Università di Modena e Reggio Emilia
Dipartimento di Scienze della Vita

UNIMORE
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA

IMPROVEMENT OF SEED QUALITY AND CONTROL OF SEED TRANSMITTED PATHOGENS

PhD in

AGRI-FOOD SCIENCES, TECHNOLOGIES AND BIOTECHNOLOGIES

XXXIV CYCLE

II year

PhD student: ***Gianmarco Conti Nibali*** *Tutor:* ***Prof . Emilio Stefani***
Co-tutor: ***Dr. Davide Giovanardi***

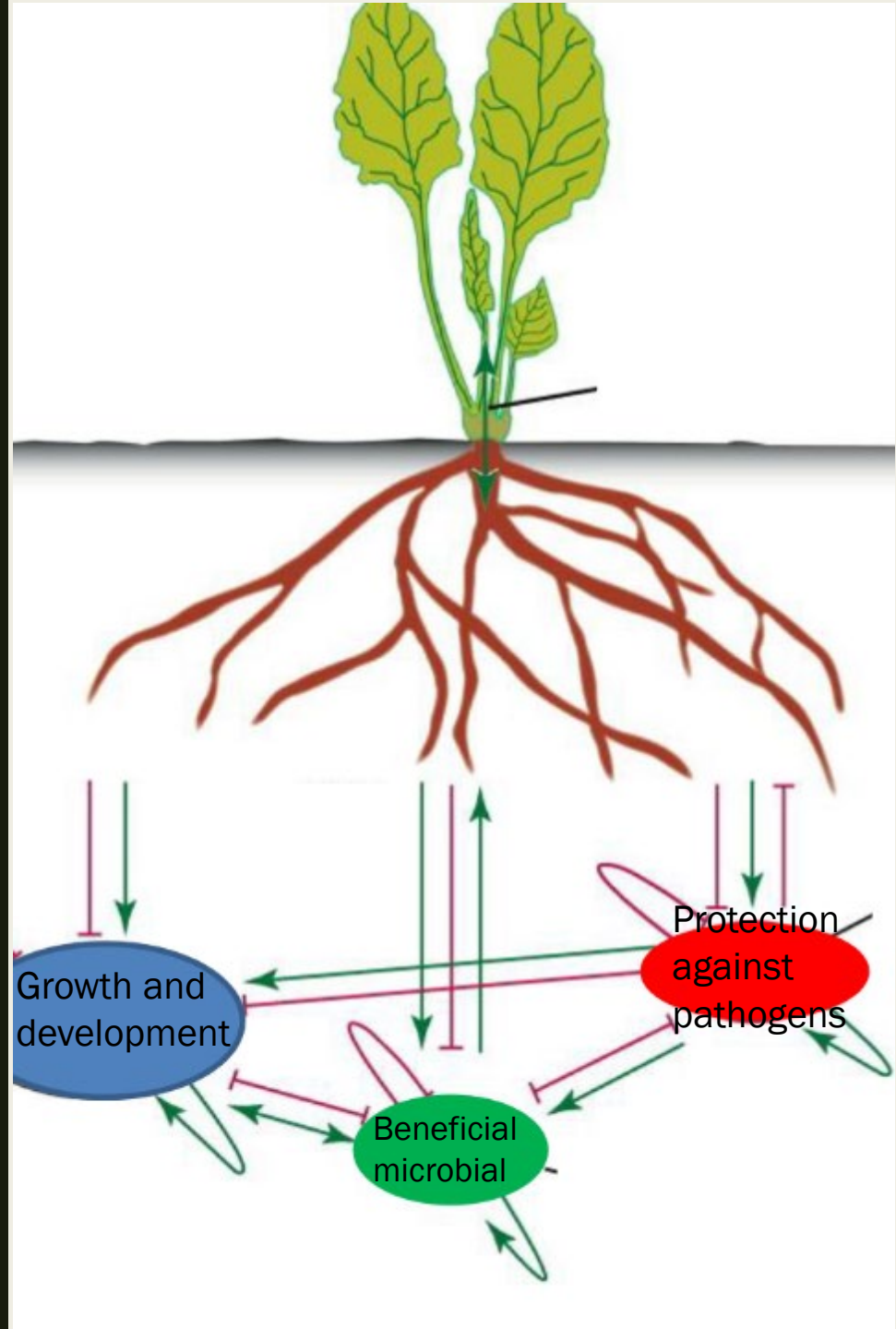
INTRODUCTION

Application of beneficial microbes to seeds is an efficient method for disseminating microbial inoculum into the soil, where they will be well-positioned to colonize seedling roots and protect cultivated plants against soil-borne diseases and pests.

Additionally, beneficial microbes are essential for supporting plant growth, both as root epiphytes and as endophytes.

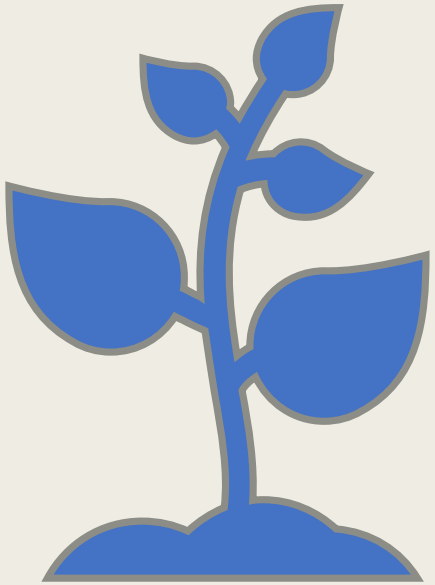
QUALITY OF A MICROORGANISM

- Antagonistic activity;
- Plant growth promoting traits;
- Enhanced bio-safety issues (no need of pesticides).



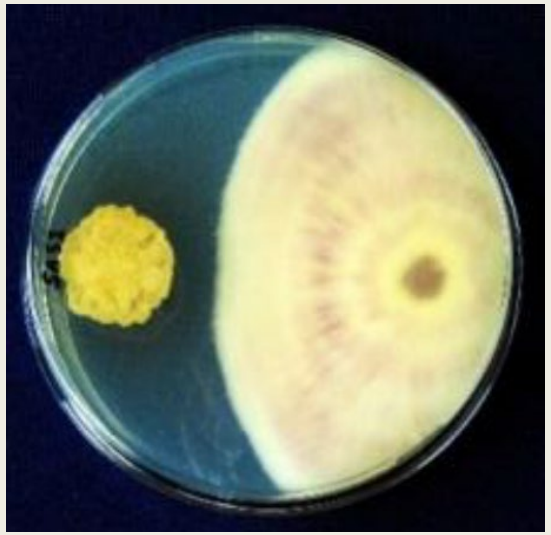
The activity carried out inside the PhD programme is focused on research and selection of microbial agents to improve:

- ☐ The germination of seeds, the vitality and strength of seedlings;
- ☐ The ability to colonizing plants as endophytes, thus acting as promoters of plant growth;
- ☐ The resilience of plants to abiotic stress and pathogens, both seed-borne and soil-borne



ANTAGONISTIC ACTIVITY

In order to identify the microorganisms that have antagonistic traits, *in vitro* antagonism tests were carried out on a set of phytopathogenic fungi



Streptomyces sp. SA51,
Streptomyces sp. DLS1568,

VS

Fusarium oxysporum f.sp. *cepae*

Sclerotinia sp.

Fusarium oxysporum f.sp. *raphani*

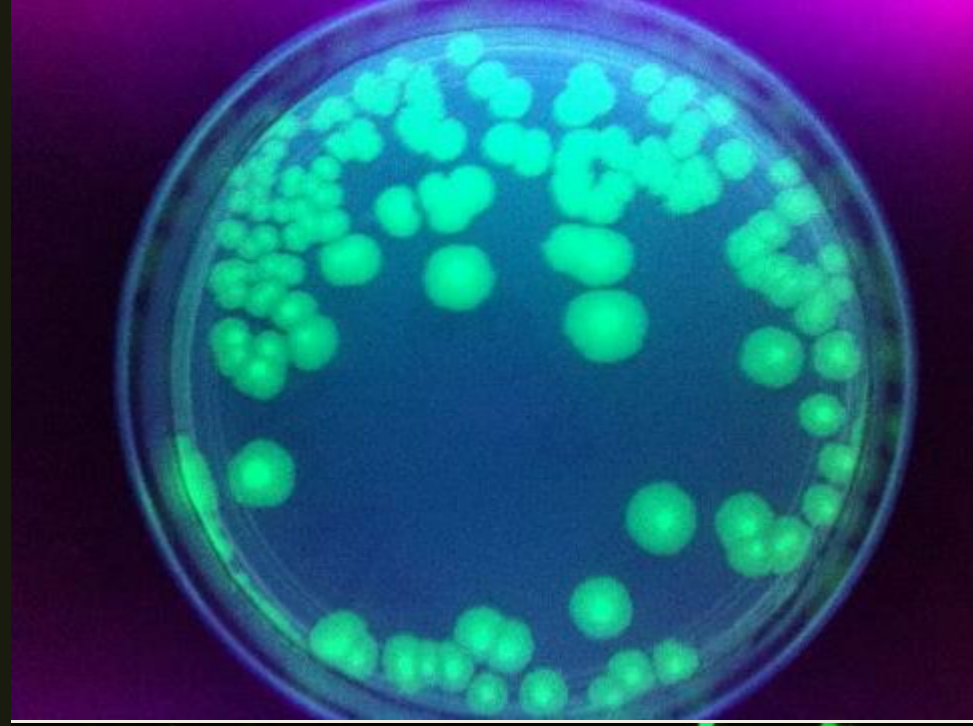
Fusarium oxysporum f.sp. *lactucae*

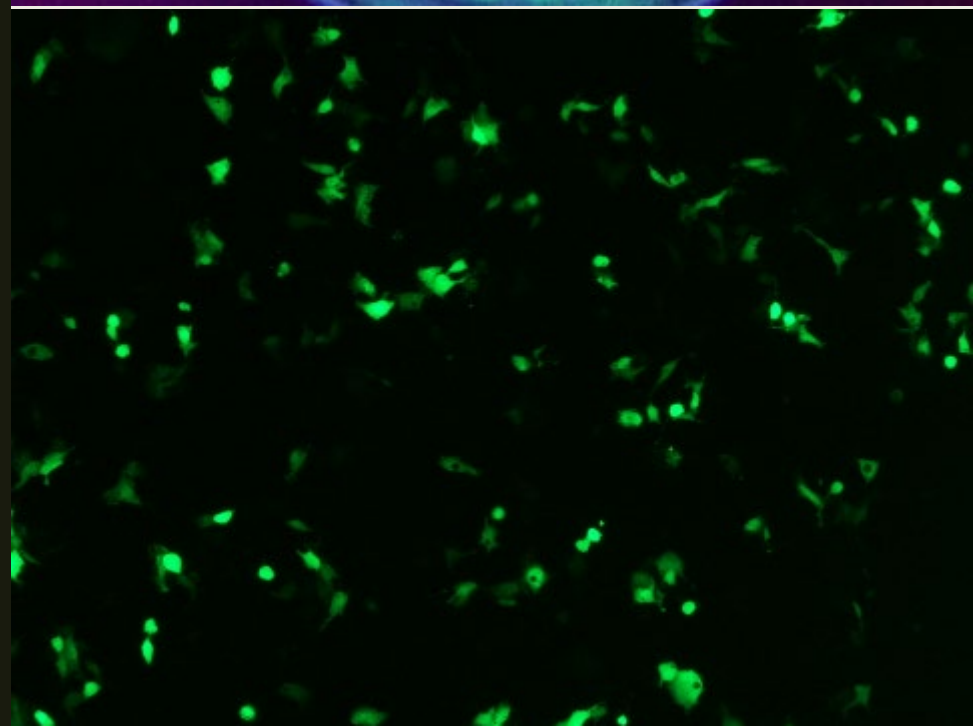
INTERNALISATION OF BENEFICIAL MICROORGANISMS INTO PLANTS

Two beneficial microorganisms *Streptomyces* sp. SA51 and *Streptomyces* sp. DLS1568 were transformed with GFP to check their ability to internalize into plants.

Results confirmed their ability to efficiently colonize onion seedlings and salad plants.

Specific PCR assays confirmed their identity in colonized plant tissues.





FIELD TEST

Seed coating with beneficial microorganisms was done and seeds (onion and fennel) sown in fields with a high inoculum pressure (*Fusarium* sp.)

- ☐ the germination capacity of seeds,
- ☐ the fitness of seedlings of interest,
- ☐ the biological control of specific plant pathogens (soil-borne fungi).

MAIN RESULTS ACHIEVED

Beneficial Streptomycetes were able to switch from epiphyte (seed coat) to endophyte status, thus efficiently colonize the plants.

Extensive field trials confirmed an improved emergence and stronger vitality of seedlings, when seeds are coated with beneficial Streptomycetes

Further research planned in 2021:

- Assess Streptomycetes dynamics inside the plant tissue;
- Confirm the plant growth promotion activity of Streptomycetes through plant gene expression;
- Identify specific biosynthetic pathways in Streptomycetes supporting their antagonistic and plant growth promoting activity