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In Vitro Assessment of Antifungal Activity of *Chrozophora rottleri* and *Wrightia tinctoria* against Post-Harvest Fungal Pathogens of Pear Fruits

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Abstract: *The present study aimed to evaluate the antifungal potential of selected medicinal plant extracts against post-harvest fungal pathogens affecting pear fruits. Methanolic extracts of Chrozophora rottleri (Geiseler) A. Juss. ex. Spreng and Wrightia tinctoria (Roxb.) R. Br. were tested at different concentrations (500, 1000, 1500, 2000, 2500, and 3000 µg/ml) against Predominant fungal pathogens isolated from naturally infected pears, namely Penicillium expansum, Aspergillus flavus, and Mucor piriformis. Plant samples were collected from various regions of Maharashtra and authenticated through taxonomic identification.*

The antifungal activity of the extracts was determined using the dilution method, with standard antifungal agents as positive controls and aqueous extracts as negative controls. Results indicated that the methanolic extracts exhibited significantly greater antifungal activity compared to the controls. Chrozophora rottleri showed up to 99% inhibition of mycelial growth at 3000 µg/ml against Penicillium expansum and Aspergillus flavus, whereas Wrightia tinctoria demonstrated complete (100%) inhibition of Mucor piriformis at the same concentration.

These findings highlight the strong antifungal efficacy of the tested plant extracts and suggest their potential as eco-friendly alternatives for managing post-harvest fungal diseases in fruits.

Keywords: *Chrozophora rottleri*, *Wrightia tinctoria*, plant extracts, post-harvest pathogens, antifungal activity, disease management

I. INTRODUCTION

Pear (*Pyrus communis* L.), a pomaceous fruit belonging to the Rosaceae family, is an important temperate fruit crop widely cultivated in the north-western Himalayan region of India. It holds considerable agricultural and nutritional significance and is primarily grown in Jammu & Kashmir, Himachal Pradesh, Punjab, and Uttarakhand, which together contribute nearly 90% of the country's total pear production.

However, during post-harvest storage, pear fruits are highly susceptible to fungal infections caused by pathogens such as *Penicillium expansum*, *Aspergillus flavus*, and *Mucor piriformis*. Synthetic fungicides are commonly employed to control blue mould and other post-harvest diseases, but their excessive and indiscriminate use has led to increasing concerns regarding environmental pollution and risks to human health.

In this context, there is growing interest in the development of eco-friendly and sustainable disease management strategies. Plant-derived solvent extracts have emerged as promising alternatives, owing to their natural origin, biodegradability, and potential antifungal properties. Pear fruits are known to be affected by a wide range of predominant fungal pathogens, including *Penicillium expansum*, *Aspergillus flavus*, *Alternaria alternata*, *Aspergillus fumigatus*, *Botrytis cinerea*, *Venturia inaequalis*, *Botryosphaeria obtusa*, *Leptodontium elatius*, *Rhizopus arrhizus*, *Mycosphaerella pomi*, *Mucor piriformis*, and *Monilinia fructigena*, among others. Among these,

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Penicillium expansum, *Aspergillus flavus*, and *Mucor piriformis* are particularly destructive during storage [3, 4, 9, 10, 12].

Although several medicinal plants have been reported to possess antifungal and antibacterial properties, their application in managing post-harvest diseases of pears remains relatively underexplored. Eco-friendly herbal extracts, being biodegradable and safe for human use, have shown considerable potential as alternatives to synthetic fungicides [6, 8, 11].

Therefore, this study aims to assess the antifungal activity of methanolic extracts of *Chrozophora rottleri* and *Wrightia tinctoria* against key post-harvest fungal pathogens affecting pear fruits.

II. MATERIALS AND METHODS

Collection of Diseased Fruits:

A survey was conducted at the APMC Fruit Market, Vashi, Navi Mumbai, from September to December 2025 to document common post-harvest disease symptoms in pear fruits. The predominant symptoms observed included bluish, black, and brown mould growth on the fruit surface. Randomly selected infected fruits were collected and transported to the Research Laboratory, Department of Botany, K. V. Pendharkar College, Dombivli (E), Maharashtra, for further analysis.

The collected fruits were washed with sterile distilled water and surface-sterilized using 0.1% mercuric chloride solution. Small infected tissue segments were aseptically transferred onto Potato Dextrose Agar (PDA) medium and incubated at 27 ± 2°C for 8 days to facilitate fungal growth and isolation.

Isolation and Identification of Test Pathogens:

Following incubation, fungal colonies were examined based on their cultural and morphological characteristics. The isolates were identified with the help of standard mycological literature as *Penicillium expansum*, *Aspergillus flavus*, and *Mucor piriformis*. Pure cultures were obtained through single-spore isolation and maintained on PDA slants at 25°C for 8 days.

Spores were collected by flooding the culture plates with sterile distilled water, and the resulting spore suspensions were stored at 4°C for further experimental use.

Collection and Preparation of Plant Extracts:

Fresh leaves of *Chrozophora rottleri* (Geiseler) A. Juss. ex Spreng and *Wrightia tinctoria* (Roxb.) R. Br. were collected from different locations in Diaghar Village, Thane, Maharashtra. The leaves were thoroughly washed under running tap water and oven-dried at 40°C overnight.

A total of 100 g of dried plant material from each species was ground into a fine powder using an electric blender and stored in labelled, airtight containers.

A modified extraction method was employed [5]. Fifty grams of powdered material were macerated in 100 mL of 95% methanol and stirred for 30 minutes. The mixtures were filtered through muslin cloth followed by Whatman No. 1 filter paper. The filtrates were evaporated at 60°C for 1 hour to obtain concentrated extracts. The residues were further dried at 37°C for 48 hours and stored in sterile, screw-capped vials at 4°C until use.

Preparation of Plant Extract Dilutions:

Before use, the dried extracts were brought to room temperature. Serial dilutions were prepared by dissolving appropriate quantities of each extract in distilled water to obtain concentrations of 500, 1000, 1500, 2000, 2500, and 3000 µg/mL.

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***In Vitro* Antifungal Screening:**

Potato Dextrose Agar (PDA) medium was prepared and sterilized by autoclaving at 121°C (15 psi) for 20 minutes. After cooling to approximately 45°C, 5 mL of each plant extract concentration was added to 20 mL of molten PDA and poured into sterile 9 cm Petri plates (three replicates per treatment) under aseptic conditions.

Each plate was inoculated at the centre with 1 mL of spore suspension of the test pathogens (*Penicillium expansum*, *Aspergillus flavus*, and *Mucor piriformis*). Control plates contained PDA without plant extract. All plates were incubated at 25°C for 8 days.

Fungal growth was measured as radial colony diameter (mm), and antifungal activity was expressed as percentage inhibition of mycelial growth using the following formula [15] :

$$P = \frac{(gC - gT)}{gC} \times 100$$

Where:

C = radial growth in the control plate (mm)

T = radial growth in the treatment plate (mm)

III. RESULTS AND DISCUSSION

Table 1. Mycelial Growth Inhibition (in percentage) by the methanolic extracts of the test plants at different concentrations.

	Chrozophora Rottleri (Geiseler) A. Juss. Ex. Spreng			*Wrightia Tinctoria* (Roxb.) R. Br.		
Concentration (µg/ml)	*Penicillium expansum*	*Aspergillus flavus*	*Mucor piriformis*	*Penicillium expansum*	*Aspergillus flavus*	*Mucor piriformis*
500	48.85	52.75	55.50	52.50	49.30	54.75
1000	58.50	55.55	63.00	63.20	54.50	62.32
1500	62.90	63.40	73.25	78.55	63.80	76.00
2000	81.50	75.75	82.50	89.55	75.30	86.50
2500	88.50	89.50	89.95	94.10	88.55	95.00
3000	98.95	99.65	100	100	100	100

The post-harvest fungal pathogens *Penicillium expansum*, *Aspergillus flavus*, and *Mucor piriformis* were identified based on their cultural and morphological characteristics and subsequently evaluated for their susceptibility to plant extracts. Potato Dextrose Agar (PDA) medium supplemented with different concentrations of *Chrozophora rottleri* extract (0–3000 µg/ml) exhibited notable antifungal activity (Table 1). A concentration-dependent decline in mycelial growth was observed in all three fungi. *Penicillium expansum* showed inhibition ranging from 48.85% to 98.95%, while *Aspergillus flavus* and *Mucor piriformis* demonstrated inhibition rates of 52.75%–99.65% and 55.50%–100%, respectively. No inhibitory effect was recorded in the control. The highest concentration (3000 µg/ml) resulted in near-complete suppression of fungal growth.

A similar inhibitory pattern was recorded with *Wrightia tinctoria* extract, which also exhibited strong antifungal properties. At 3000 µg/ml, it achieved almost complete inhibition of mycelial growth in all tested pathogens. The results clearly indicate that both plant extracts are most effective at higher concentrations.

These observations are consistent with earlier reports highlighting the antifungal potential of plant-derived extracts against pathogens such as *Fusarium*, *Alternaria*, and *Helminthosporium* [14]. Furthermore, similar antifungal activity has been reported for extracts of garlic [7], neem [13], *Withania somnifera* [2], mustard, and horseradish [1] against fungi like *Penicillium digitatum*, thereby supporting the present findings.

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