PLANT-MICROBE INTERACTIONS IN THE PHYLLOSPHERE: FACING CHALLENGES OF THE ANTHROPOCENE

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1. INTRODUCTION.

The Anthropocene is the geological human-dominated epoch defined by rapid and major climatic changes.

These changes threaten biodiversity and ecosystem services.

Plant-microbe interactions involve a great variety of microbes and are influenced by environmental conditions (**Fig 1**).

Microbes can have a myriad of beneficial effects on their plant hosts: promoting growth, protecting from pathogens and nutrient acquisition.

Our review stresses the importance of understanding how host-microbe interactions could drive the adaptation of terrestrial ecosystems to global change.

2. URBANISATION.

Urban centers and human activities cause airborne and soil pollution.

Higher pollution drives differences in the taxonomic (*who is there?*) and functional traits (*what are they doing?*) of plant microbiota.

Phytoremediation and phylloremediation are the processes by which plants can be used to decontaminate polluted soil or air, respectively.

In both cases, collaboration between the plant host and microbes can enhance this process.

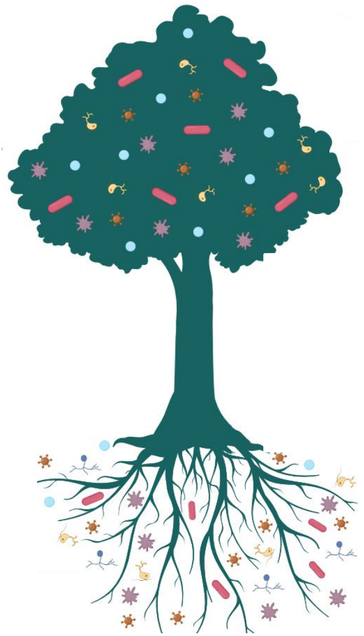
Plant-microbe interactions could be a great tool to remediate pollution.

MICROBES

- Archaea
- Bacteria
- Fungi
- Oomycetes
- Protists
- Viruses

ROLES

- Symbionts
- Pathogens
- Mutualists
- Commensals
- Amensals



HOST

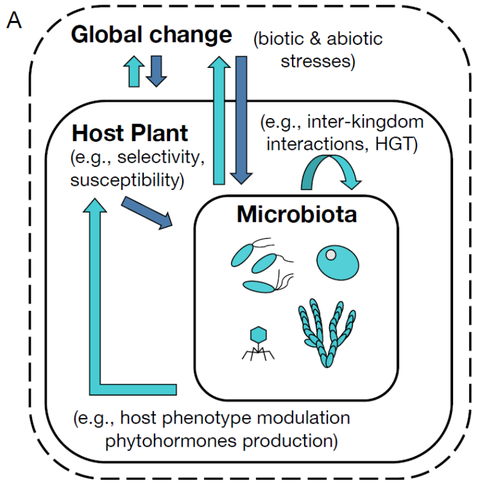
- Species identity
- Genotype
- Immune system

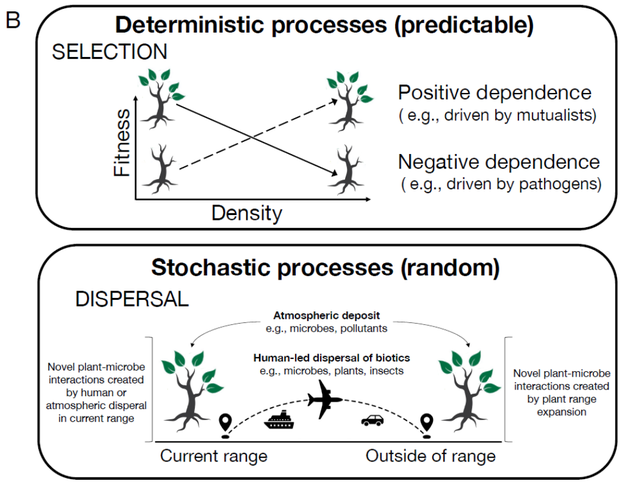
ENVIRONMENT

- Land-use
- Biotics & abiotics
- Local vegetation
- Temperature
- Precipitation
- Nutrients

CHEMICALS

- Biologicals
- Pesticides
- Fertilizers





3. RANGE SHIFT.

Species distribution range shift because of:

- climate changes modify the habitat
- introduction to new habitats by humans.

There is mixed evidence on the role of microbes in facilitating the survival of species in new ranges (**Fig. 2**).

Plant-microbe interactions in new habitats could be beneficial (new symbionts, loss of pathogen) or detrimental (loss of symbionts, new pathogen).

Understanding their impact could help us for the conservation of economically and culturally important species.

4. CHANGING CLIMATE.

Intra-annual temperature variation (seasonality) is a key driver of plant microbial community composition.

Functional and evolutionary processes are associated with seasonal patterns.

Human-caused changes in seasonality could disrupt these processes, with unknown consequences.

More frequent droughts endanger global food security.

Plant-microbe interactions have been shown to ameliorate survival and growth of plants under drought conditions.

5. FUTURE DIRECTIONS. Plant microbiota could have an underappreciated impact on terrestrial ecosystem biodiversity and productivity as global change continues in the decades ahead. Harnessing the potential of plant microbiota to support ecosystem services requires studying the role of microbial interactions through the lens of community ecology develop applications for conservation/agricultural means.

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