

New approaches for selecting effective microorganisms to control late blight

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Looking for alternatives

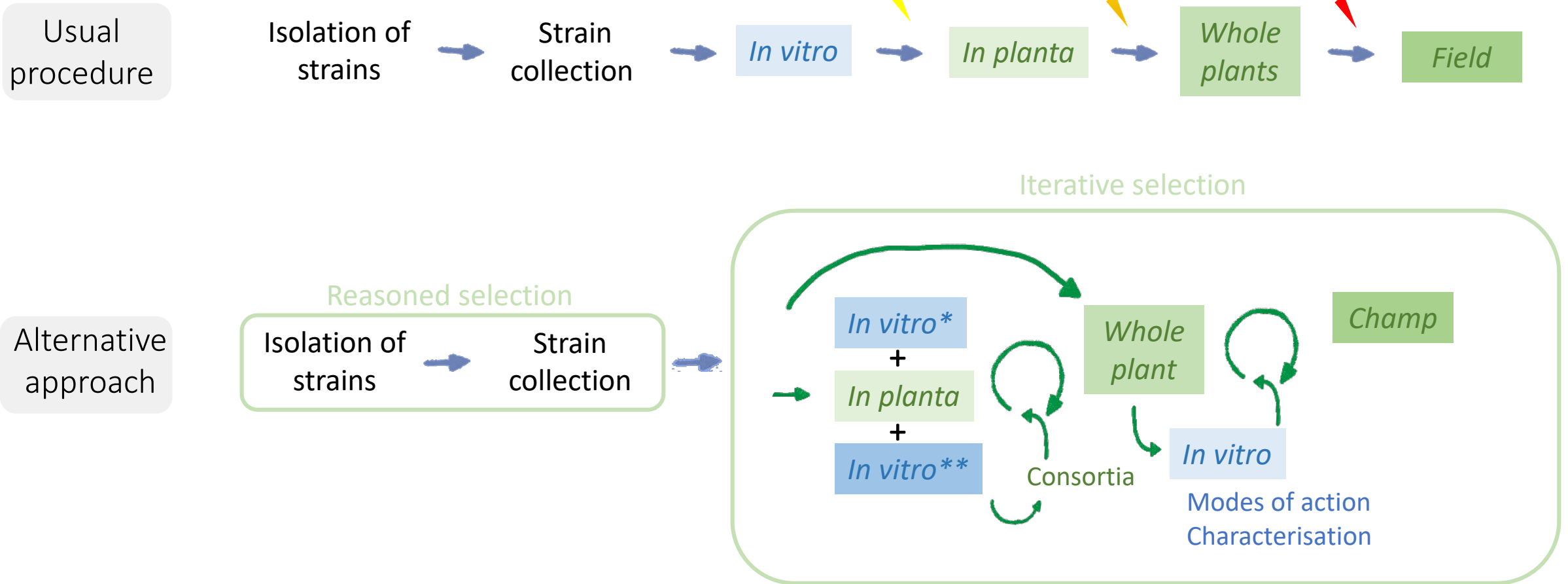
Going back to the plant itself...

- All plant compartments are colonized by microorganisms
- Diversity of microorganisms...
 - ✓ Selected by the plant
 - ✓ At the interface between the plant and its environment
 - ✓ Potentially beneficial and/or protective...

...against late blight?



The selection of microorganisms



* In water (no nutrients added)

** In minimal medium

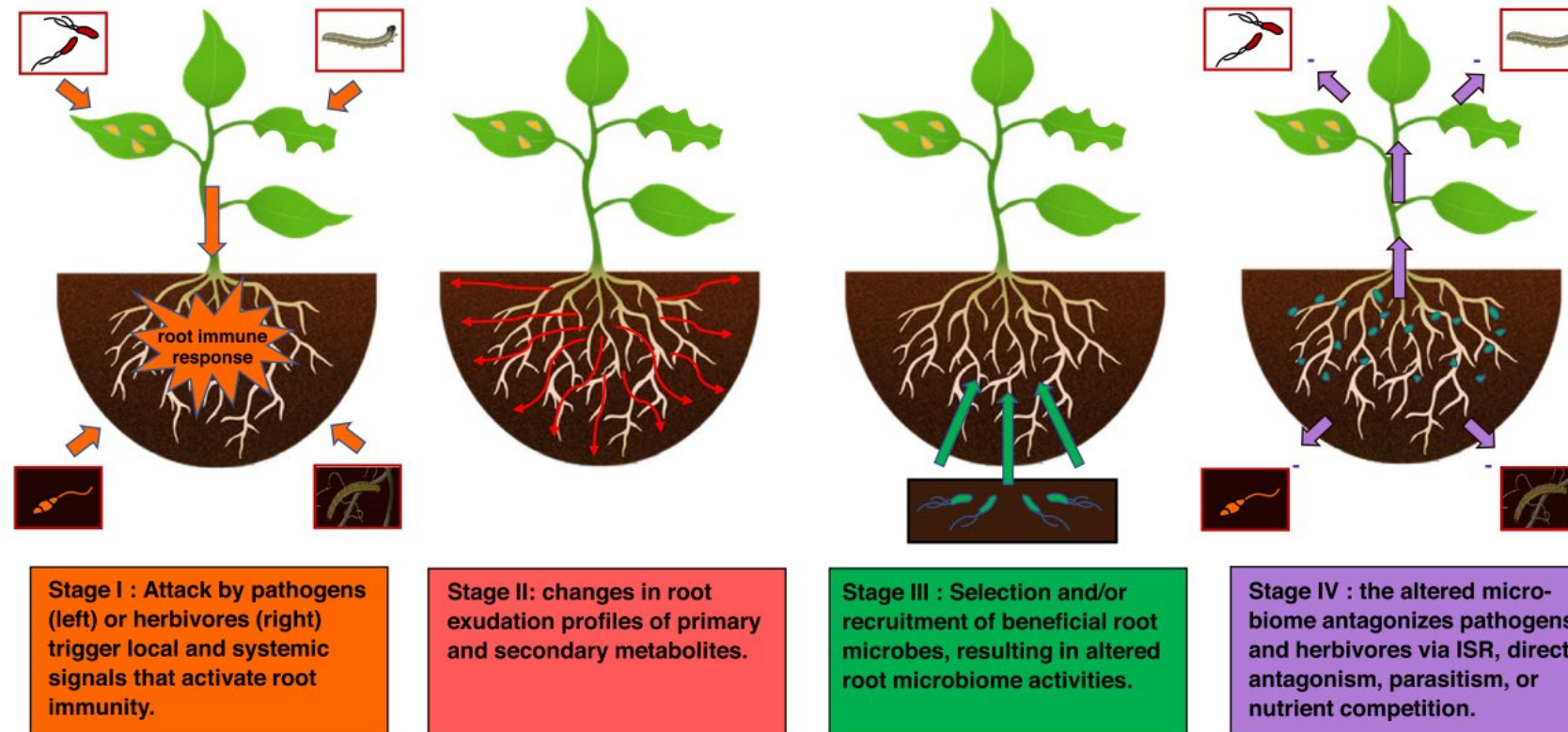
*Which strains are the most promising candidates?
What makes a strain a promising candidate?*

Selection of microorganisms by the plant

Vivien Pichon



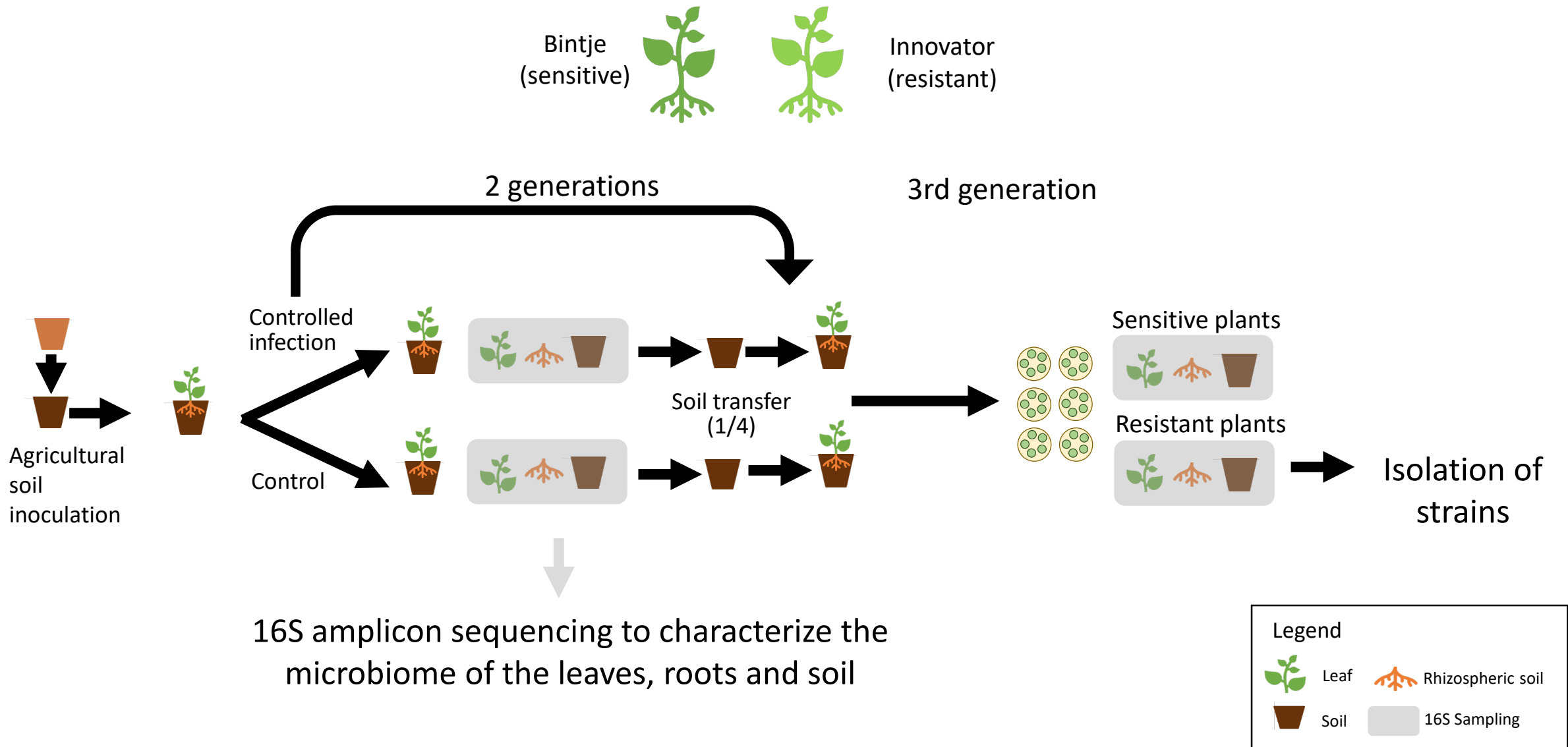
“Cry for help” hypothesis



Current Opinion in Microbiology

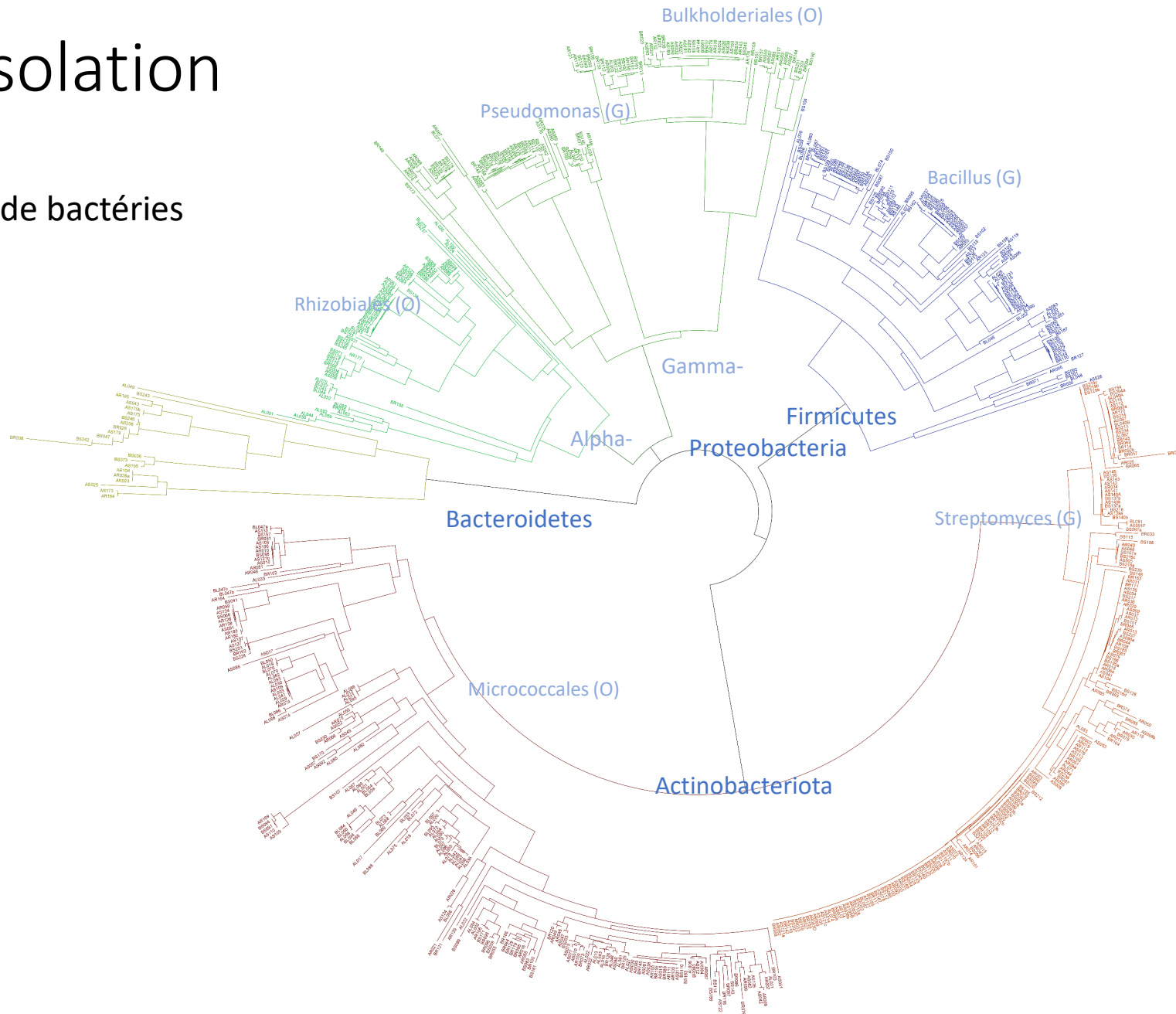
From Rolfe et al., 2019

Selection of microorganisms by the plant

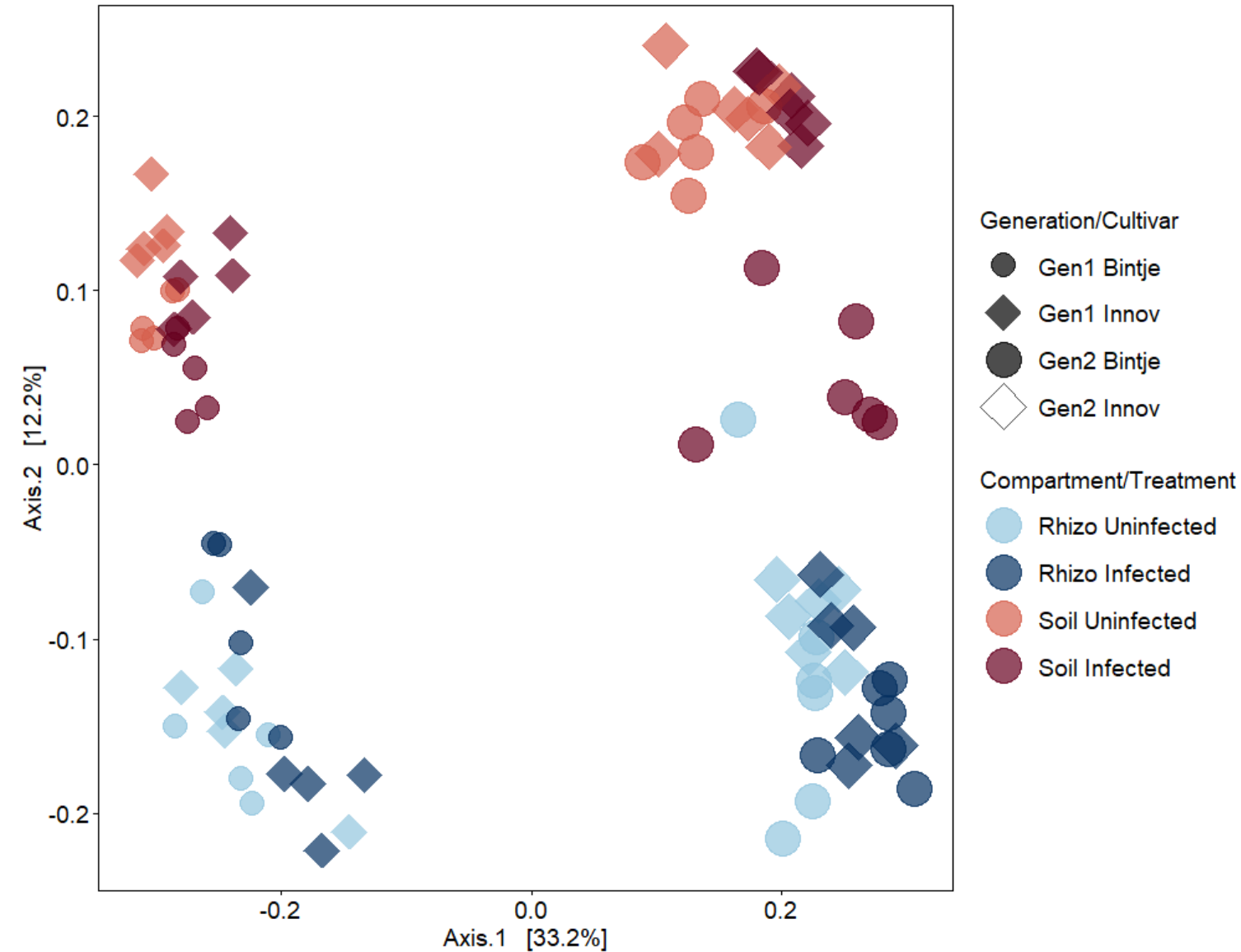


The isolation

643 souches de bactéries



Soil and rhizosphere (1st and 2nd generations)



- Soil and rhizosphere harbor distinctive communities
- There seems to be a cultivar effect for the soil samples (that is stronger in the 2nd generation)
- For Bintje, there seems to be a shift in the community composition when plants are infected (stronger in the 2nd generation)

Using microbiome data analysis to identify strains of interest

Looking for strains that are more (or less) abundant in the microbiome of infected plants

9260 ASV (Amplicon Sequence Variant) detected



500 ASV detected as differentially abundant



Microbiome analysis:



400bp

Strain collection:

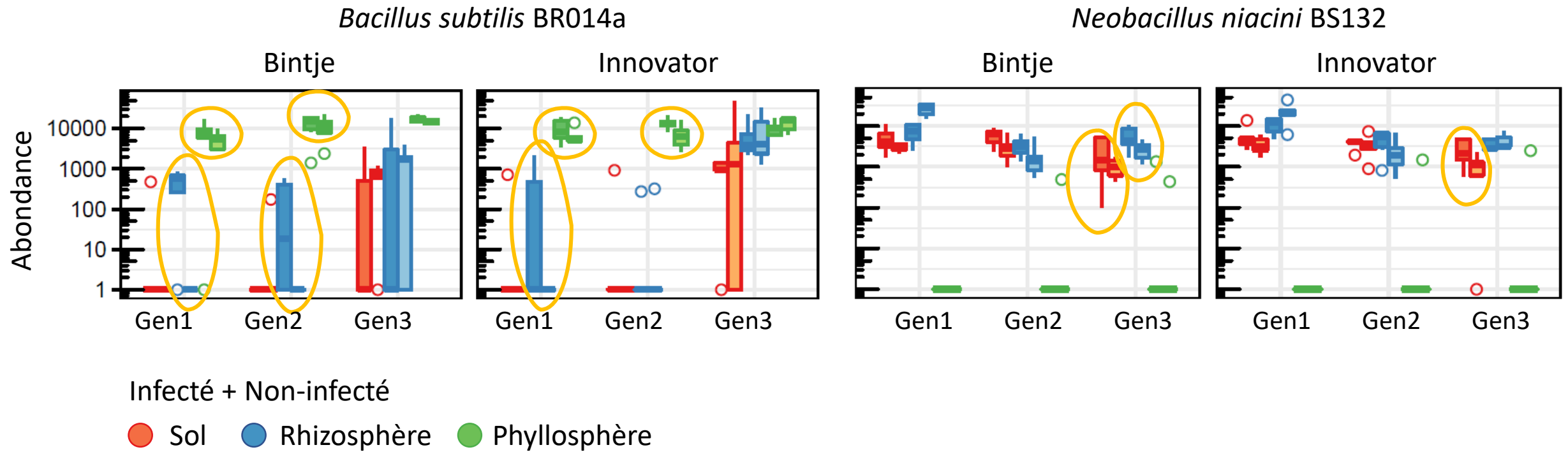


1000bp

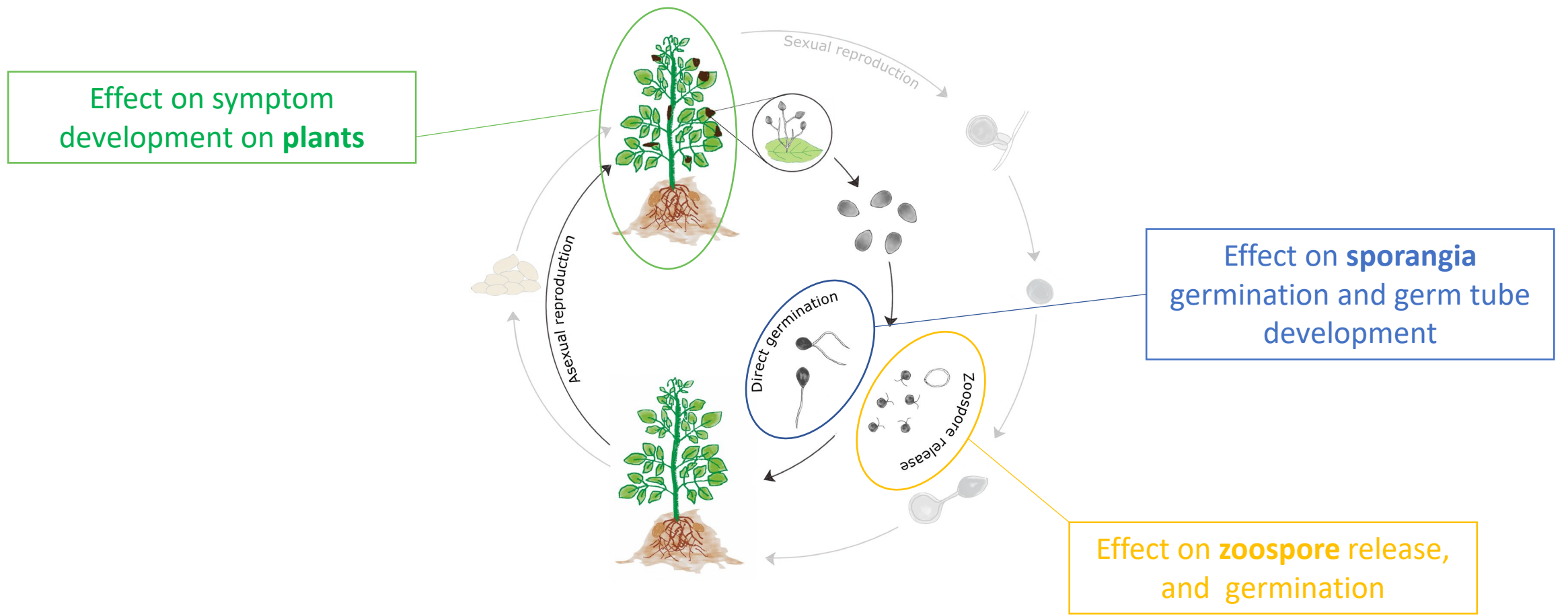


List of strains of interest (170) (-32)

Using microbiome data analysis to identify strains of interest

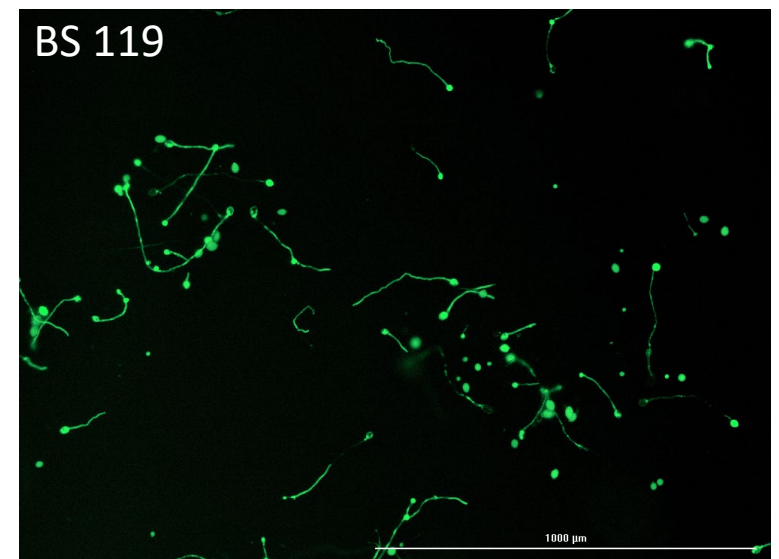
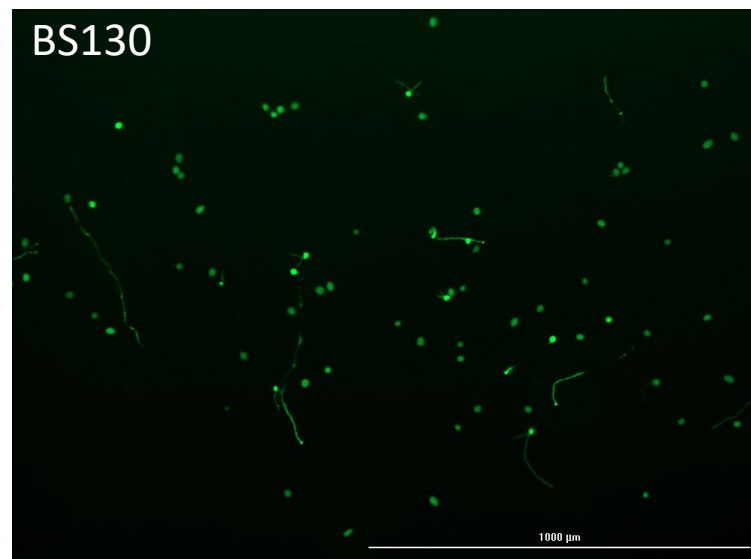
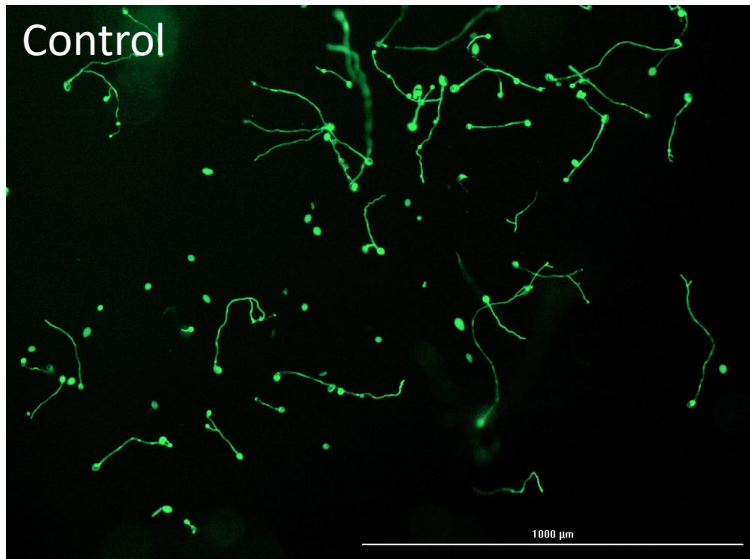


Testing the strains of interest



Effect on sporangia germination

*In vitro**

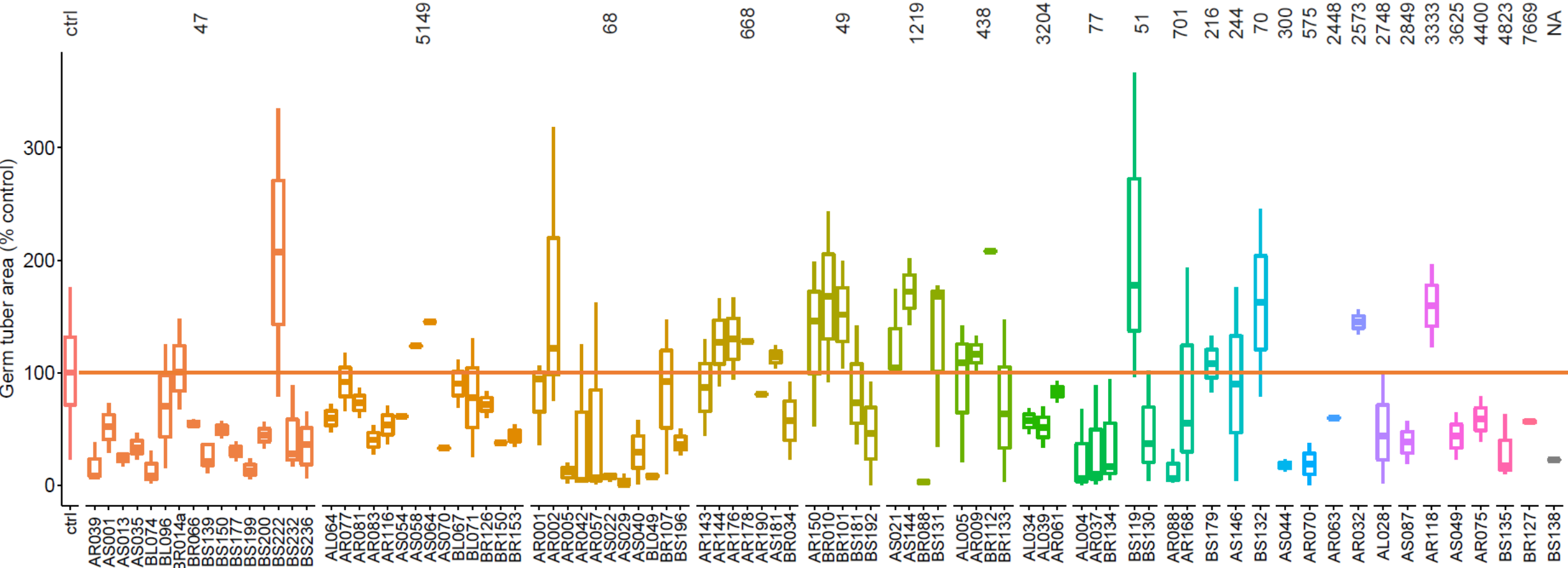


Effect on sporangia germination

*In vitro**



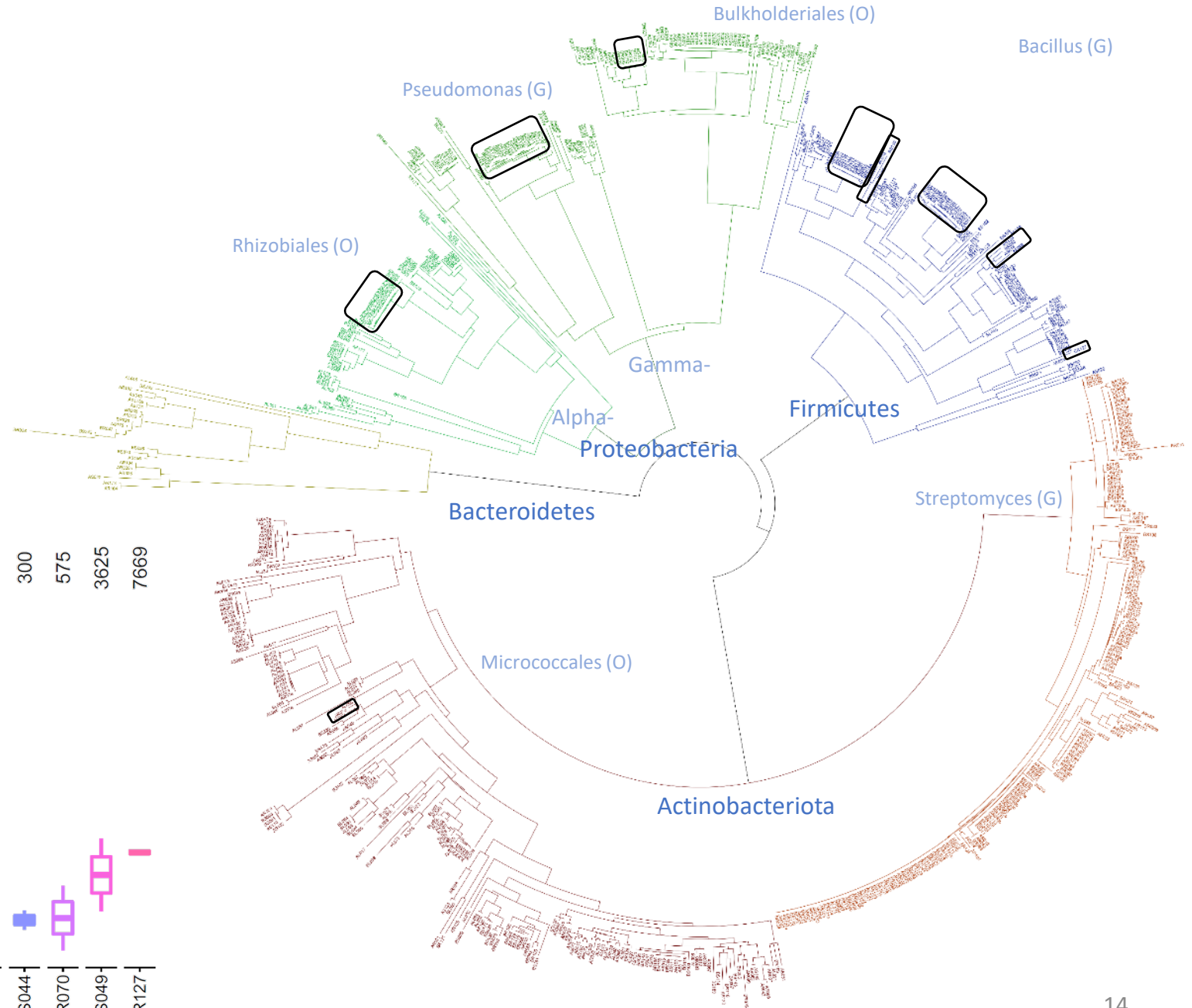
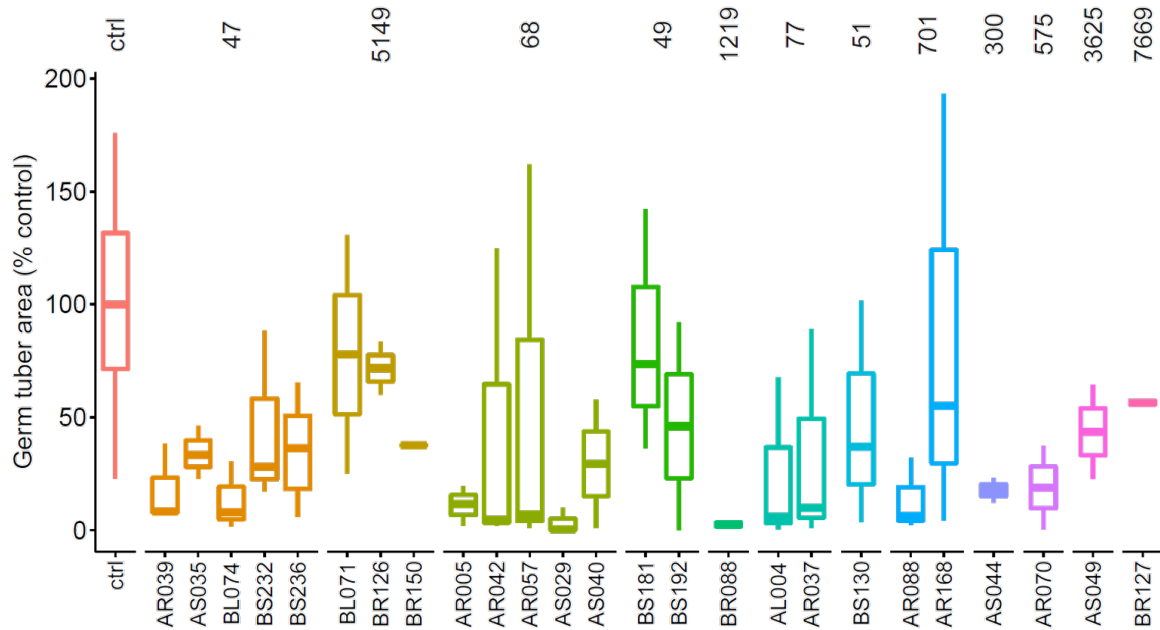
Germ tube area per sporangium relative to control



N=1 to 4

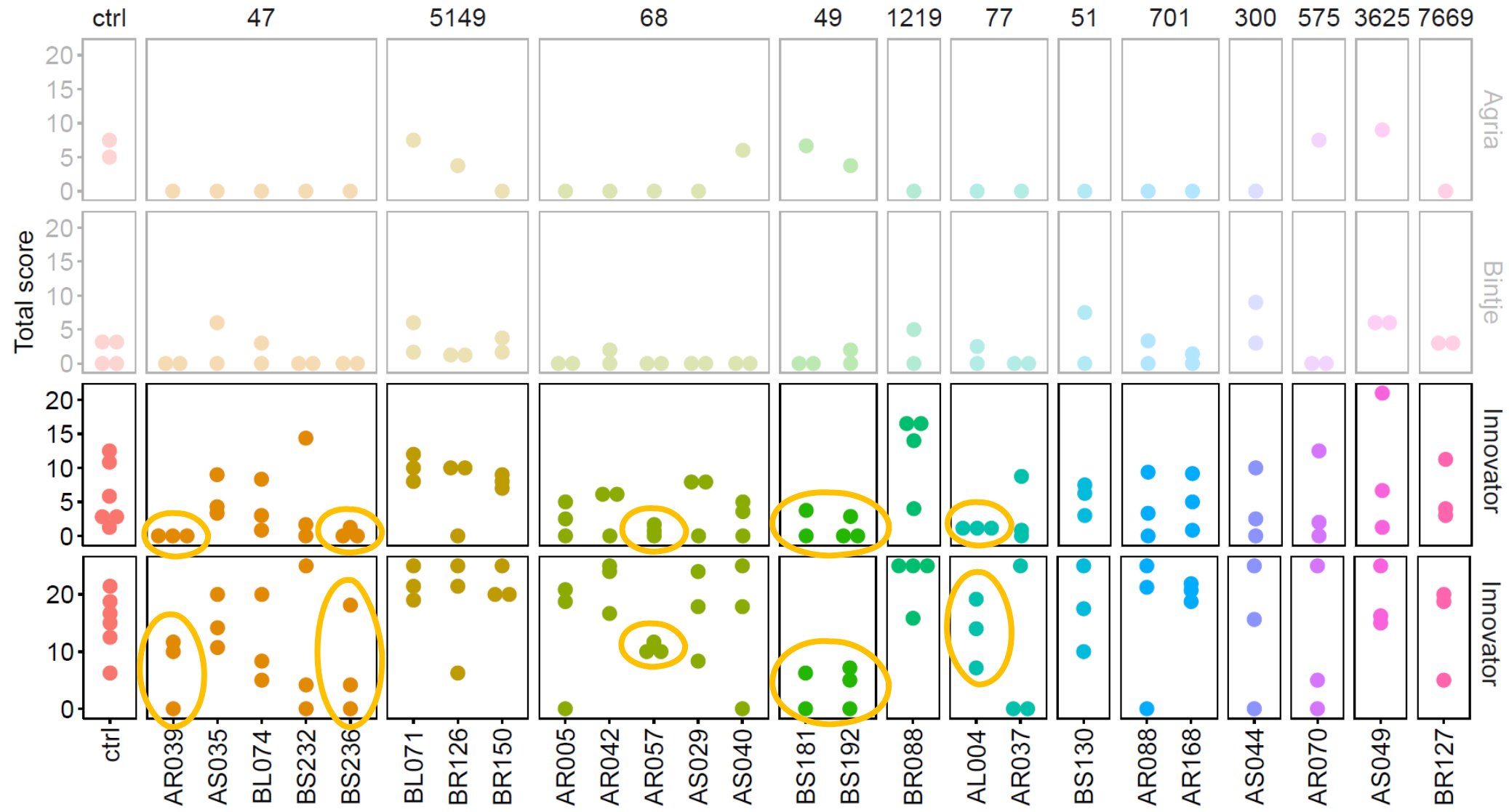
First selection

Acidovorax, Bacillus,
Lysinibacillus,
Paenarthrobacter,
Pseudomonas,
Rhizobium



Effect on symptom development

Whole plant





Untreated control



BS236



BS181



Conclusions

- Infection with *P. infestans* can lead to shifts in the leaf, soil and rhizosphere microbiome of potato plants
- The strains enriched in the microbiome of infected plants belong to 27 bacterial genera, among which *Bacillus* (31 %), *Variovorax* (12 %), *Rhizobium* (10 %), *Acidovorax* (5,9 %), and *Pseudomonas* (5.2 %)
- Strains belonging to the same ASV (same species?) show different inhibitory activities
- The outcome of selection strategies based on *in vitro* experiments (rich media) differ from selection strategies based on *in planta* and *in vitro* (poor media) experiments



Thank you!

University of Fribourg

Laure Weisskopf

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Agroscope

Brice Dupuis

Patrice de Werra

Maud Tallant



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... and you for your attention!