

Oral communication

Antifungal activity of essential oil from *Lippia alba* cultivated in Senegal against mycotoxigenic fungal species associated with stored food commodities

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Introduction

Contamination of stored grains by mycotoxigenic molds (*Aspergillus sp.*, *Fusarium sp.*) represents :

➤ **A major challenge for food security in Senegal (West Africa)**



Maize
Zea mays (L.)
(>760.000 t)



Post-harvest losses **16,3%** of the production



Peanut
Arachis hypogaea (L.)
(~900.000 t)



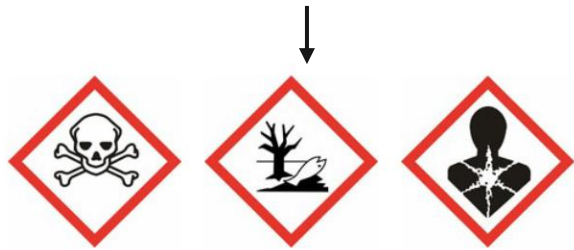
Post-harvest losses **≈ 18 %** of the production

➤ **A major challenge for public health** → Mycotoxins are toxic, carcinogenic, and immunosuppressive.



Toward natural alternatives: the case of *Lippia alba*

Management of these losses relies on chemical pesticides :



Need for eco-friendly alternatives (biopesticides)



Plant essential oils (EOs) are widely explored for their effectiveness against pests :



Lippia alba
(Verbenaceae)



- Environnemental degradation
- Toxic residues (non-target species)
- Development of pest resistance

- Easy to cultivate (short growth cycle)
- Resistant to water stress
- Adapted to Senegalese climatic conditions
- Widely distributed accross Senegal
- Insecticidal and antifungal potential



Research aim



To evaluate the *in vitro* antifungal activity of *Lippia alba* essential oil (EO) cultivated in Senegal against fungal species associated with stored cereals



MATERIAL AND METHODS



Plant material and essential oil extraction

- Extraction of *L. alba* essential oil using a pilot-scale distiller from a mixture of leaves, flowers, and fruits



Harvest at UGB Farm, Sanar, Senegal



Shade-drying of the plant material (mix of leaves, flowers and fruits) for 6 days in a ventilated area



EO extracted by steam distillation using 2 kg of dry matter, 2 hours, n=3

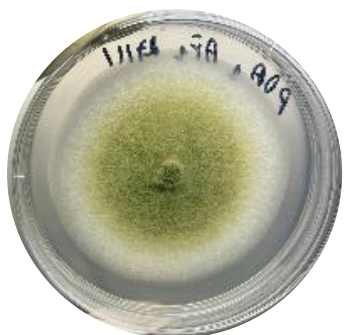


Chemical profiling GC-MS :
-Polar and non-polar column
-Identification: NIST library and Retention Indices (RI)



Targeted fungal species

*Aspergillus
flavus*



*Aspergillus
niger*



*Fusarium
oxysporum*



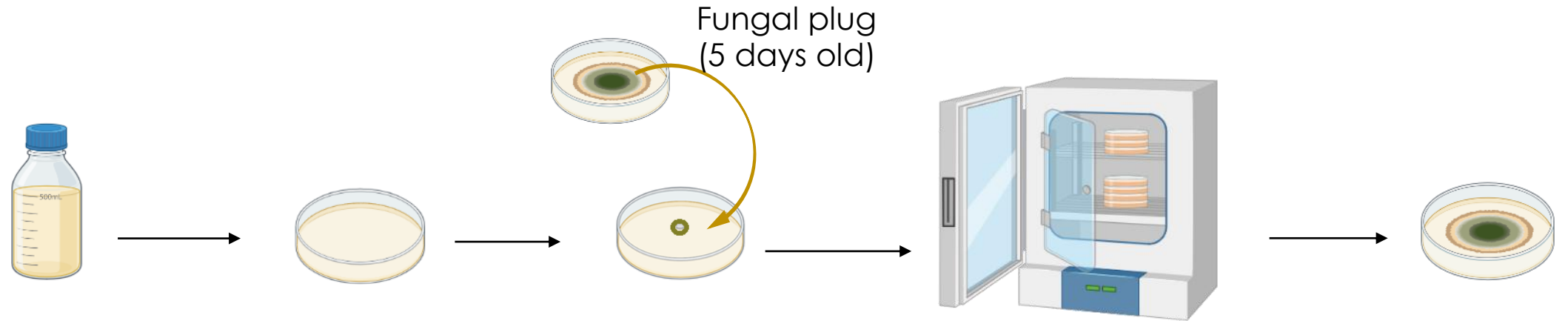
*Fusarium
verticillioides*



- Four major mycotoxigenic fungi species **associated with stored grains**
- known for their **impact on food security** and **public health** through **mycotoxin production**

in vitro antifungal bioassay (direct contact method)

- Experimental workflow conducted under sterile conditions



PDA kept at 50°C and incorporated with

Pouring into petri dishes (15mL/dish)

Inoculation (6 mm mycelial plug)

Incubation (7 days at 27°C)

Monitoring of mycelial growth



EO solubilized in DMSO 0.5% (**0.25; 0.5; 1 et 2mg/mL**)



Dimethylsulfoxide (DMSO) 0.5% (**negative control**)



Mancozeb 2mg/mL (**positive control**)

Biological replicates: n = 3
Technical replicates: 5 (Petri dishes)



- Calculation of mycelial growth inhibition percentage at day 7
- Statistics using ANOVA and Tukey's test ($p < 0.05$)

Minitab® 19

- Software used :

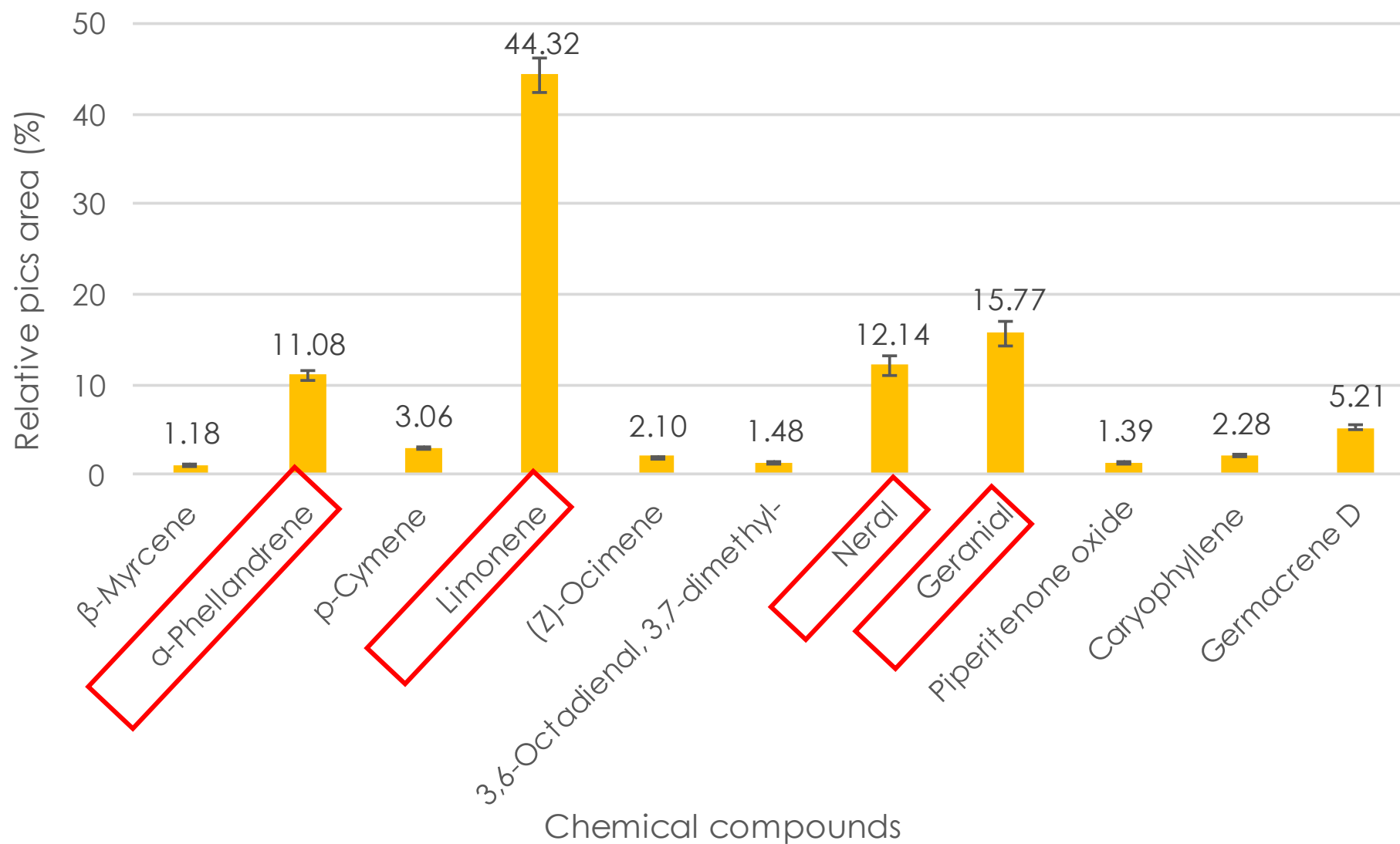




Results and discussion



Chemical composition of the essential oil

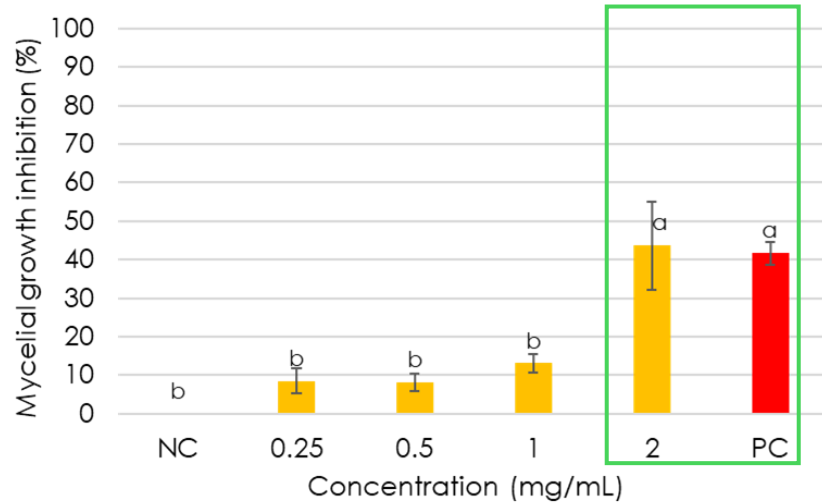


- Limonene and citral isomers (néral and geranial) are known for their antifungal activity

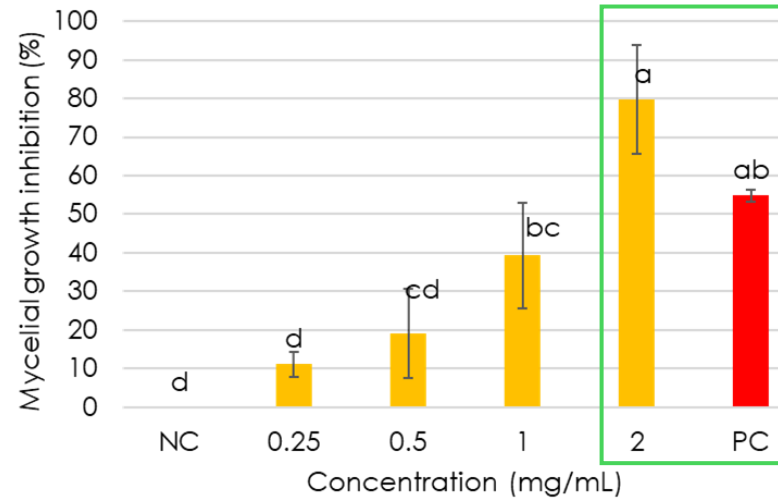


in vitro antifungal activity (1/2)

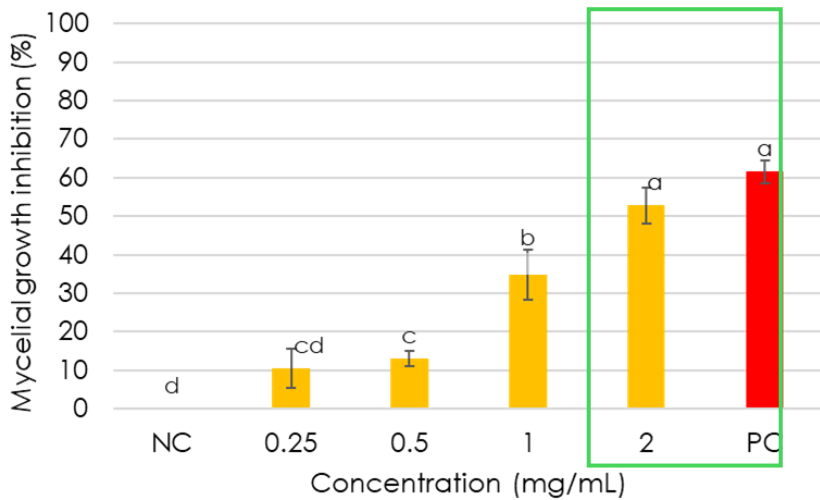
Aspergillus flavus



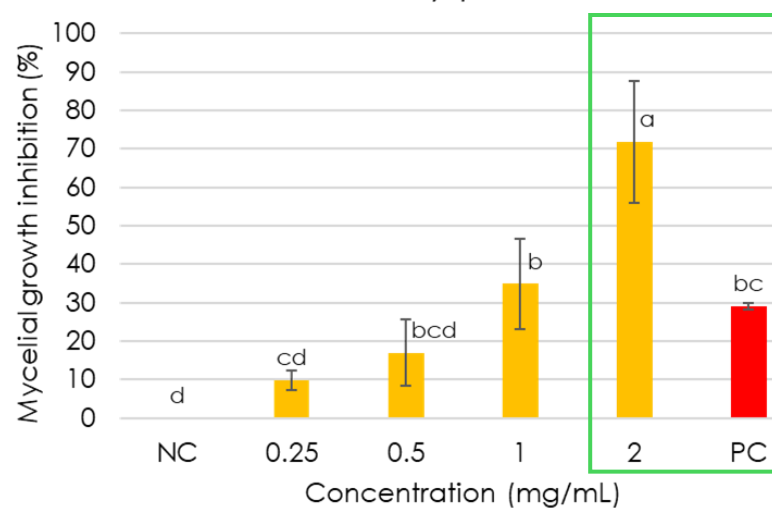
Fusarium verticillioides



Aspergillus niger



Fusarium oxysporum



- Clear dose-dependent effect
- *Fusarium* species are more sensitive than *Aspergillus* species
- At 2 mg/mL, *Lippia alba* EO outperformed Mancozeb against *Fusarium* sp.
- Strong antifungal activity of *L. alba* EO

NC = Negative Control; **PC = Positive Control (Mancozeb, 2 mg/mL)**



in vitro antifungal activity (2/2)

- IC₅₀ values of *L. alba* EO against the tested fungal strains

Fungal strains	IC ₅₀ (mg/mL)	R ²
<i>A. flavus</i>	2.44	0.99
<i>A. niger</i>	1.82	0.99
<i>F. verticillioides</i>	1.26	0.96
<i>F. oxysporum</i>	1.40	0.91

R² coefficient indicates a strong fit for the dose-response models

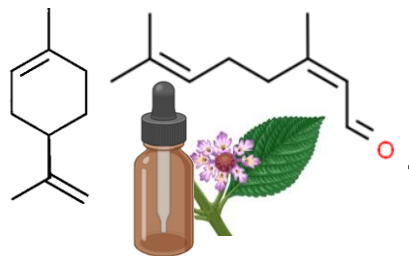
- *F. verticillioides* was the most sensitive strain (lowest IC₅₀)
- *A. flavus* was the least sensitive strain (highest IC₅₀)
- Difference in sensitivity can be attributed to cell wall structure and detoxification mechanisms



Conclusion and perspectives



Lippia alba : a local and sustainable resource in Senegal



Negative control EO Mancozeb
(*Fusarium verticillioides* after 7 days of incubation)

Strong antifungal activity :
EO ≥ Mancozeb (2mg/mL)

Perspectives:

Vapor phase assays

in vivo trials on grains

Mycotoxin inhibition assays



Transition to real-world application on stored grains



Final goal : To provide a concrete, natural solution to local farmers to improve food security in Senegal



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Thanks for your attention
