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NOVEL IDEAS TO SUPPORT PLANTS. LET'S BET AGAINST PATHOGENS!

Design of microbial consortia for the biocontrol of soilborne pathogens in legumes

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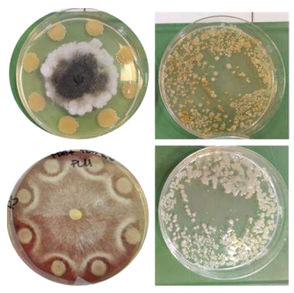
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PLANTÌA Project

Introduction

The soil health and fertility has become one of the main topics in the agricultural field, resulting in the research of novel and natural pathways for biostimulation and the biocontrol of plant pathogens. PLANTÌA project aims to develop sustainable strategies to increase legume crop resilience, by using microbial consortia (MC) and compost tea (CT).

Beneficial microrganisms



Compost tea



Legume resilience



Materials and methods

Colonies isolated from different matrixes were characterized for the antagonistic activity, biostimulant and biocontrol traits. The best performing bacteria were then analysed for the compatibility and the biocontrol in *vivo.* The obtained consortia were applied to pea and chickpea for the biocontrol of *Rhizoctonia solani* and *Fusarium solani*.

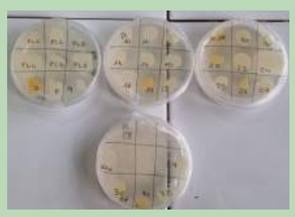
Compost



Compost tea



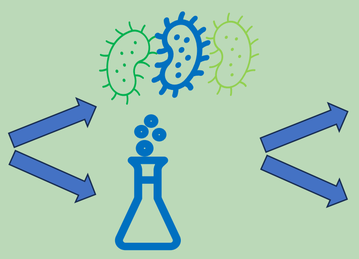
Microflora isolation



Characterization and selection

- Antagonistic activity
- Molecular identification
- Biochemical characterization
- Root colonization trait studies
- Biocontrol *in vivo*
- Compatibility studies

Consortia



Boosted CTs

Consortia biocontrol

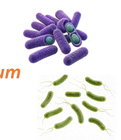


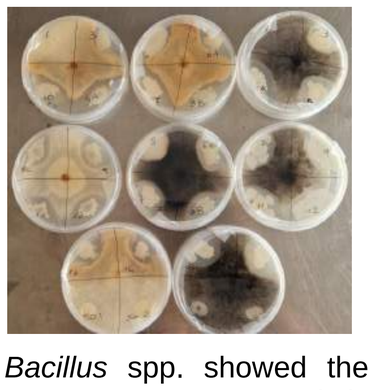
Results

Molecular analysis allowed to identify different spieces of bacteria including:

- ***Bacillus* spp.**
  - *Bacillus thuringiensis*
  - *Bacillus halotolerans*
  - *Bacillus* spp.
- ***Pseudomonas* spp.**
  - *Pseudomonas chlororaphis* subsp.
  - *Pseudomonas putida*
  - *Pseudomonas citronellolis*
  - *Pseudomonas aeruginosa*
  - *Pseudomonas* spp.
- ***Klebsiella* spp, *Variovorax***
- ***Pedobacter* sp., *Mycrobacterium phyllosphaeriae***

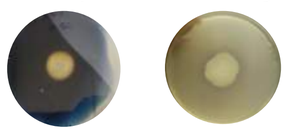




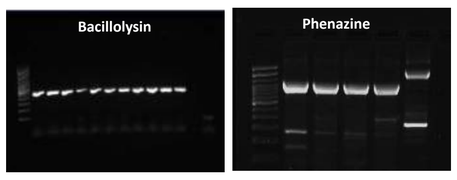


Bacillus spp. showed the strongest antagonistic activity, followed by *Pseudomonas chlororaphis* spp.

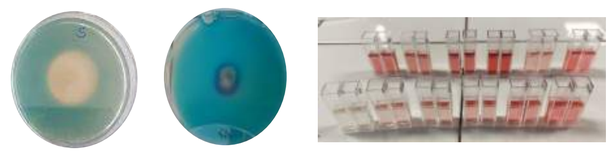
Among *B. halotolerans*, *B. thuringiensis* and *Pseudomonas* spp. different strains showed the ability to produce amylases and proteases



Moreover *Bacillus* and *Pseudomonas* spp. showed to possess genes associated with antibiotics production

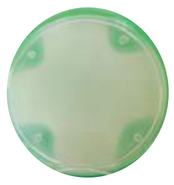


Strains of *B. thuringiensis P. putida, P. citronellolis, P. chlororaphis* were able to produce indoloacetic acid, siderophores.

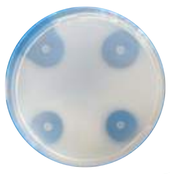


Mainly, *B. halotolerans* and *P. citronellolis* were able to solubilize P and to be tolerant to zinc.

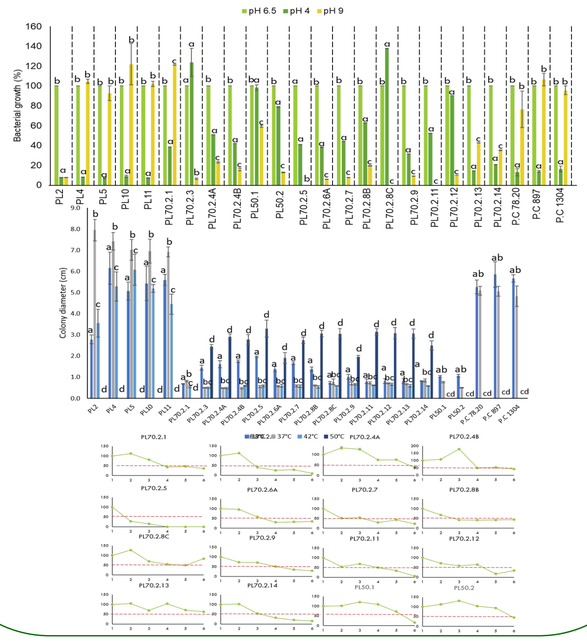
NBRIP



Basal agar medium + zinc

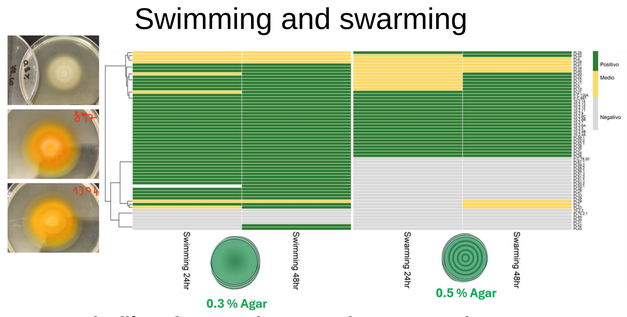


Abiotic stress tolerance

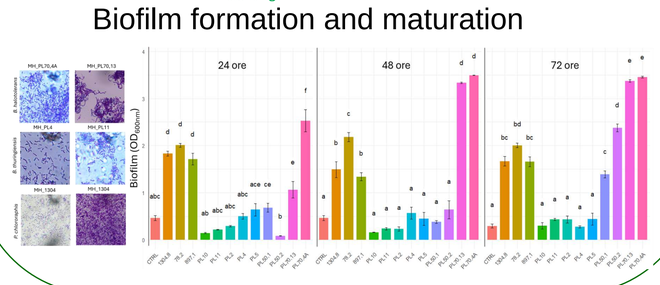


Motility and biofilm are generally associated with a better capacity to colonize surfaces including roots

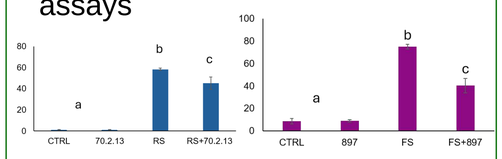
Swimming and swarming



Biofilm formation and maturation

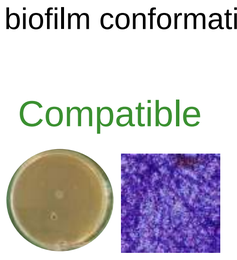


The best performing strains were included into *in vivo* biocontrol assays

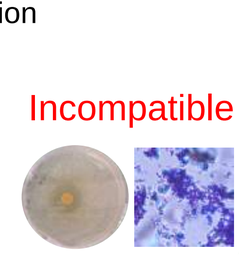


The compatibility among strains were checked on agar plates and in biofilm conformation

Compatible



Incompatible

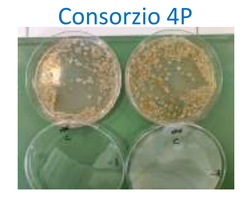


Consorzio 4B



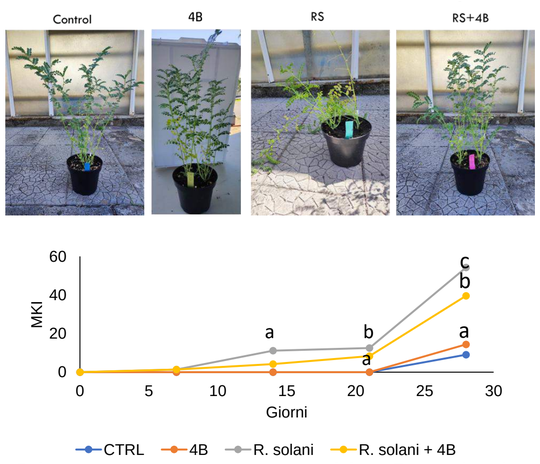
B. halotolerans
B. thuringiensis
P. putida

Consorzio 4P



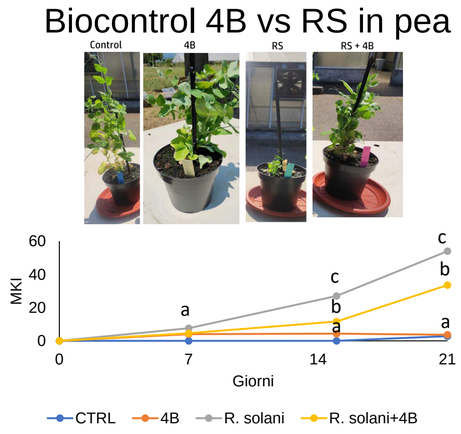
P. chlororaphis spp.
P. putida

Biocontrol 4B vs RS in chickpea



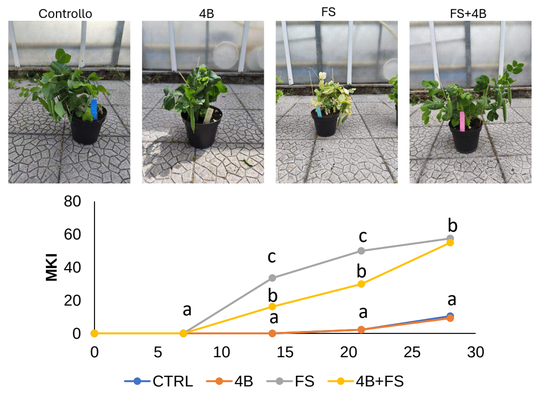
Disease severity caused by *R. solani* reduction of **25%** in the presence of 4B

Biocontrol 4B vs RS in pea



Disease severity caused by *R. solani* reduction of **32%** in the presence of 4B

Biocontrol 4B vs FS in pea



Disease severity caused by *F. solani* reduction of **50%** in the presence of 4B

Conclusion

The approach used in this research project allowed us to identify suitable bacterial candidates for the development of microbial consortia, highlighting strain compatibility as a key factor for their effective combination. This strategy led to the development of the 4B consortium, which showed promising potential for the biocontrol of soil-borne pathogens affecting legumes

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