Evaluation Of Antifungal Potential of Withania Somnifera Dunal. (Ashwagandha) Root Extract Against Some Dominant Fungi

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***Abstract*—Withania somnifera (Ashwagandha) is a medicinally important plant known for its wide range of pharmacological properties. The present investigation was undertaken to evaluate the antifungal potential of W. somnifera root extract against some dominant fungi. Roots were collected, shade-dried, powdered, and extracted using ethanol. Preliminary phytochemical screening revealed the presence of alkaloids, flavonoids, tannins, phenols, and withanolides. The antifungal activity was assessed against Fusarium oxysporum, Alternaria alternata, Aspergillus niger, and Rhizoctonia solani by the poisoned food technique. Although Bavistin showed higher inhibition, the extract revealed significant antifungal activity, supporting its potential as a natural biofungicide. The findings highlight the importance of W. somnifera as an eco-friendly alternative for managing plant fungal diseases and suggest further investigation for field applications and bioactive compound isolation.**

***Index Terms*—Withania somnifera, Ashwagandha, antifungal activity, medicinal plants, plant pathogens, biofungicide**

I. INTRODUCTION

Plant pathogenic fungi such as Fusarium oxysporum, Alternaria alternata, Aspergillus niger, and Rhizoctonia solani are responsible for significant crop losses worldwide which makes unfit for comsumption. Their infections often trigger oxidative stress and localized inflammation-like responses in host plants, leading to tissue necrosis, chlorosis, and reduced productivity causing great loss. Conventional fungicides are widely used to manage fungal diseases, but their long-term use causes environmental hazards, resistance development, and phytotoxicity also playing important role in pollution. Medicinal plants provide an eco-friendly and sustainable alternative to synthetic fungicides. Withania somnifera (Ashwagandha), an important medicinal plant of Ayurveda, is well known for its anti-inflammatory, antimicrobial, and immunomodulatory activities. Whole plant is beneficial, its roots contain bioactive compounds such as withanolides, alkaloids, and flavonoids, which have been reported to suppress microbial growth and modulate stress responses. Final conclusion is that the findings are expected to provide insights into the use of Ashwagandha as a plant-based biocontrol agent and contribute to the development of sustainable approaches for crop protection

II. METHODS AND MATERIALS

Plant material

Roots of Withania somnifera were collected from University Campus, Aurangabad in air tight polythene bags and authenticated by a taxonomist, and shade-dried for 7–10 days. The dried roots were powdered and stored in airtight containers in the laboratory of college.

Preparation of extract:

For preparation of extract fifty grams of powdered root was extracted with 500 ml ethanol using Soxhlet extraction. The solvent was evaporated under reduced pressure, and the crude extract was stored at 4°C. Stock solutions were prepared in ethanol at 50 mg/ml.

Test fungi

After observation of colonies from investigation, four dominant plant pathogenic fungi Fusarium oxysporum, Alternaria alternata, Aspergillus niger, and Rhizoctonia solani were obtained from the departmental culture collection and maintained in vivo on Potato Dextrose Agar (PDA) medium

III. ANTIFUNGAL ASSAY (POISONED FOOD TECHNIQUE)

For the antifungal potential ,the crude extract was incorporated into PDA medium to achieve final concentrations of 100, 200, 300, 400, and 500 µg/ml. PDA plates with ethanol served as solvent controls, and plates amended with Bavistin (50 µg/mL) served as positive controls or controlled. Mycelial discs (5 mm) from 7-day-old cultures were inoculated at the center of each plate. Plates were incubated at 25 ± 2°C for 7 days in incubator.

IV. OBSERVATION TABLE

Table 1. Antifungal activity of W. somnifera root extract against selected fungi (Poisoned Food Technique).

Sr.No	Fungus	Control growth (mm)	100 µg/ml	200 µg/ml	300 µg/ml	400 µg/ml	500 µg/ml	Bavistin 50 µg/ml
1.	Fusarium oxysporum	90	16.7%	31.1%	45.6%	60.0%	75.6%	89%
2.	Alternaria alternata	85	15.3%	31.8%	47.1%	64.7%	80.0%	88%
3.	Aspergillus niger	92	13.0%	29.3%	45.7%	63.0%	78.3%	90%
4.	Rhizoctonia solani	88	15.9%	31.8%	50.0%	67.0%	82.9%	89%

V. RESULTS

The antifungal activity of W. somnifera root extract showed a clear dose-dependent effect (Table 1). At 100 µg/mL, inhibition ranged between 13–17%, while at 300 µg/mL, inhibition reached 45–50% for most fungi. Maximum inhibition was observed at 500 µg/mL, where inhibition ranged from 75.6% (F. oxysporum) to 82.9% (R. solani). Bavistin (50 µg/mL) exhibited 88–90% inhibition across all fungi.

VI. DISCUSSION

From the results it is cleared that Withania somnifera root extract has strong antifungal potential against the tested phytopathogenic fungi. The extract significantly inhibited fungal growth in a concentration-dependent manner, with maximum inhibition at 500 µg/ml. The highest sensitivity was observed in Rhizoctonia solani, while Fusarium oxysporum was comparatively more resistant. The activity is likely due to bioactive phytochemicals such as withanolides, alkaloids, and flavonoids, which may disrupt fungal cell walls, alter membrane permeability, or interfere with enzymatic activity

VII. CONCLUSION

The investigation confirmed that Withania somnifera root extract exhibits significant antifungal activity against major plant pathogenic fungi. The concentration-dependent inhibition, particularly against Rhizoctonia solani and Alternaria alternata, highlights its potential as a biocontrol agent. Future studies should focus on isolation of active compounds, elucidation of the mode of action, and field-level validation for its use in sustainable agriculture.

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