iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** XII **Month of publication:** December 2024

DOI: https://doi.org/10.22214/ijraset.2024.65883

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue XII Dec 2024- Available at www.ijraset.com

The Antibacterial Activity of *Aloe barbadensis miller* (Aloe Vera), *Chromolaena odorata* (Christmas Bush), *Citrus limon* (Lemon), *Thespesia populnea* (Portia Tree), *Dracaena trifasciata* (Snake Plant) Against Pathogens that Causing Pyogenic Infections

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Abstract: ***Pyogenic infections, caused by bacteria known as pyogenes, are characterized by local inflammation and pus formation. Common diseases resulting from pyogenic organisms include folliculitis, impetigo, erythrasma, furuncles, carbuncles, macules, papules, styes, acne, erysipelas, and meningitis. These infections are a significant cause of nosocomial infections, which are associated with high morbidity rates. Due to the rising antibiotic resistance and adverse effects of antibiotics, researchers are exploring alternative treatments. Traditional medicine, prevalent in almost every culture, offers a potential source of alternative antimicrobial agents. This abstract summarizes the antimicrobial properties of certain plants traditionally used against skin infections, such as lemon, Aloe vera, and snake plants, which have been found to exhibit anti-inflammatory properties. Plant-derived medicines can be used in various forms, including powders, liquids, or mixtures. Further research on traditional medicinal plants may contribute to developing alternative therapies for pyogenic infections, especially in developing countries where these infections are common. Maintaining personal hygiene and proper handling of patient samples in hospitals is essential for preventing the spread of pyogenic infections.***

Keywords: Pyogenic infections, Inflammation, Ethanol, Chloroform, Dimethyl Sulfoxide

I. INTRODUCTION

Pyogenic infections are characterized by local inflammation and pus formation caused by predominant pyogenic bacteria like *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Pseudomonas aeruginosa*. Common pyogenic diseases include folliculitis, impetigo, erythrasma, acne, and meningitis. Folliculitis, often caused by *S. aureus*, affects hairy skin areas and can progress to boils. Impetigo, usually linked to *S. pyogenes*, presents as yellow crusts in hot, humid conditions and is treated with penicillin. Erythrasma, caused by *Corynebacterium minutissimum*, manifests as coral pink lesions and is treated with erythromycin. Acne involves the gram-positive rod *Propionibacterium acnes*, which blocks sebaceous glands, leading to inflammation. Nosocomial (hospital-acquired) pyogenic infections are a significant concern, often spread through improper sample handling and contaminated surfaces. Due to increasing antibiotic resistance, alternative treatments, such as plant-based remedies, are being explored. *Aloe vera* has anti-inflammatory properties, inhibiting cyclooxygenase pathways and reducing prostaglandin E2. *Chromolaena odorata* shows strong anti-inflammatory activity, inhibiting oedema in animal models. Lemon juice (*Citrus limon*) has been found to reduce pro-inflammatory cytokines through the ERK1-2/NF-κB pathway. Other plants like *Thespesia populnea* and *Dracaena trifasciata* have also demonstrated anti-inflammatory, antimicrobial, and wound-healing properties.

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II. MATERIALS AND METHODS

A. Collection of Plant Materials

The plant materials used in the study were collected from Coimbatore. Aloe vera, Christmas Bush, lemon, Portia tree fruit, and snake plant were collected from the herbal garden of Nehru Arts and Science College, Coimbatore, during January 2023. All the plant materials were brought to the laboratory and immediately processed for extraction.

B. Preparation of Plant Materials

Various parts of the collected plant materials were used for the study. Leaves were collected from the Christmas bush and snake plant, fruits from lemon and Portia tree, and gel was separated from Aloe vera. Aloe vera: The leaves were washed with distilled water, and the gel was separated by peeling them. The separated gel was mashed and stored in a sterile container. Christmas bush: Matured leaves were collected, thoroughly washed with distilled water, and crushed using a mortar and pestle. The resulting paste was stored in a sterile container. Lemon: Whole ripened fruits were washed with distilled water, cut into small pieces, and then crushed using a mortar and pestle. The resulting paste was stored in a sterile container. Portia tree: The whole Portia tree fruit was washed with distilled water and soaked in distilled water for 10-15 minutes. The seeds were removed, and the fruit was crushed using a mortar and pestle. The resulting paste was stored in a sterile container. Snake plant: The leaves were cleaned with distilled water, soaked in distilled water for 10 minutes, and then crushed using a mortar and pestle. The resulting paste was stored in a sterile container.

C. Extraction of compounds from plant materials using ethanol and chloroform

Ethanolic Extraction: 15 grams of each prepared plant material was mixed with 150 ml of 70% ethanol, and the mixture was kept in a sterile conical flask on a rotary shaker for 4-5 days at 150 rpm. After 5 days, the extracts were air-dried, treated with 10 ml of DMSO for 15 minutes, and stored in sterile Eppendorf tubes at 4°C until further use.
Chloroform Extraction: 15 grams of each prepared plant material were mixed with 150 ml of chloroform, and the mixture was kept in a sterile conical flask on a rotary shaker for 4-5 days at 150 rpm. After 5 days, the extracts were air-dried, treated with 10 ml of DMSO for 15 minutes, and stored in sterile Eppendorf tubes at 4°C until further use.

D. Isolation of Bacteria from Pus Samples

Clinical samples of pyogenic infections were collected from hospitals. The cultures were then subjected to Gram staining, and their colony morphology was studied using selective and differential media.

E. Determination of Antibacterial Activity using the well diffusion method.

Mueller Hinton (MH) agar is used as the media to check the antibacterial activity of a particular plant extract. First, a clean conical flask is taken, and 3.8 grams of MH agar is suspended in 100 mL of distilled water. Additionally, 2 grams of agar agar is added to the distilled water, stirring the mixture thoroughly. A cotton plug is placed in the conical flask, which is then wrapped with paper or aluminum foil. The conical flask is sterilized in an autoclave at 121°C and 15 lbs. pressure for 15-20 minutes. After sterilization, the media is poured into sterilized petri dishes and allowed to solidify. Next, sterilized cotton swabs are prepared and dipped into a broth culture that has been incubated for three hours. The swab is then evenly spread across the surface of the solidified media in the petri plates to form a bed of culture. Wells are made in the MH agar using a sterile cork borer or micropipette tip, and 4-5 drops of the plant extract are added to each well. The plates are then closed and incubated at 37°C for 24 to 48 hours to assess the antibacterial activity.

III. RESULT

The ethanolic and chloroform extracts of *Aloe barbadensis miller*, *Chromolaena odorata* (Christmas Bush), *Citrus limon* (Lemon), *Thespesia populnea* (Portia Tree), and *Dracaena trifasciata* (Snake Plant) were examined for their antimicrobial properties. Various colonies of different colors, shapes, and sizes were observed on culture media. (Figure:-1) Among the chloroform extracts, *Thespesia populnea* showed the largest average zone of inhibition, while Aloe vera had the smallest. (Figure: - 2)For the ethanol extracts, *Aloe barbadensis miller* demonstrated the largest zone of inhibition, with *Dracaena trifasciata* showing the smallest. (Figure:- 3) Overall, *Citrus limon* and *Thespesia populnea* exhibited larger zones of inhibition, indicating higher antimicrobial activity. Phytochemical compounds were more effectively extracted with ethanol than chloroform, suggesting that ethanol extracts are generally more potent. The results indicate that *Citrus limon* and *Thespesia populnea* are more effective against pathogens causing pyogenic infections.

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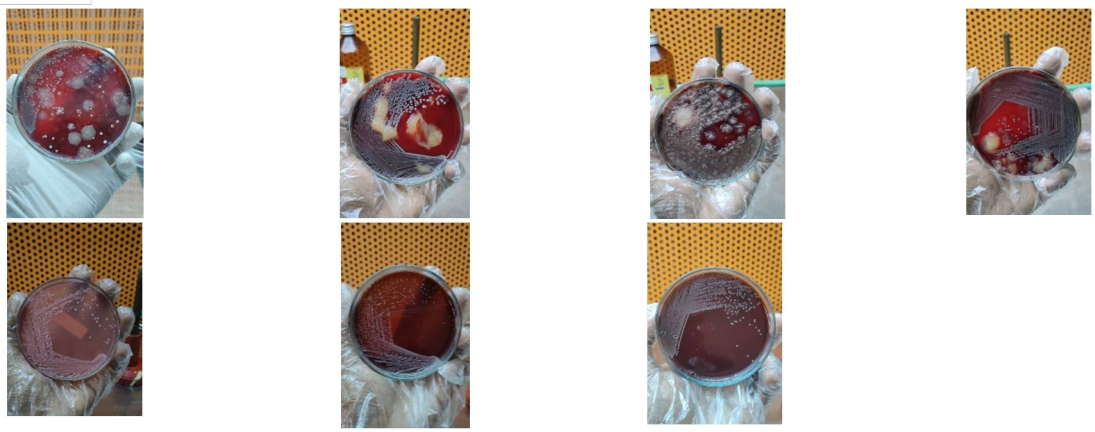

Figure 1:- Colonies on culture media

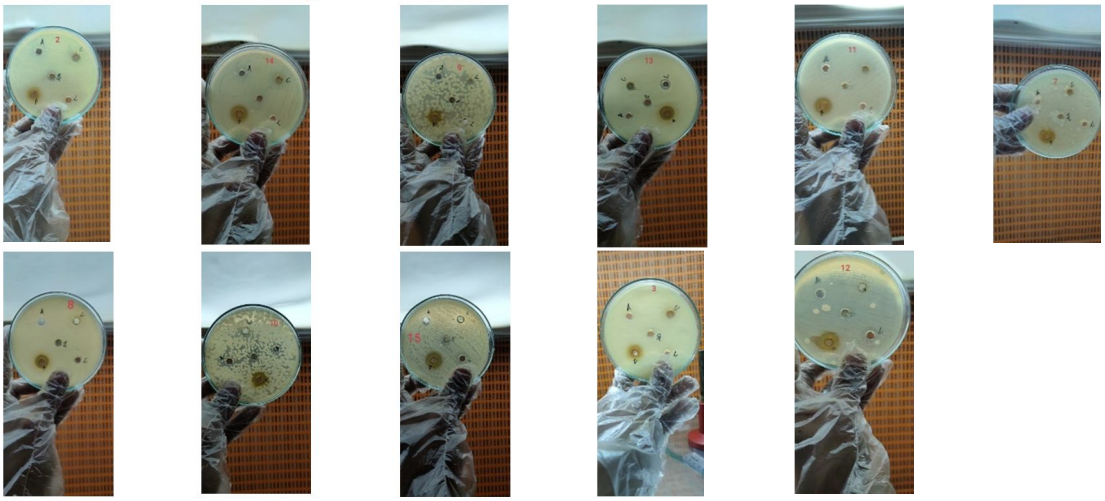

Figure 2:- Inhibitory zones of Chloroform extracts

Figure 3:- Inhibitory zones of Ethanol extracts

	Zone of Inhibition of Ethanolic Extracts					Zone of Inhibition of Chloroform Extracts				
Petriplate No:-	Aloe Vera	Christmas Bush	Lemon	Portia Tree	Snake Plant	Aloe Vera	Christmas Bush	Lemon	Portia Tree	Snake Plant

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1	0 mm	0 mm	9 mm	11.5 mm	12 mm	0 mm	9.5 mm	8.5 mm	13.5 mm	0 mm
2	0 mm	0 mm	14 mm	0 mm	0 mm	0 mm	0 mm	0 mm	12.5 mm	0 mm
3	0 mm	0 mm	9 mm	11 mm	8.5 mm	0 mm	0 mm	0 mm	14.5 mm	0 mm
4	0 mm	0 mm	13 mm	10 mm	0 mm	0 mm	0 mm	0 mm	13 mm	0 mm
5	0 mm	0 mm	13 mm	11 mm	14 mm	0 mm	0 mm	0 mm	12 mm	0 mm
6	0 mm	0 mm	12 mm	10 mm	9 mm	0 mm	10 mm	9.5 mm	13 mm	0 mm
7	0 mm	9.5 mm	13 mm	10.5 mm	8.5 mm	0 mm	0 mm	0 mm	13.5 mm	0 mm
8	12 mm	0 mm	15 mm	0 mm	0 mm	0 mm	0 mm	13 mm	15.5 mm	0 mm
9	15 mm	0 mm	13 mm	0 mm	0 mm	0 mm	0 mm	9.5 mm	13.5 mm	0 mm
10	0 mm	0 mm	11 mm	11.5 mm	0 mm	0 mm	0 mm	0 mm	13 mm	0 mm
11	0 mm	13.5 mm	17.5 mm	10 mm	0 mm	0 mm	0 mm	12 mm	14.5 mm	9 mm

Table 1:- Zone of Inhibitions 0f Ethanol and Chloroform Extracts

Sl No:-	Plant name	Zone size of Chloroform extract.	Zone size of Ethanol extract
1.	Aloe vera	0 mm	13.5 mm
2.	Christmas bush	9.75 mm	11.5 mm
3.	Lemon	10.5 mm	12.7 mm
4.	Portia tree	13.5 mm	10.7 mm
5.	Snake plant	9 mm	10.4 mm

Table 2:- Average Zone of Inhibitions

IV. DISCUSSION

The antibacterial properties of various natural compounds, including plants like *Aloe barbadensis miller*, *Chromolaena odorata*, *Citrus limon*, *Thespesia populnea*, and *Dracaena trifasciata*, have been investigated against pathogens that cause pyogenic infections, which are associated with abscesses, pus formation, and tissue destruction caused by bacteria such as *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Pseudomonas aeruginosa*. Aloe vera has been shown to inhibit the growth of these pathogens, particularly in ethanol extracts. *Chromolaena odorata*, traditionally used in African medicine, and *Thespesia populnea*, used in Indian and Pacific Islander medicine, have both demonstrated antibacterial activity, especially against *Staphylococcus aureus* and *Streptococcus pyogenes*. *Citrus limon*, rich in vitamin C, also showed significant inhibitory effects, particularly in ethanol extracts.

Dracaena trifasciata, commonly known as the snake plant, has been studied for its antibacterial properties, showing effectiveness against *Staphylococcus aureus* and *Pseudomonas aeruginosa*. The study highlighted that the efficacy of these plant extracts varied based on the solvent used, with ethanol extracts generally showing more significant antibacterial activity than chloroform extracts, likely due to the higher phytochemical content in ethanol extracts. The results suggest that *Citrus limon* and *Thespesia populnea*, in particular, contain potent antibacterial compounds, although further research is needed to isolate these compounds and assess their safety and efficacy in clinical settings.

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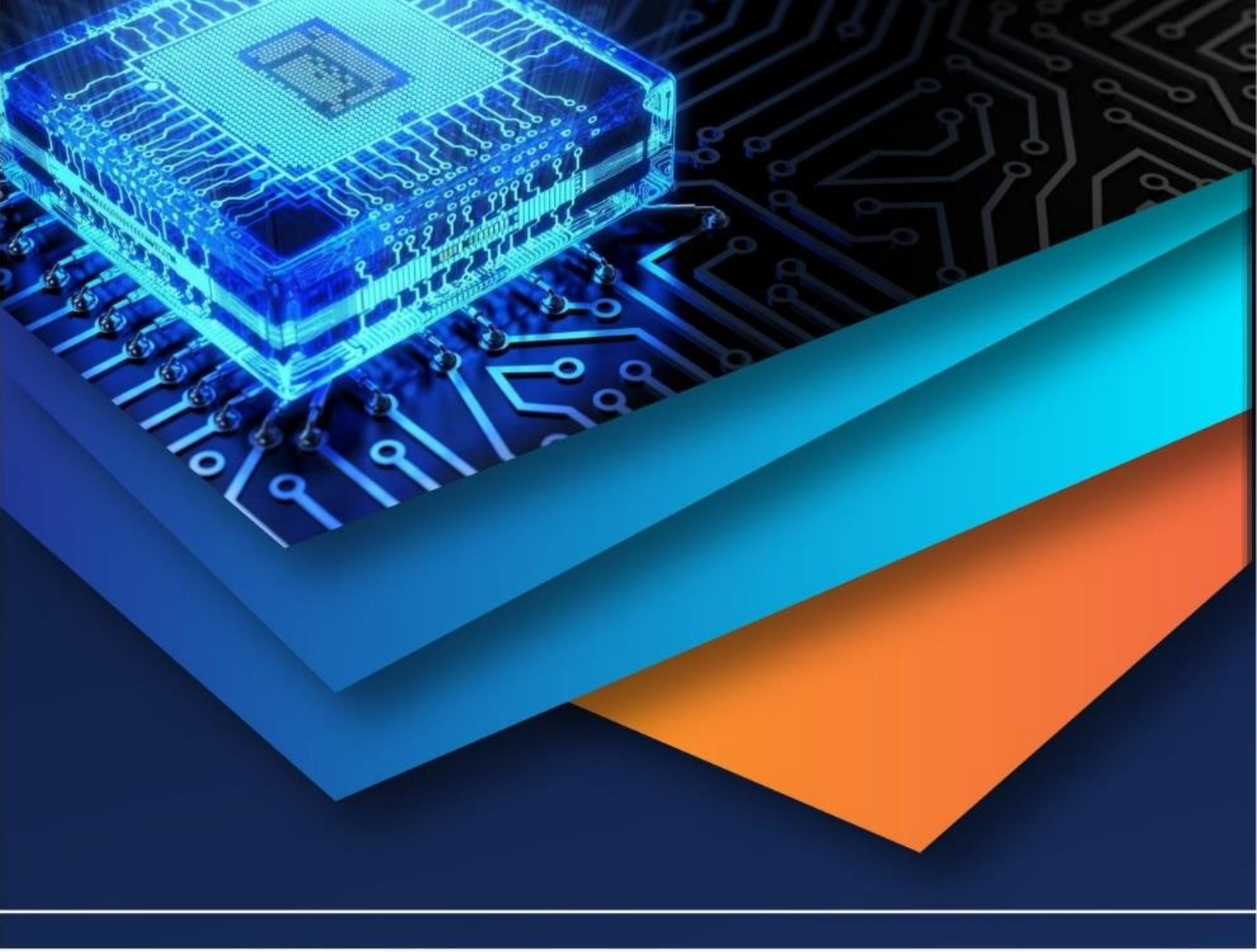

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