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- Research on the role of roots & rhizosphere in growth & yelding of horticultural plants.

- Development of sustainable methods of cultivation and fertilization of horticultural plants for the production of high quality fruit and vegetables and to increase the natural fertility of the soil using beneficial bacteria, mycorrhizal fungi and other components of twphe soil biosphere.

SYMBIO BANK

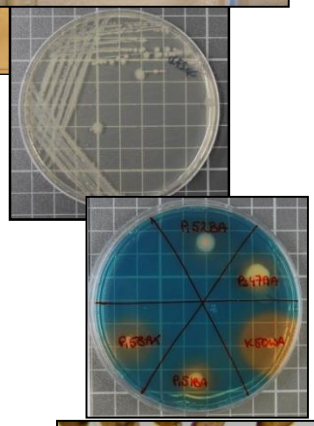
OBJECTIVES:

- **Isolation and characterization of symbiotic soil microorganisms naturally colonizing the roots of horticultural crops or soil for horticultural practice.**
- **Identification of beneficial species and strains of microorganisms using classical, biochemical and molecular techniques.**
- **High effectiveness – *in vivo* analyses to select the most beneficial species / strains of microorganisms for horticultural practice.**
- **Preparation of native mycorrhizal and bacterial inocula.**

SYMBIO BANK RESOURCES

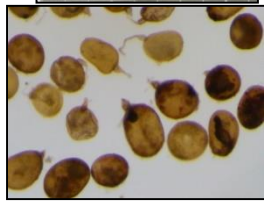
Spores of arbuscular mycorrhizal fungi (AMF)
(number of spores from the rhizosphere of)

• strawberry	18.0 thousand
• apple	10.5 thousand
• sour cherry	1.5 thousand
• pear	14.0 thousand
• wild strawberry	9.0 thousand
TOTAL	**53 thousand spores**



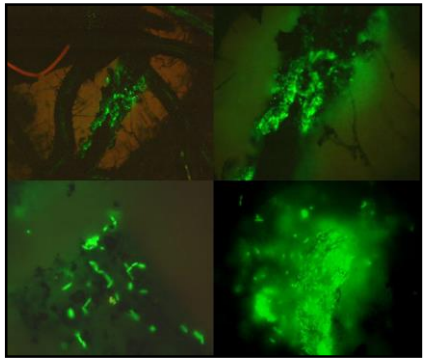
Isolates of bacteria

• *Pseudomonas fluorescens*	300
• synthesizing siderofores	500
• solubilizing phosphates	200
• cellulose digesters	40
• forming spores	125
• fixing atmospheric nitrogen	100
• *Actinomycetes*	100
TOTAL	**1365**

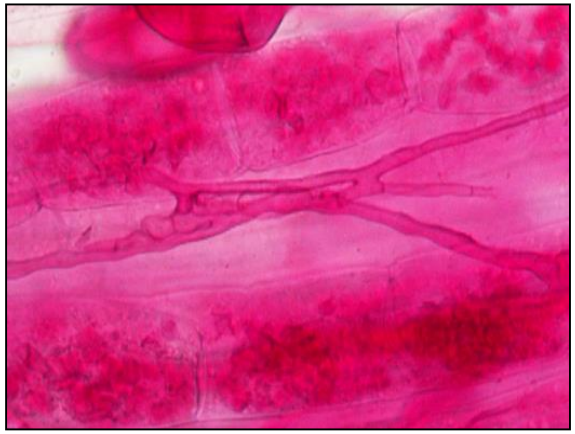


ACHIEVMENTS OF RHIZOSPHERE LAB

- **Selection, identification and collecting of the most beneficial microorganism's strains for plant growth and yield, and for preparation of microbial inocula.**
- **Development of innovative bioproducts and technologies for improving soil quality and increasing growth and yield of crop plants:**
  - **consortia against soil pathogens**
  - **consortia for increasing availability of mineral ions**
  - **consortia for stimulating root development and rhizosphere processes**
  - **consortia for improvement of degraded soil**



Cells of beneficial bacteria no plant roots' surface



Arbuscules inside of plant roots

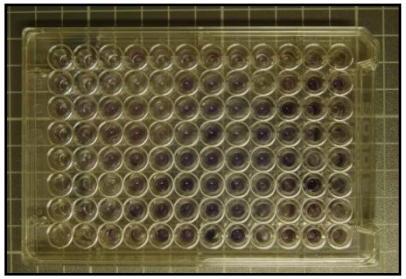
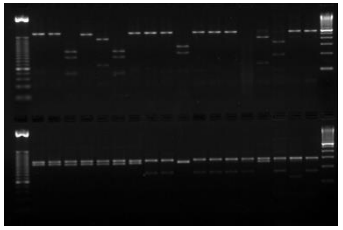
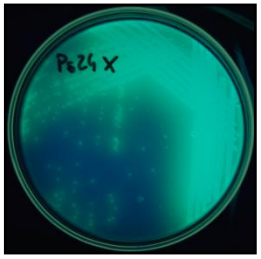


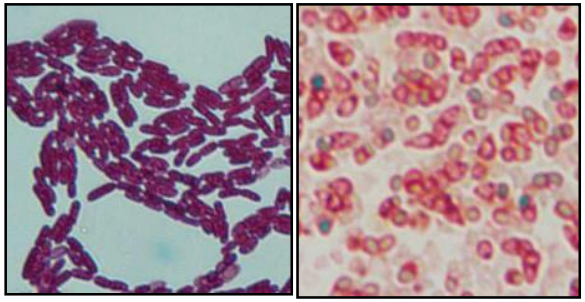
Plate of BIOLOG identification system



RFLP



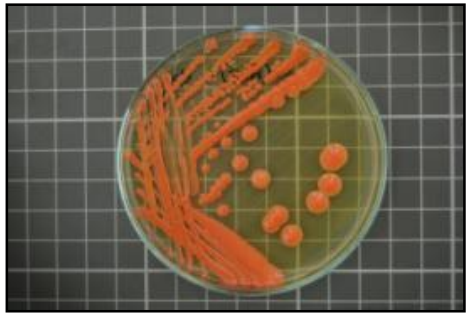
***Pseudomonas* sp. on selective medium**

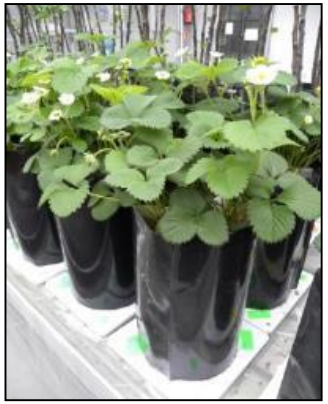


***Bacillus megaterium* cells**

- **<u>Increasing the efficiency of water use by species of crop plants</u> typical of the temperate zone (mainly fruit crops, vegetables, cereals).**
- **<u>Improvement of soils quality</u> by using strains of beneficial microorganisms, especially bacteria and mycorrhizal fungi.**
- **To increase the efficiency of production on small farms, technologies of microbiological fertilization of plants in conjunction with applications of organic matter and water.**
- **We offer:**
  - **microbiologically enriched biopreparations for field and greenhouse applications,**
  - **preparations for composting nitrogen-rich organic residues, including animal manure which contain microorganisms, humic acids and biochar.**
- **<u>Applications of strains of microorganisms to the soil in difficult growing conditions - saline, acidic or alkaline soils</u> will allow cultivation of plants under previously adverse conditions.**

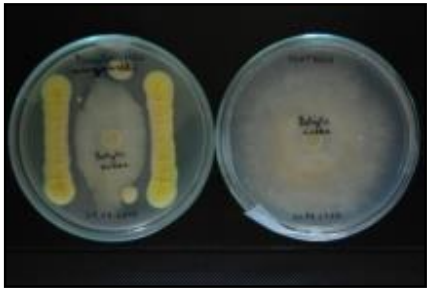
- **The use of our microorganisms for:**
  - **improving the growth and yield of plants,**
  - **preventing diseases of crop plants,**
  - **microbial stimulation/stabilization of agricultural soils (e.g. mycorrhizal fungi, bacteria, humic acids, organic fertilizers, composts in no-tillage cultivation on loose soils, such as loess).**
- **‚Skierniewickie Microorganisms' are effective in the management and reforestation of degraded and polluted soils.**
- **Reforestation of degraded arable soils as the methods of preventing desertification of existing farmland areas, especially in horticultural crops.**
- **Preserving vulnerable arable land and bioremediation of the soil on farmlands, e.g. to reinforce the edges of terraces on which arable crops or vegetables are grown.**





(Deng et al. 2014)

- **New microbial solutions allowing agriculture to spread to the lands that have not yet been developed for agricultural purposes, necessary due to the increasing affluence of European and Chinese society and the increased demand for land for growing crops intended for animal feed (Liu et al. 2016).**
- **Research on species of fruit plants of the temperate zone that are grown in Europe and China, such as apples, apricots, pears, plums, perennial crops.**
- **Testing the effects of microorganisms on pathogens as a way of environment friendly plant protection technique.**
- **New microbial methods of food production with limited use of chemicals will improve the quality of food available in Europe and China.**



Antagonistic fungi inhibiting growth of *B. cinerea*

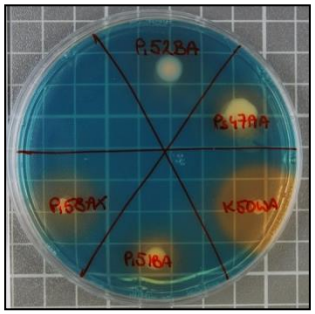
Root system of apple tree cv. 'Ariwa' treated with Humus Active + Aktywit PM.

Fisher 2009; Ham 2009; Hartmann and Neumuller 2009)

- **<u>Microbial strains we developed are helpful in bioremediation of soils contaminated with oils, synthetic pollutants or heavy metals</u> and will allow to recover soil's health and productivity.**

- **Combined use of microbial soil improvers and organic fertilizers is the basis for <u>sustainable production of high quality food and other agricultural goods on low quality, degraded soils.</u>**

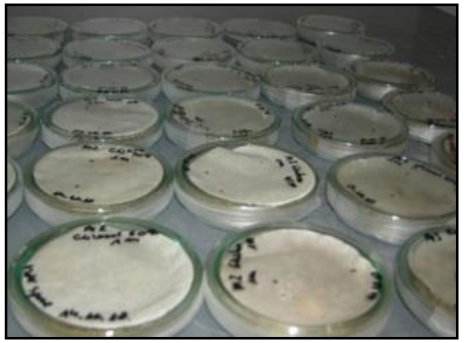
- **<u>Restoration of quality/vitality of soils localized on degraded areas</u> will help in utilization of these areas in agriculture, forestry and in social services like: tourism, sports and recreation.**



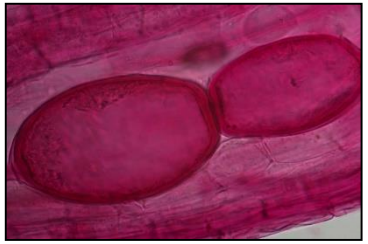
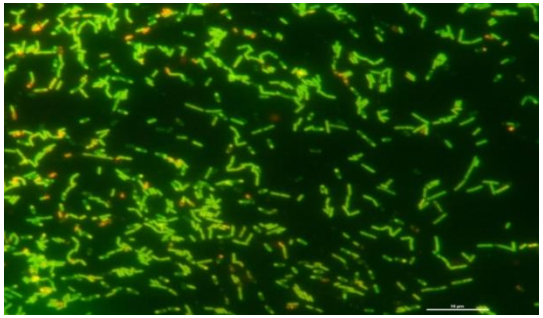
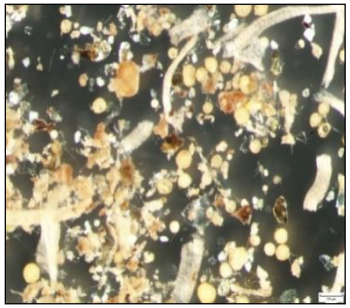
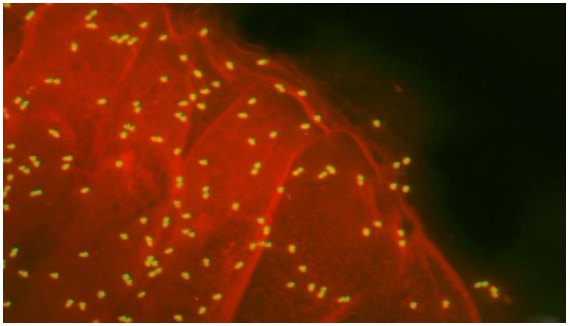
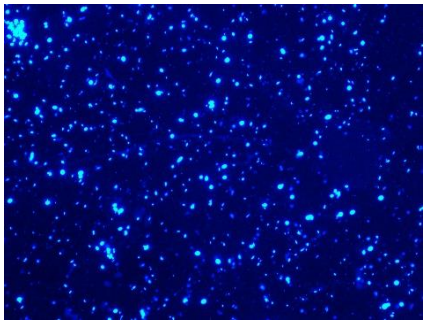
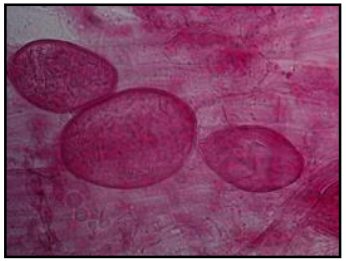
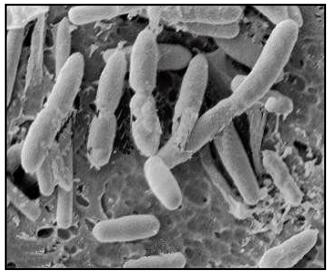
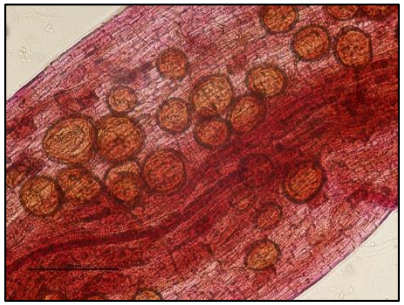
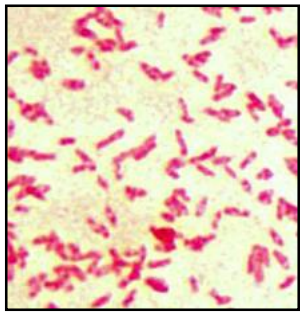
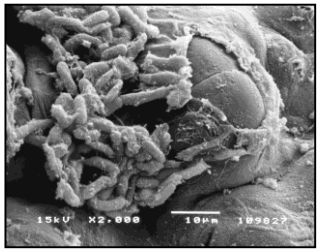
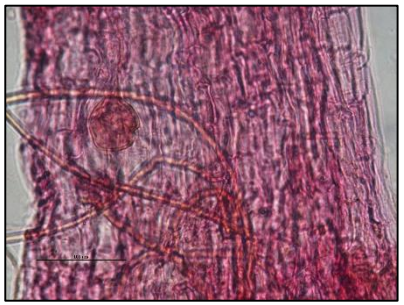
Production of siderophores (natural chelates) by soil bacteria

Spores of mycorrhizal fungi which allow better plant growth in poor or low quality soils.

Greenhouse tests of impact of organic amendments on plant growth



Assessment of the condition and germination of beneficial fungi spores after freezing





THANK YOU