IDENTIFICATION OF ANTIFUNGAL VOLATILE ORGANIC COMPOUNDS (VOCS) FROM *STREPTOMYCES SCABIEI* 87-22 USING GC×GC-TOF-MS

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Context and scientific issues

Plant pathogens harm food production and the economy, while synthetic fungicides pose health and environmental risks, emphasizing the need for new alternatives[1]

Streptomyces scabiei 87-22 shows promises by producing antifungal volatile organic compounds (VOCs). This study seeks to identify the VOCs responsible for their antifungal effects, with the aim to open the door to developing environmentally friendly biofungicides[2]

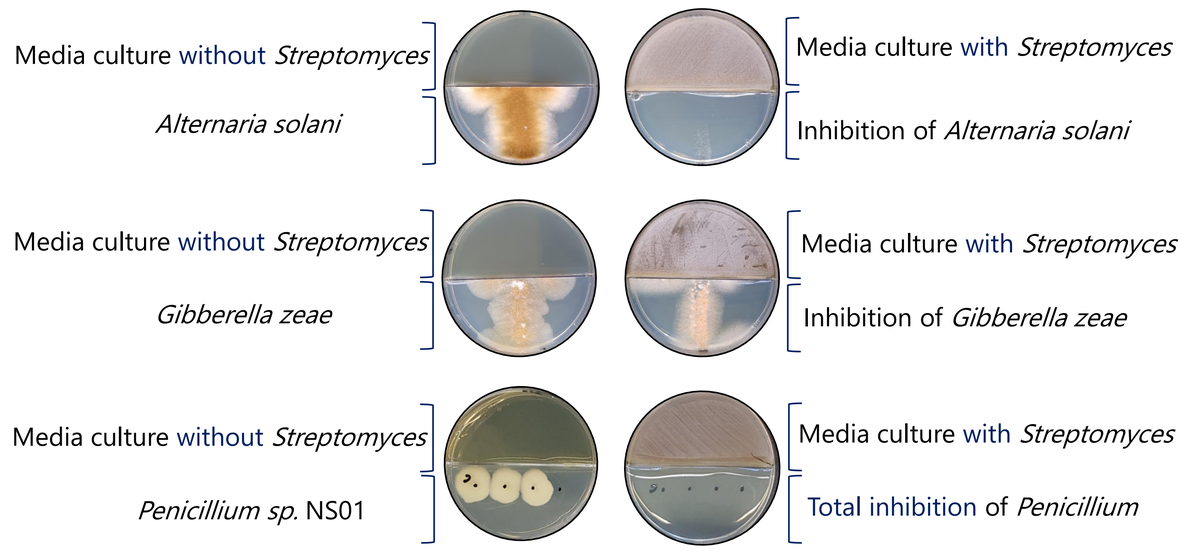
Phytopatogenic fungi

Crop diseases | Health risks | Economic losses

Need of new biotech strategies to mitigate crop damages ⟷ Antifungal VOCs produced by *Streptomyces* bacteria

Study inception

- In vitro experiments were conducted on *Alternaria solani*, *Gibberella zeae*, and *Penicillium* sp. NS1 to assess antifungal activity
- Different growth conditions of *Streptomyces scabiei* 87-22 were evaluated using five culture media: MHB, LB, TSB, ISP2, and ISP6



Materials and methods

1 - Sample preparation

Biological replicates: A_I, B_I — Technical replicates: A1_I, A2_I, A3_I, B1_I, B2_I, B3_I

Culture media + Stryptomyces

A_N, B_N — A1_N, A2_N, B1_N, B2_N

Culture media (Control)

2 - Analysis

SPME GC×GC-TOF-MS

DVB/CARB/PDMS

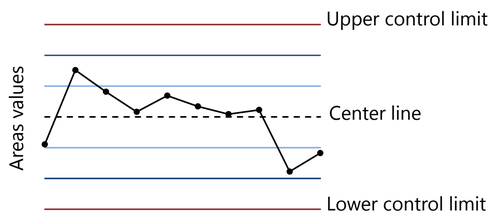
Modulator — Detector

^{1}D Rxi-5MS — ^{2}D Rxi-17Sil MS

3 - Data processing

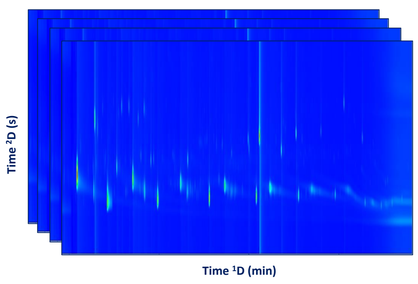
- Quality Control (QC) chart for 37 compounds

6-Methyl-5-Hepten-2-one



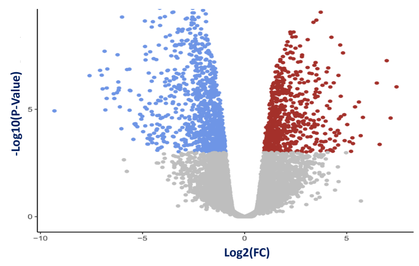
4 - Targeted analysis

- Investigation 100 antifungal VOCs from previous studies



5 - Non targeted analysis

- Tile Based approach (F-Ratio)
- Principal component analysis
- Volcano plot

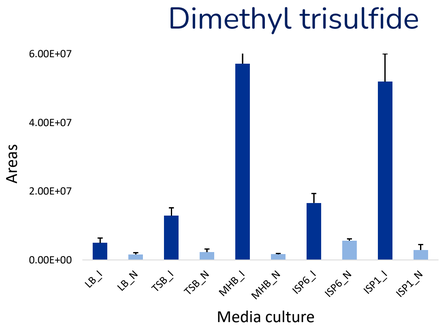


Results and discussion

Targeted analysis

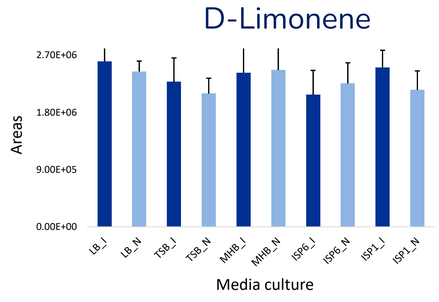
- 20 Antifungal VOCs were identified in the different samples

Dimethyl trisulfide



- VOCs production depend on the culture media

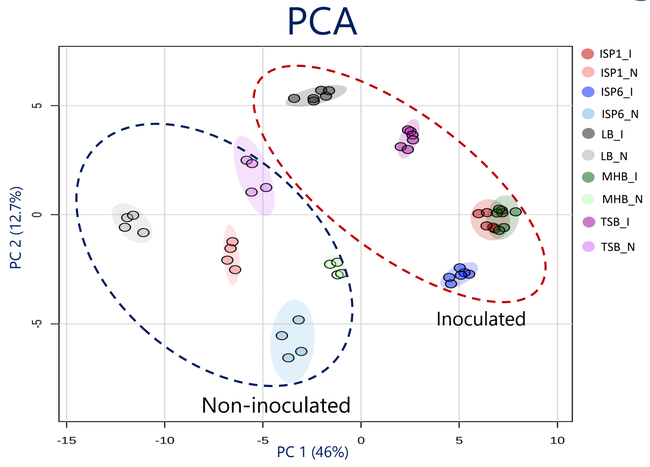
D-Limonene



- Some VOCs are inherent to the culture media
- Non targeted approach is needed

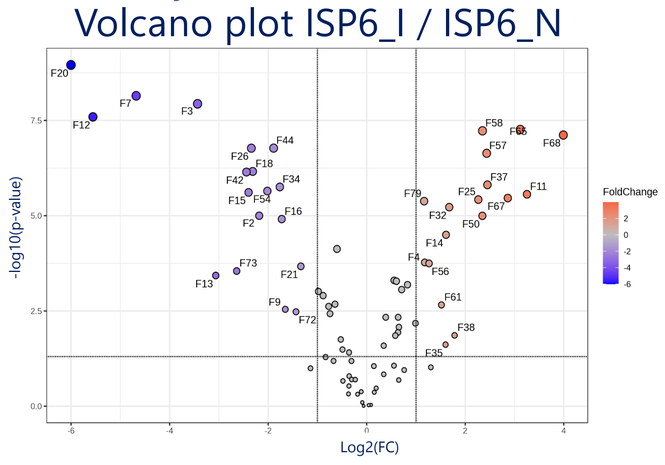
Non targeted Analysis

PCA



Distinct clusters for each media ⟷ Difference in VOC profiles

Volcano plot ISP6_I / ISP6_N



Volcano plots were used to compare inoculated and non-inoculated conditions

» 25 VOCs with a fold change higher than 2

In vitro test

	Microorganism																	
	Alternaria solani						*Gibberella Zeae*						*Penicillium sp.NS01*					
Concentration(%)	100	50	10	1	0.1	0.01	100	50	10	1	0.1	0.01	100	50	10	1	0.1	0.01
Compound 1	100	100	100	100	0	0	100	100	100	100	0	0	100	100	100	100	55	0
Compound 2	100	100	100	100	0	0	100	100	100	100	0	0	100	100	100	100	27.5	0
Compound 3	100	100	100	0	0	0	100	100	100	0	0	0	100	100	100	62.5	0	0
Compound 4	100	100	50	0	0	0	100	100	2	0	0	0	100	100	63	12.5	0	0
Compound 5	22.5	15	4	0	0	0	15	5	0	0	0	0	50	31	13	0	0	0
Compound 6	1	2	1	0	0	0	0	5	5	0	0	0	0	13	63	0	0	0

0 : no inhibition ; 100 : total inhibition of the fungi

The antifungal effect has been confirmed for 4 VOCs

Conclusion and perspectives

- Out of 25 identified VOCs, 4 demonstrated antifungal activity in vitro, highlighting their potential as antifungal agents
- Conduct antifungal tests on the remaining 19 VOCs to fully evaluate their potential
- Extend the study to a broader range of bacterial strains to assess their antimicrobial spectrum

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[1] M.X. Chen, *et Al*, i, Metabolome analysis for investigating host-gut microbiota interactions, J. Formos. Med. Assoc. 118 (2019) S10–S22.

[2] Pacios-Michelena, S, *et Al.*, A. Application of Streptomyces Antimicrobial Compounds for the Control of Phytopathogens. Front. Sustain. Food Syst. 2021, 5.

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