Indigenous Grapevines as a Novel Source of Bio-pesticides for Viticulture

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Background

Commercial grapevines are highly susceptible to pathogen attack. These pathogens cause serious diseases that affect fruit quality, yield, and impact the wine-making process. There is a constant need for new and innovative pesticides that are, efficient, sustainable, and safe for human health.

Downy mildew caused by the oomycete *Plasmopara viticola*

Fungal infection caused by *Botrytis cinerea*

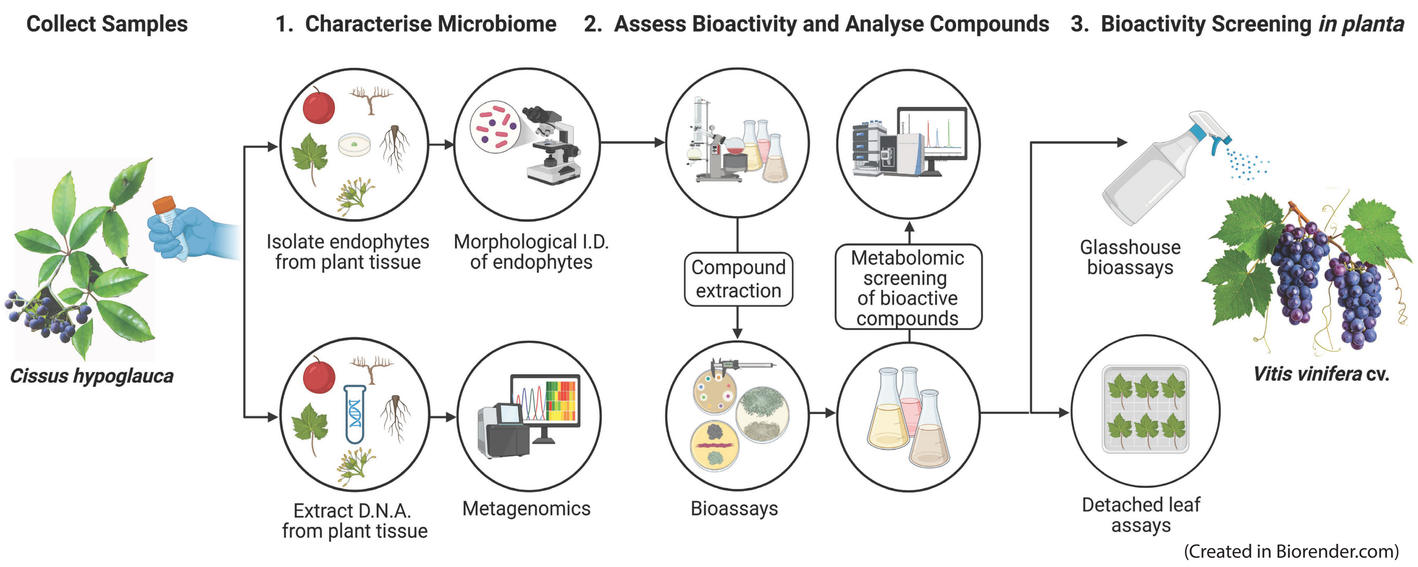
Endophytes are microorganisms that form the internal microbiome of plants. They play a crucial role in a plant's defense against pathogen attack. One of their key protective strategies involves the production of compounds which have anti-pathogenic properties. The microbiomes of indigenous grapevines remain largely unexplored, and could potentially be a valuable source of new compounds with bio-pesticide potential.

Australian Indigenous grapevine *Cissus antarctica*

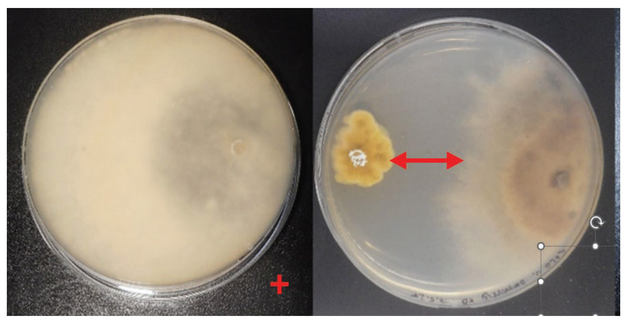
Aims

1. Characterise the microbiome of indigenous and commercial grapevines through metagenomic sequencing.
2. Evaluate the bioactivity of native grapevine endophytes and their extracted compounds against grapevine pathogens and identify and analyse any bioactive compounds.
3. Test bioactive compounds *in planta* using *Vitis vinifera* cvs.

Methods



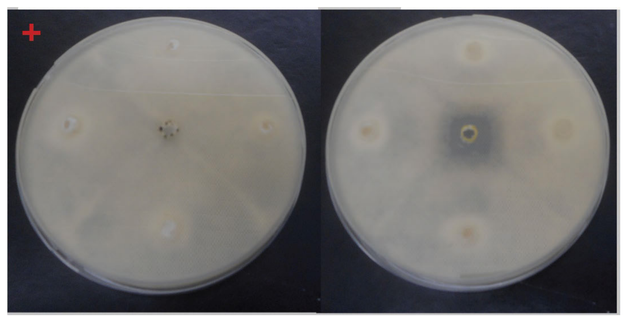
Results



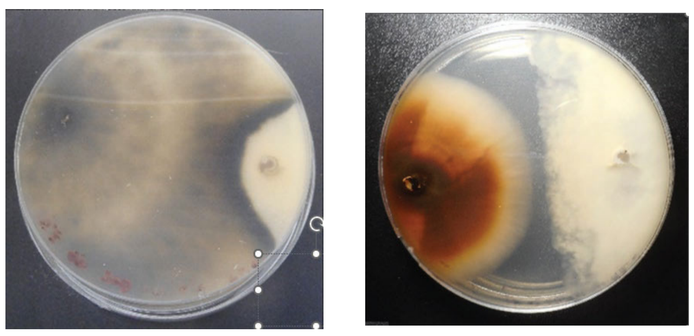
Inhibition of *B. cinerea* by the root endophyte *Streptomyces* sp.

Microbiome metabarcoding of the leaves, roots, and stems of three *Cissus* sp. mapped 397 bacterial endophytes and 38 fungal endophytes. Culture dependent analysis produced 14 unique isolates.

The cultured endophyte with the highest inhibition rate against *B. cinerea* was *Neofusicoccum* sp., the second highest was *Streptomyces* sp., and the third *Ilyonectria* sp.



Inhibition of *B. cinerea* by the crude compound extracts from root endophyte *Streptomyces* sp.



Inhibition of *B. cinerea* by endophytes *Neofusicoccum* sp. (left) and *Ilyonectria*. sp (right).

Conclusion

- Our research demonstrates that Australian indigenous grapevines harbor rich and highly diverse communities of fungal and bacterial endophytes.
- Several endophyte cultures displayed the ability to restrict the growth of the pathogenic fungus *B. cinerea* frequently found in viticulture.
- Indigenous grapevines likely serve as a valuable reservoir of biocontrol agents for viticulture.

Next Stage

- Metagenomic profiling of indigenous and commercial grapevines.
- Continue with the isolation of endophytes from native grapevines and the examination of their bioactivity.
- Identification of bioactive, endophyte-derived compounds.

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