

Study of Bacterial Toxin as Antifungal, Antibacterial, and its Effect on Germ Tube Formation in *Candida albicans* and Cell Count of *Candida parapsilosis*.

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Abstract

Microbial toxins have shown promising antifungal and antibacterial properties, making them potential candidates for alternative therapeutic strategies. This study evaluates the effects of Pseudomonas toxin and shiga toxin on fungal growth inhibition, germ tube formation in *Candida albicans*, and cell count reduction in *Candida parapsilosis*. Additionally, the antibacterial effects of these toxins against *Escherichia coli* and *Shigella* were analyzed.

Results demonstrated that Pseudomonas toxin exhibited significantly higher antifungal activity compared to shiga toxin. It caused fungal cell wall disintegration within 72 hours and inhibited germ tube formation in *Candida albicans* after 24 hours. Furthermore, *Candida parapsilosis* cell count showed a declining trend when exposed to the toxin. Antibacterial assays confirmed the effectiveness of the toxin against *E. coli* and *Shigella*, suggesting broadspectrum antimicrobial potential.

These findings highlight microbial toxins as viable alternatives to conventional antifungal and antibacterial treatments, warranting further research into their mechanisms and clinical applications.

Keywords: Microbial toxin, Pseudomonas toxin, *Candida albicans*, *Candida parapsilosis*, antifungal activity, antibacterial properties

1. Introduction

Fungal and bacterial infections present significant challenges in medical science, with increasing resistance to conventional drugs necessitating the exploration of alternative antimicrobial agents. Microbial toxins, produced by bacteria and fungi, have been found to possess potent antifungal and antibacterial properties, making them promising candidates for novel therapeutic approaches.

Among various microbial toxins, Pseudomonas toxin has gained attention for its strong inhibitory effects on fungal species. This study investigates the effects of Pseudomonas toxin and Shiga toxin on fungal inhibition, particularly their impact on germ tube formation in *Candida albicans* and cell count reduction in *Candida parapsilosis*. Additionally, the antibacterial activity of these toxins against *E. coli* and *Shigella* is analyzed.

This research aims to determine the efficacy of microbial toxins as potential antifungal and antibacterial agents, assessing their impact on fungal morphology, viability, and bacterial growth.

2. Materials and Methods

2.1 Selection of Microbial Toxins

Two bacterial toxins, Pseudomonas toxin and shiga toxin, were selected.

Antifungal drugs Clotrimazole and Ketoconazole were used as control agents for comparative analysis.

Fungal and Bacterial Strains

Fungal Species Tested:

Aspergillus niger

Candida albicans

Rhizopus spp.

Fusarium spp.

Melanospora spp.

Bacterial Strains Tested:

Escherichia coli (*E. coli*)

Shigella spp.

2.2 Antifungal Assay

Fungal strains were cultured in Sabouraud Dextrose Agar (SDA).

Pseudomonas and shiga toxins were added to the cultures, and growth inhibition was monitored at 24, 48, and 72 hours.

Microscopic analysis was conducted to observe morphological changes.

2.3 Germ Tube Formation in *Candida albicans*

Candida albicans was incubated with and without *Pseudomonas* toxin for 24 hours.

Germ tube formation was observed microscopically and compared across conditions.

2.4 Effect on *Candida parapsilosis* Cell Count

Candida parapsilosis cultures were exposed to *Pseudomonas* toxin.

The cell count was recorded at 24-hour intervals to measure the impact of the toxin on fungal viability.

2.5 Antibacterial Assay

Bacterial strains were cultured in Nutrient agar medium.

Toxins were introduced, and bacterial growth inhibition zones were measured to assess antibacterial potency.

3. Results

3.1 Antifungal Activity of *Pseudomonas* and Shiga Toxin

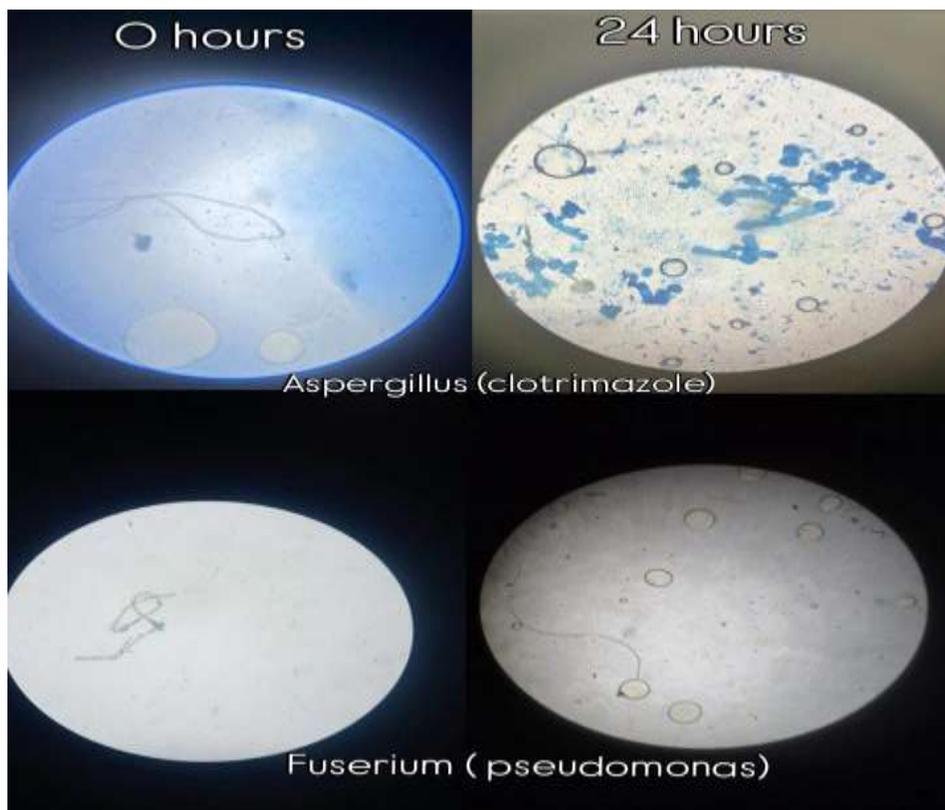
Pseudomonas toxin demonstrated a significantly higher inhibitory effect on fungal growth compared to shiga toxin.

Fungal cell wall disintegration was observed microscopically within 72 hours of toxin exposure.



24hrs

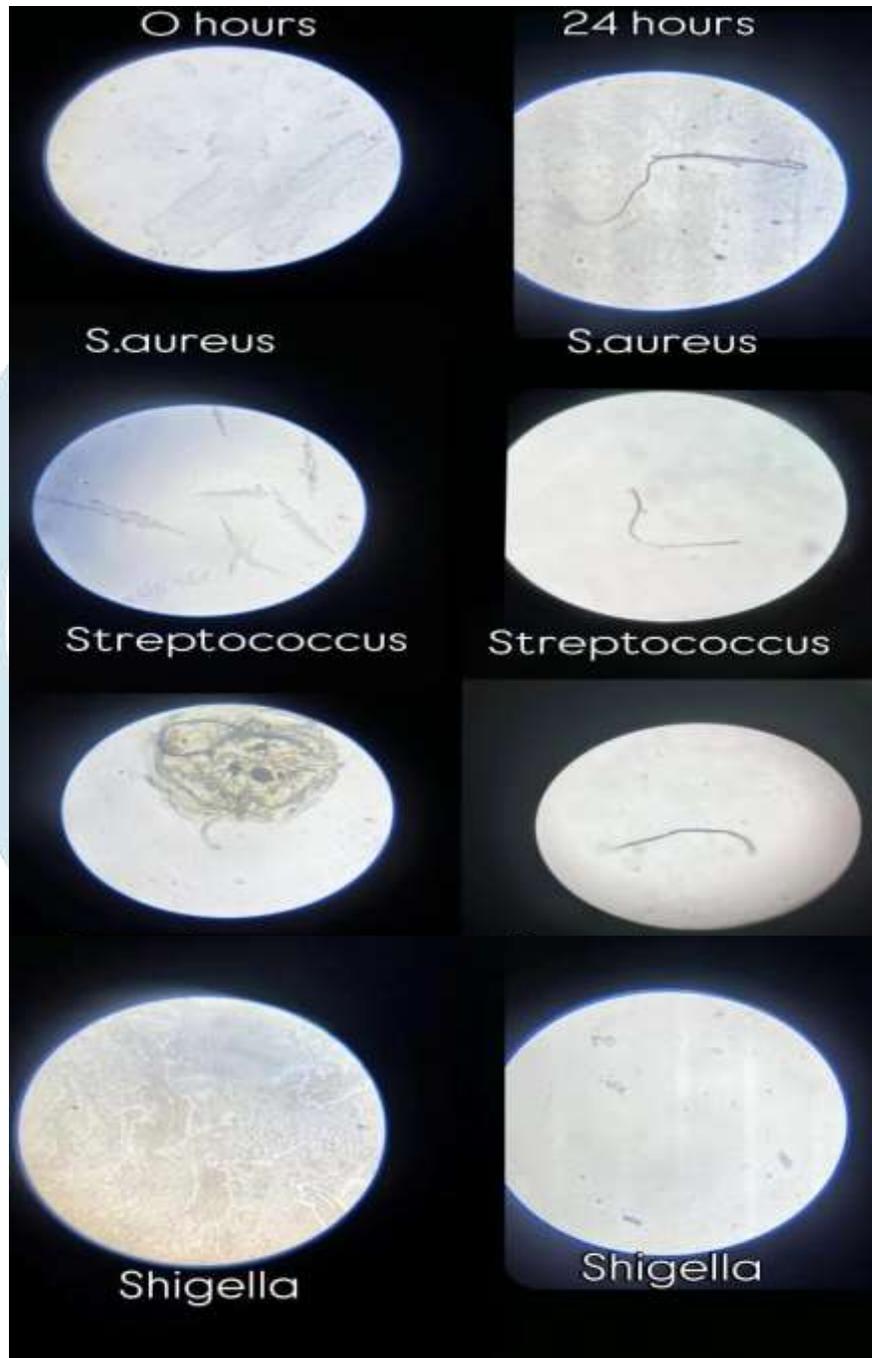
48hrs



3.2 Germ Tube Inhibition in *Candida albicans*

In the absence of toxin, *Candida albicans* exhibited normal germ tube formation.

When exposed to Pseudomonas toxin, germ tube formation was inhibited after 24 hours.



3.3 Reduction in Candida parapsilosis Cell Count

The viable cell count of *Candida parapsilosis* showed a decreasing trend when treated with Pseudomonas toxin, indicating effective fungal suppression.

-for 0 hr

The cell count for live cells were showed to be 91 and dead cells(stained) were showed to be 15

-After 4 hrs

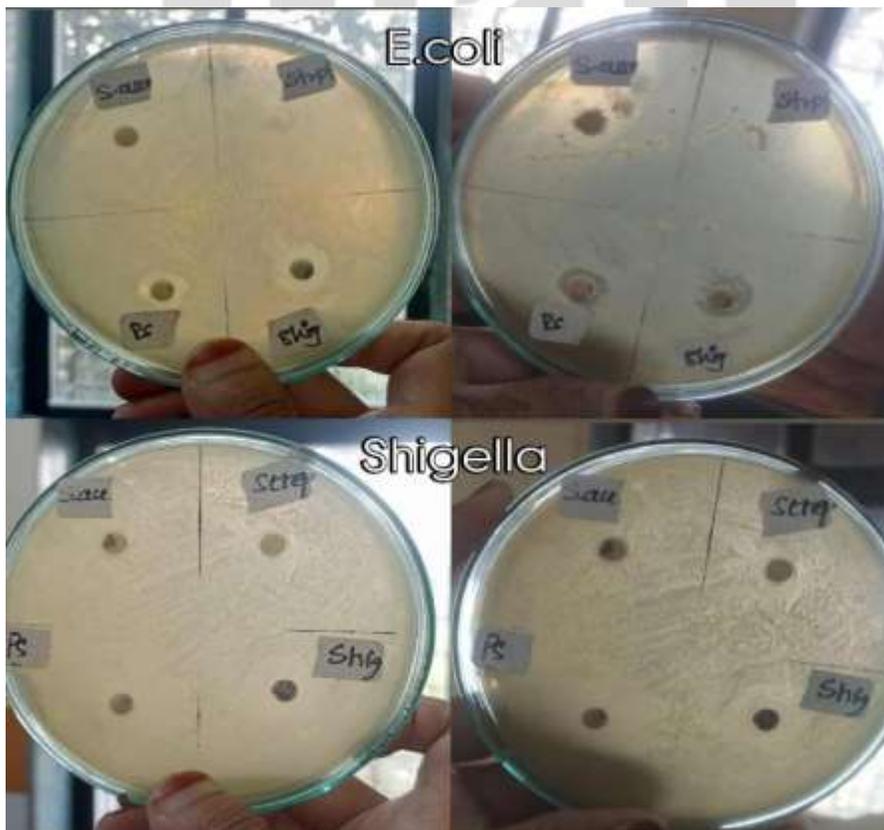
* The cell count for live cells were showed to be 7 and dead cells(stained) were showed to be 99*



3.4 Antibacterial Activity Against E. coli and Shigella

Pseudomonas toxin showed significant bacterial growth inhibition.

Measurable inhibition zones confirmed its antibacterial effectiveness against E. coli and Shigella.



4. Discussion

The results of this study highlight the strong antimicrobial potential of Pseudomonas toxin. Its ability to disrupt fungal cell walls, inhibit germ tube formation, and reduce *Candida parapsilosis* cell count suggests its effectiveness as an antifungal agent. Furthermore, its antibacterial activity against *E. coli* and *Shigella* underscores its broad-spectrum antimicrobial properties.

The inhibition of germ tube formation in *Candida albicans* is particularly significant, as germ tubes play a crucial role in fungal virulence and pathogenesis. By preventing germ tube formation, Pseudomonas toxin may effectively reduce the pathogenic potential of *Candida albicans*.

Given the increasing resistance to conventional antifungal and antibacterial drugs, microbial toxins could serve as valuable alternatives. Further research is needed to explore their mechanisms of action, potential toxicity, and clinical applicability.

5. Conclusion

This study demonstrates that Pseudomonas toxin exhibits strong antifungal and antibacterial properties:

1. It effectively inhibits fungal growth and disrupts fungal cell walls.
2. It prevents germ tube formation in *Candida albicans*.
3. It reduces *Candida parapsilosis* cell count over time.
4. It shows strong antibacterial activity against *E. coli* and *Shigella*.

These findings suggest microbial toxins as promising alternatives to conventional antimicrobial agents. Further research is required to evaluate their potential therapeutic applications in medicine.

6. Bibliography

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