

Diversity of microorganisms in the *Hedera helix* phyllosphere and their role in phytoremediation of air pollution

Vincent Stevens

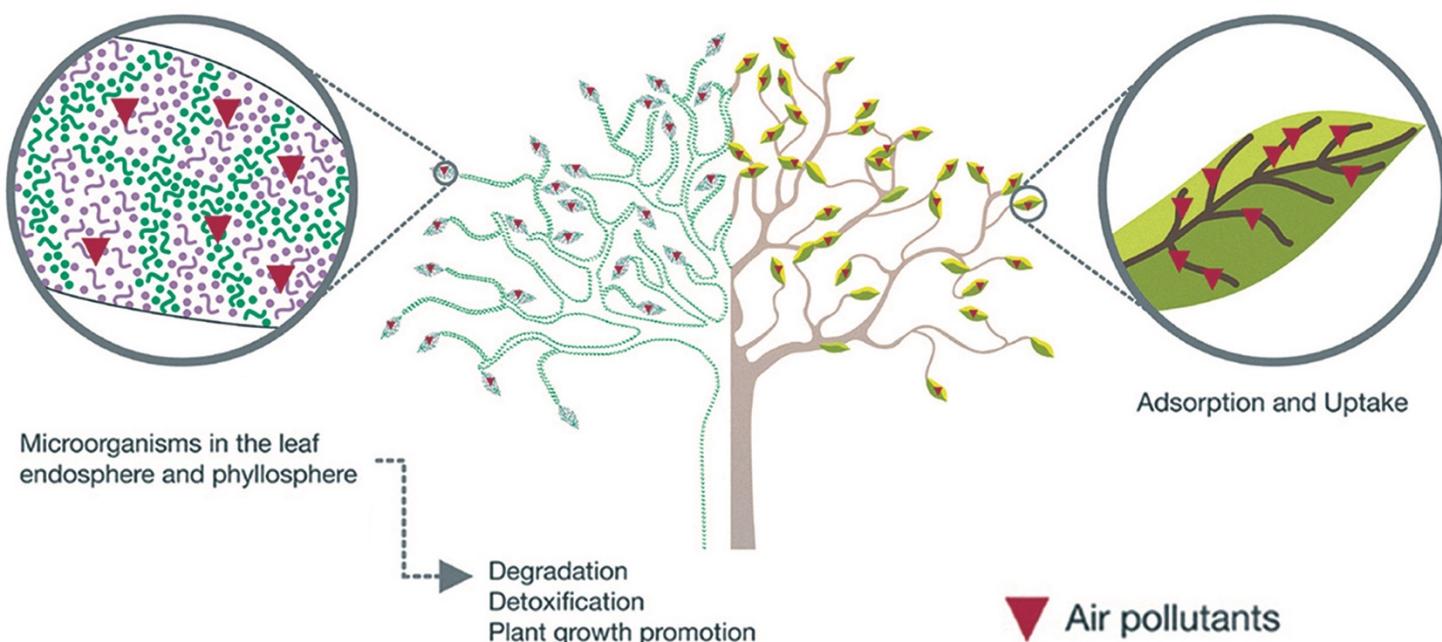


Today, more people die from air pollution than from malaria and HIV infection together



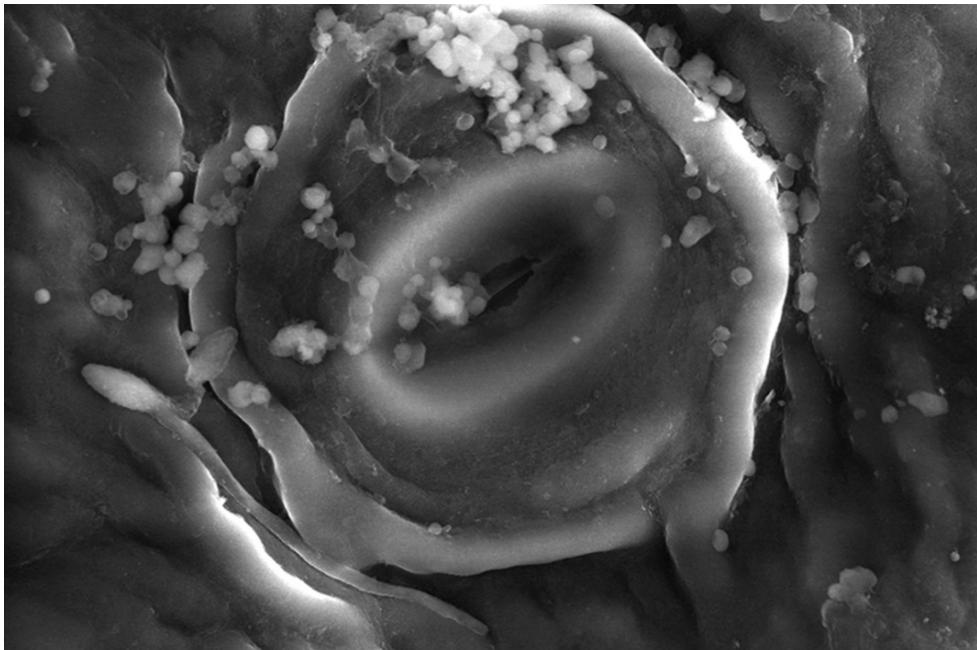
Getting help from plants and their microbes

- **Phytoremediation** → the use of plants and their associated microorganisms to clean up contaminated environments



Microbial life in the phyllosphere

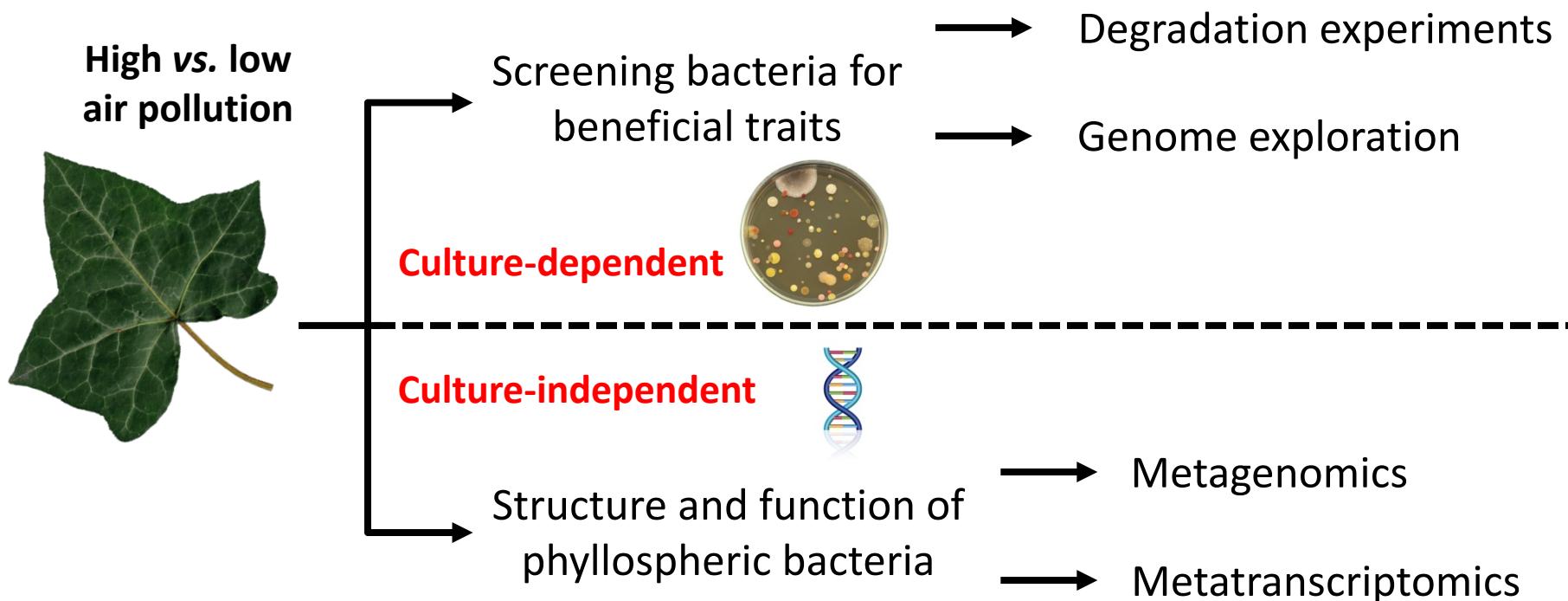
- **Phyllospheric bacteria** constitute promising candidates to detoxify airborne pollutants
- *Hedera helix* (common ivy)



Research objectives

- i. Elucidate the structure and function of phyllospheric bacterial communities associated with *H. helix*
→ Differences between high and low levels of air pollution?
- ii. Investigate the genetic basis of fossil fuel-related VOCs detoxification mechanisms
- iii. Establish an optimized plant–microbe system to detoxify these VOCs

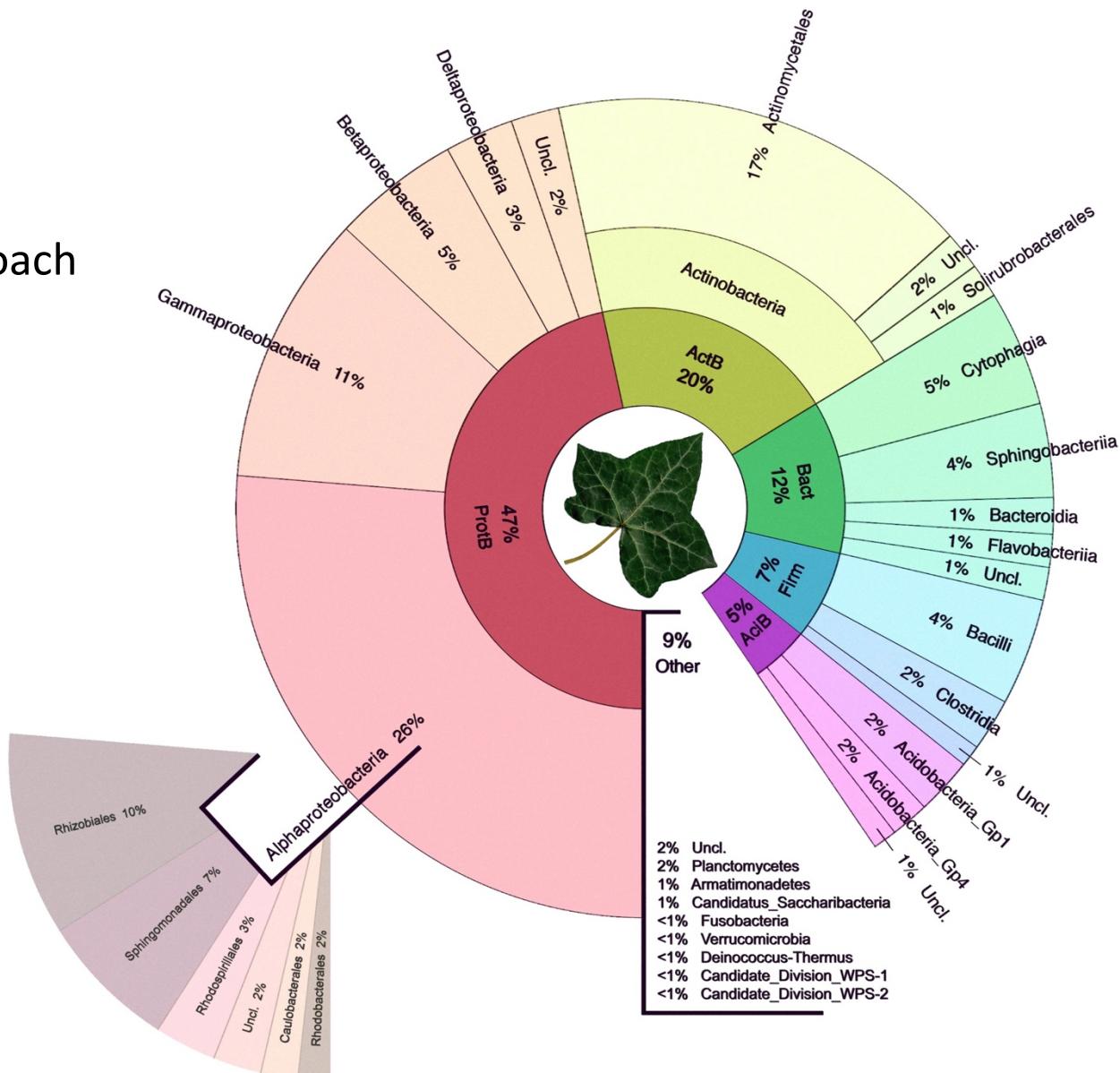
Methodology



→ Combine knowledge for laboratory and field inoculation experiments

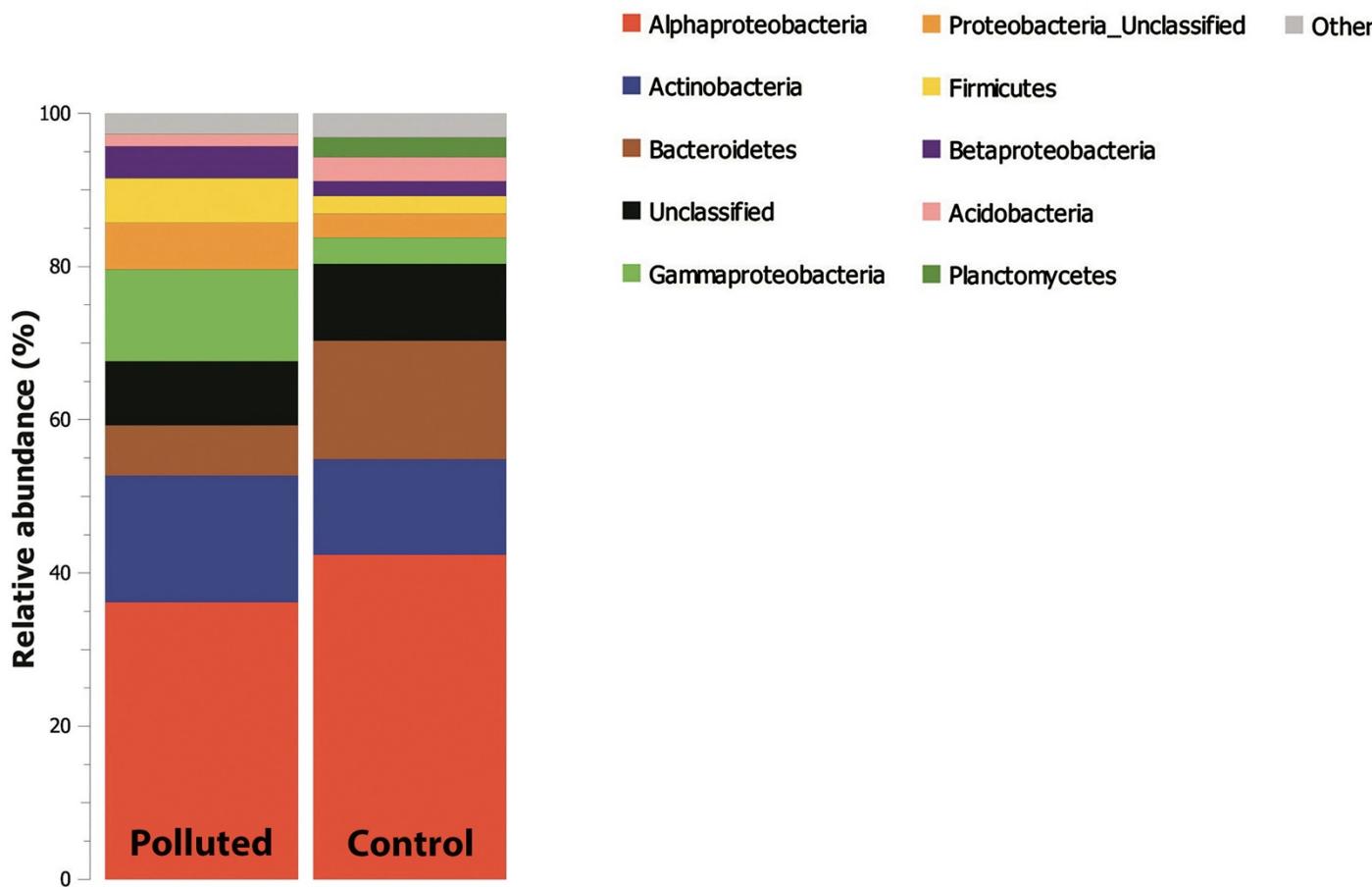
Taxonomic structure of *H. helix* phyllobiome: a pilot study

- Pilot characterization
 - Amplicon-based approach (16S V3–V4, 514 bp)
 - 454 pyrosequencing technology
 - Similar to *A. thaliana*



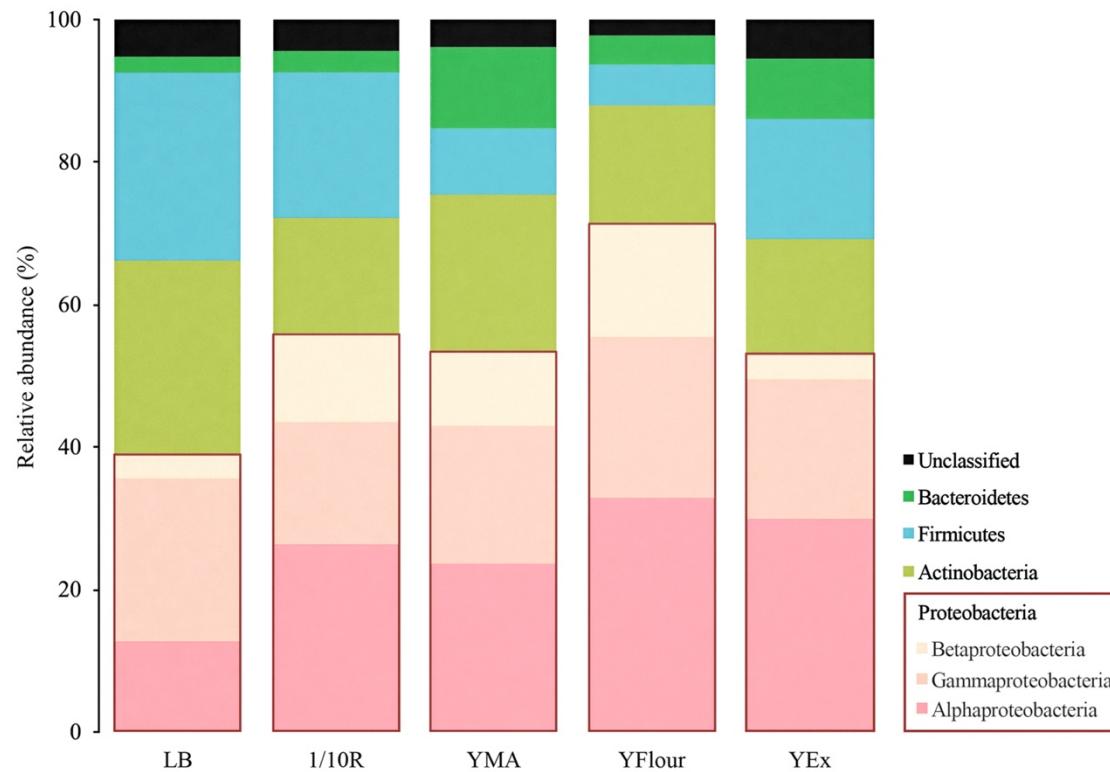
City centre vs. nature reserve

Amplicon-based metagenomics

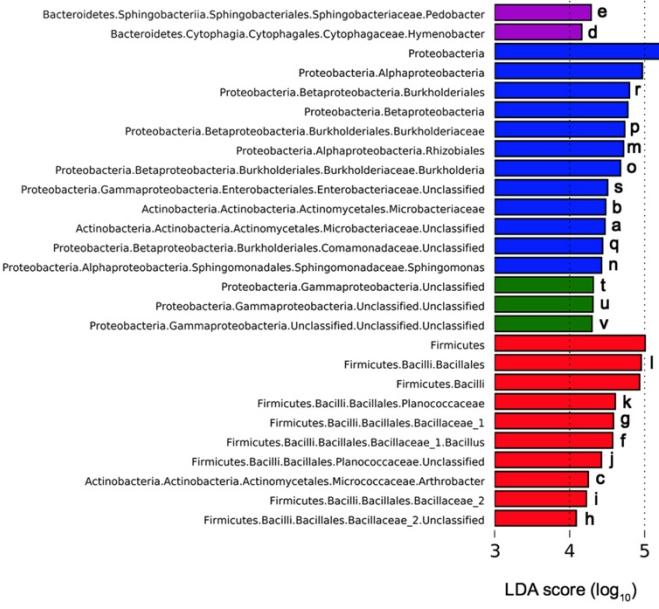
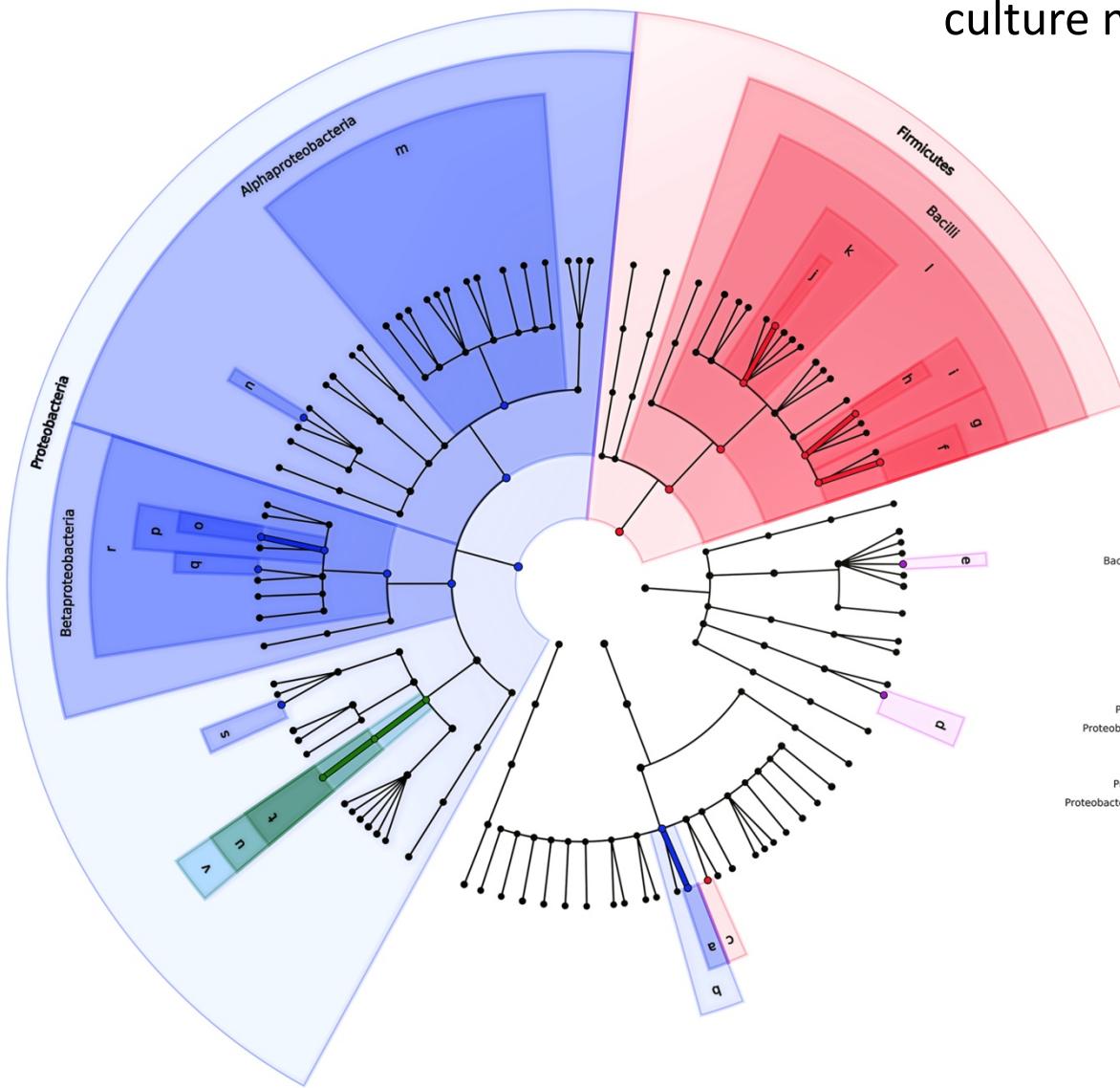


Culturing of phyllospheric bacteria

- *The Great Plate Count Anomaly*
- +/- 400 bacterial colonies isolated using 5 different culture media

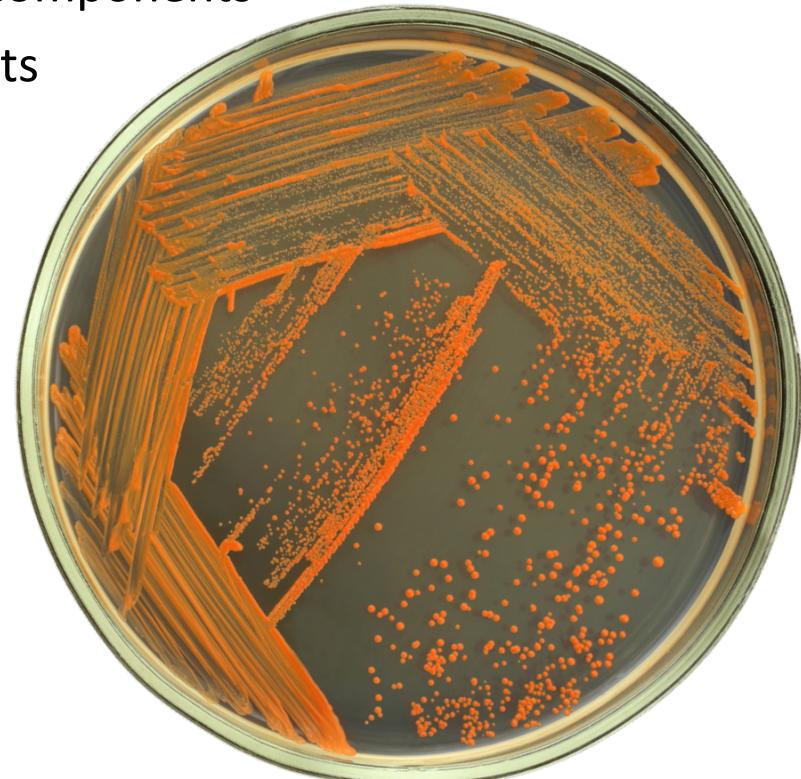


Differential abundant taxa on culture media assessed using LEfSe



Screening bacteria for beneficial traits

- 2 bacterial strains tested positively in several screening tests for beneficial traits related to phytoremediation of air pollution
 - Metabolization of diesel fuel components
 - 4 plant growth-promoting traits
- Further evaluation with degradation experiments (ongoing) and whole genome sequencing (WGS; completed)

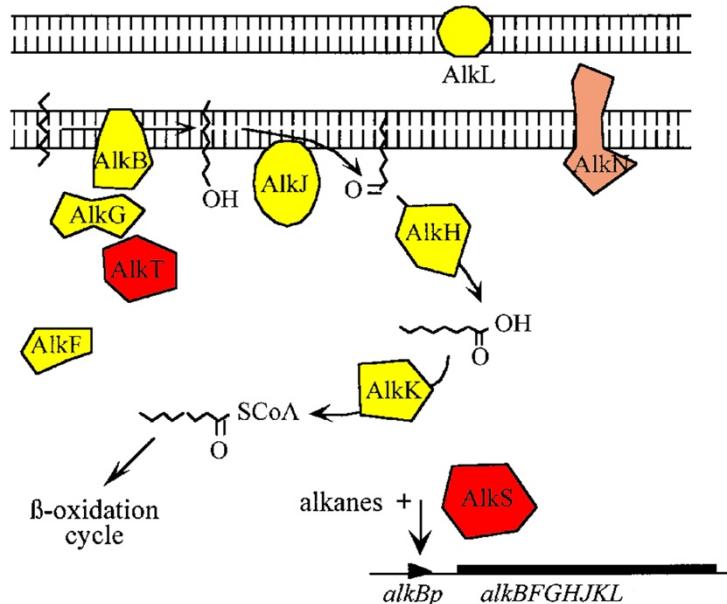


Rhodococcus erythropolis VSD3

Genome exploration



- Whole genome sequencing (WGS)
- Presence of relevant pathways confirmed, e.g. *n*-alkane degradation by *Rhodococcus erythropolis* VSD3
- Novel detoxification mechanisms?



Concluding remarks

- **Past:** pilot characterization of *H. helix* phyllobiome and comparison high/low air pollution
 - **Future:** improving the study design and implementing complementary/updated technology and methods
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- **Past:** identification of bacteria with promising potential as inoculants in phytoremediation
 - **Future:** further evaluation by ongoing laboratory and field experiments



Towards a plant–microbe system to improve air quality?



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