Characterization of microbial communities associated to *Pistacia lentiscus* and *Helichrysum microphyllum* subsp. *tyrrhenicum* in Sardinian abandoned mining areas

E-ICES 19
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INTRODUCTION

- Sardinia is an Italian region located in the Western Mediterranean Sea.
- In the past, the Sulcis-Iglesiente area in SW Sardinia was one of the most important metal mining district in Europe.
- Abandoned mining areas are a crucial worldwide environmental problem posing serious risks for human health and ecosystems.
- Phytoremediation has been recognized as a cost-efficient and environmentally friendly technology for in situ restoration of mining areas implying the creation of a vegetation cover for the long-term metal stabilization.
- The microorganism-plant association is a crucial point in the survival and metal tolerance of plants in metal contaminated environments.

OBJECTIVE

Study of plant - microbes interaction for the improvement of phytostabilization as green technology in the restoration and revegetation of mine tailing dumps.

EXPERIMENTAL STRATEGY

- **Structure of prokaryotic and fungal communities** by analysis of the 16S rRNA gene and ITS region.
- Identification of the main environmental drivers.

Greenhouse phytoremediation test to evaluate abiotic parameters (e.g. hydric regime)

- Germination efficiency.
- Hypogeal and epigeal growth.
- Metal accumulation.

Mine substrate, rhizosphere and plant tissues

Mine substrate, rhizosphere and plant tissues

Bioaugmentation assisted phytoremediation

- Isolation and characterization of the bacterial strain properties relevant for metal tolerance and stabilization as well as plant growth promotion.

ANNUAL MONITORING OF MICROBIOLOGICAL PARAMETERS IN MINE SUBSTRATE

1	outside
2	outside
3	outside
1	border
2	border
3	border
1	inside
2	inside
3	inside
4	inside
5	inside
6	inside
1	bare

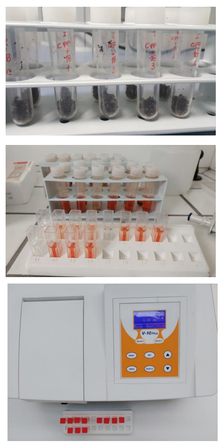
PHYSICO-CHEMICAL ANALYSIS

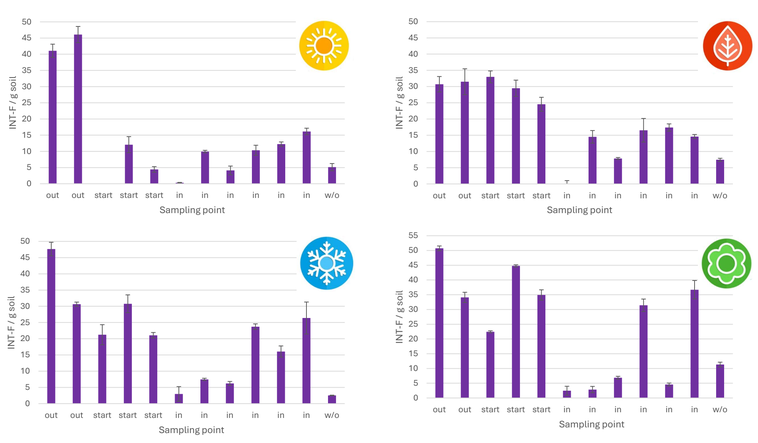
Table 1. Physico-chemical parameters in the mine substrates from the Campo Pisano tailing dump. Each value is the average of five samples.

Parameter	Mean±SD	CV%
Moisture (%)	**4.9±2.3**	**46.5%**
pH (KCl)	**6.7±0.4**	**6.2%**
Inorganic carbon (g kg^{-1} dw)	**14.9±8.4**	**56.0%**
Organic carbon (g kg^{-1} dw)	4.2±1.4	32.8%
Total nitrogen (g kg^{-1} dw)	**1.09±0.53**	**48.1%**
Total phosphorous (g kg^{-1} dw)	**0.42±0.13**	**30.8%**
Bioavailable phosphorous (g kg^{-1} dw)	**5.7±1.8**	**32.5%**

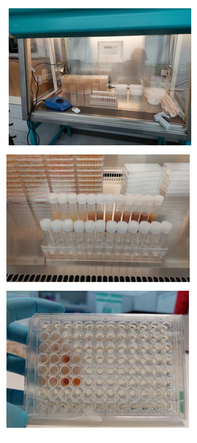
Bold: $p < 0.05$; SD, standard deviation; CV%, coefficients of variation; dw, dry weight

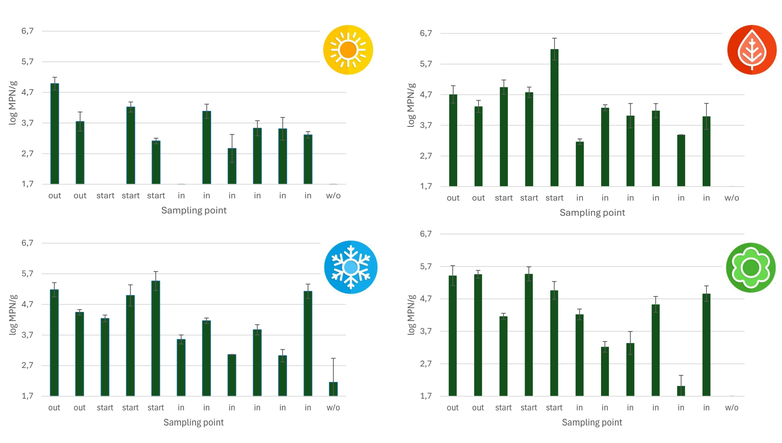
DEHYDROGENASE ACTIVITY





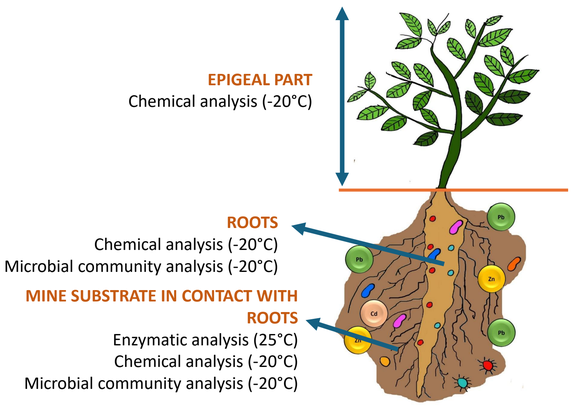
ABUNDANCIES OF HETEROTROPHIC BACTERIA

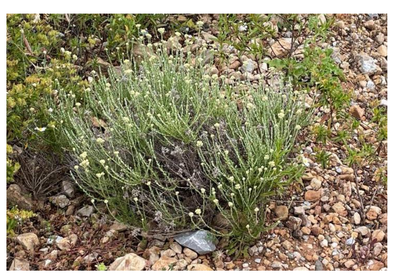




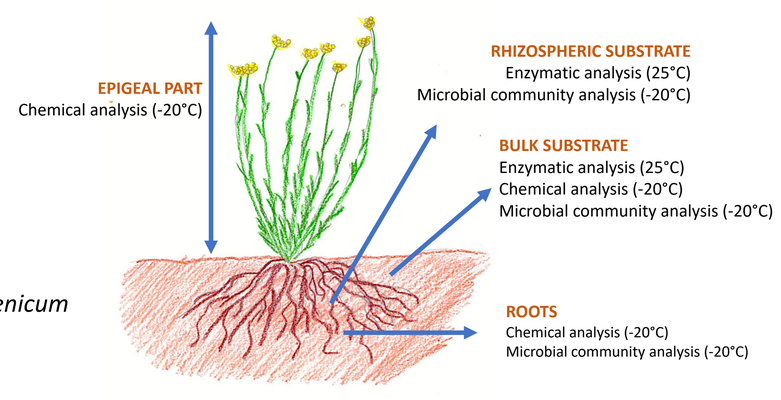
PLANT SAMPLING

Pistacia lentiscus





Helichrysum microphyllum subsp. *tyrrhenicum*



RESULTS

- The metabolic activity of microorganisms in mine substrates was evaluated by dehydrogenase assay that showed a significant increase starting inside, moving toward the border, and extending outside the mine tailing dump.
- The concentration of heterotrophic bacteria was determined by Most Probable Number technique and followed the same trend.
- Currently, we are carrying out the analysis of the bacterial and fungal communities by the Next Generation Sequencing of rRNA genes from hypogeal tissues and substrate samples.

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