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Antifungal activity of Alagoas red propolis extract on the mycelial growth of *Fusarium verticillioides in vitro*

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Introduction

Maize (*Zea mays*) is a staple food worldwide. *Fusarium verticillioides*, an endophytic and opportunistic pathogen prevalent in the tropics, causes ear and stalk rot, rotten kernels and seedling damage, and produces **fumonisins** - hepatotoxic mycotoxins regulated by ANVISA (limit: 2 µg/g). It is detected in **>90% of Brazilian maize samples**.

Objective

To evaluate the *in vitro* effect of Alagoas red propolis extract, rich in phenolics and flavonoids, on *F. verticillioides* mycelial growth and to estimate its IC_{50}.



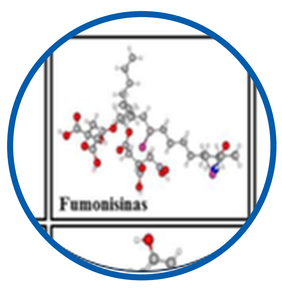
F. verticillioides



Ear rot



Rotten kernels



Mycotoxins (fumonisins)



Abnormal ears



Seedling damage

Materials and methods

A Experimental workflow



B Representative plates after 144 h (Ø = mean colony diameter of both assays)



Results

3.99 ppm
Relative IC_{50} · Assay 1 (R^2 = 0.93)

5.74 ppm
Relative IC_{50} · Assay 2 (R^2 = 0.95)

77–79%
Maximum inhibition (75–150 ppm)

73.6 → 16.1 mm
Colony diameter: control vs 150 ppm

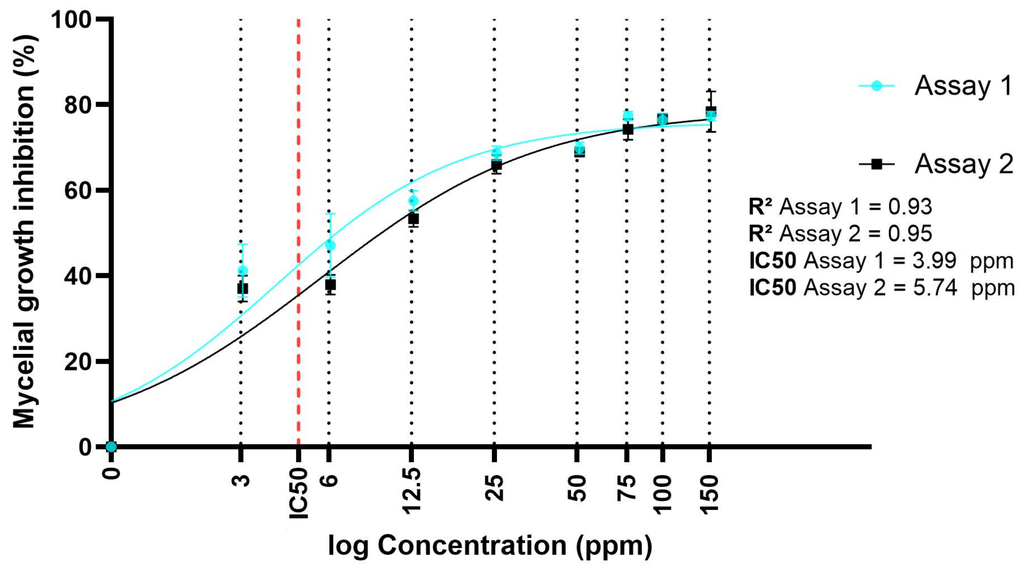


Figure 1. Dose–response curves of mycelial growth inhibition (%) at 144 h, nonlinear regression (variable slope). Red dashed line: relative IC_{50} (half-maximal inhibition). Inhibition of 50% relative to the control occurs between 6.25 and 12.5 ppm.

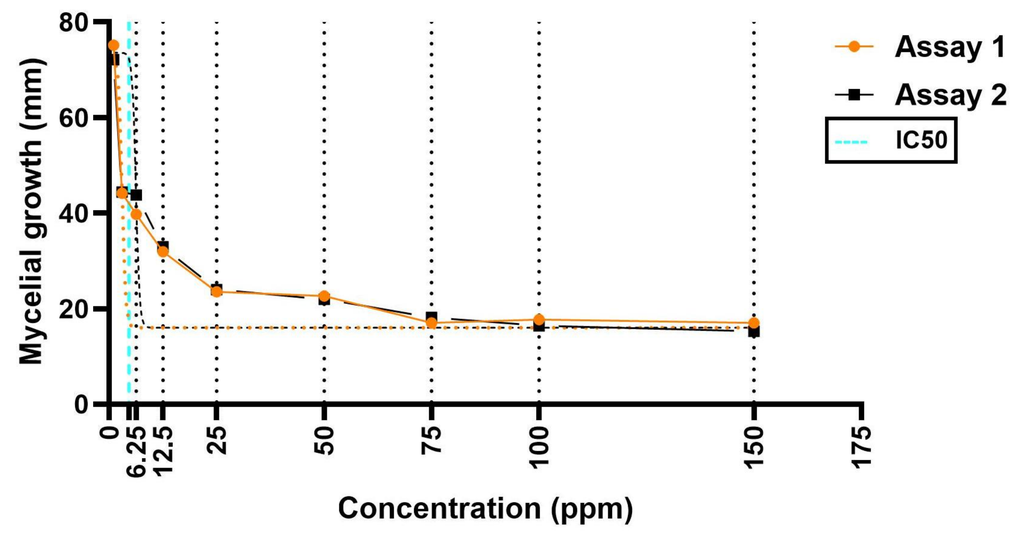


Figure 2. Mean colony diameter (mm) of *F. verticillioides* under red propolis treatments in two independent assays. Cyan dashed line: IC_{50}.

Conclusion

Alagoas red propolis extract inhibited *F. verticillioides* at every concentration tested, in a dose-dependent way (relative IC_{50} = 3.99–5.74 ppm; 50% inhibition vs. control between 6.25 and 12.5 ppm) that plateaued at ~78% inhibition from 75 ppm, indicating a fungistatic effect. Results were reproducible in two independent assays. It is a promising biocompatible alternative to control Fusarium ear rot and mitigate fumonisin risk in maize.

References: BRASIL. Agência Nacional de Vigilância Sanitária. Instrução Normativa nº 160, de 1º de julho de 2022. Estabelece os limites máximos tolerados (LMT) de contaminantes em alimentos. Brasília, DF: ANVISA, 2022:

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