant growth.

Results

Results showed that some strains have the capacity for ammonification, phosphorus solubilisation, urease, gelatinase and esterase activity, production of phytohormones, osmoprotectants, and exopolymers. Taxonomic classification allowed strains to be assigned to genera such as i.a. *Kocuria*, *Bacillus*, *Staphylococcus*, and *Rhodococcus*.
In the experiment with winter wheat, it was reported that plant dry weight was up to 19.23% higher after the addition of bacteria compared to the control under saline conditions.

Conclusion

The study showed that the isolated bacteria possessed properties that enabled them to survive under osmotic stress conditions. In addition, they were found to have a positive effect on wheat growing.

The next step in the OSMO-PROTECT project is to develop a biopreparation for agricultural use based on selected bacteria.

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