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A SYSTEMATIC REVIEW OF MEDICAL PLANTS USED AS ANTIMICROBIAL AGENTS

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ABSTRACT

Pathogenic microorganisms like bacteria, viruses, parasites, or fungi are what cause infectious diseases. Diseases can pass from one person to another either directly or indirectly. The second biggest cause of death worldwide is infectious diseases. We get about one-fourth of our medicines from plants found in rainforests. But there have only been a handful of medicinal plants used in extensive scientific research. The need for new antibacterial drugs has arisen from the development of bacterial resistance to currently existing antibiotics. Several plants are frequently utilized as herbal medicines for the treatment of infectious diseases in rural and underdeveloped areas of India. For possible antibacterial activity, four of these herbs that the locals frequently utilize were examined.

KEYWORDS: Antimicrobial Agents, Medicinal Plants, Pathogens.

INTRODUCTION

Nearly 50 000 people worldwide die from infectious diseases every day, making them the largest cause of preventable deaths. Diarrhea-related morbidity and death, particularly in children, remain serious issues in many developing nations. Most frequently, infections caused by pathogenic *Escherichia coli*, Vibrio cholerae, Areomonas species, Shigella species, Salmonella species, Klebsiella species, Campylobacter species, and Staphylococcus aureus. Drug resistance to human pathogenic microorganisms has recently been widely reported from all corners of the globe.[1,2,3]

As a result of widespread antibiotic use, bacteria have developed resistance. Along with this issue, antibiotics can occasionally have negative consequences on the host, such as

hypersensitivity, loss of healthy gut and mucosal microorganisms, immunosuppression, and allergic reactions.[4] The treatment of infectious diseases has become more difficult as a result.[5] In order to cure infectious diseases, it is necessary to create alternative antimicrobial medications. One strategy is to examine the potential antibacterial characteristics of local medicinal plants. Plant materials continue to be a valuable resource in the fight against major diseases worldwide.

WHO (1993) estimates that 80% of the world's population relies on traditional medicine, and a significant portion of traditional medicines use plant extracts or their active ingredients. However, it is a relatively recent field of study to examine plants scientifically to identify their antibacterial active ingredients. Traditional medical practises, particularly the use of medicinal herbs, continue to be crucial in meeting the fundamental healthcare requirements of underdeveloped nations.

Plants with antimicrobial activity

1. ***Alangium salvifolium***

   Alangium salvifolium, also known as the sage-leaved alangium, is a plant species belonging to the family Alangiaceae. While it is primarily valued for its ornamental and medicinal uses, it also possesses certain antimicrobial properties. Here are some of the antimicrobial properties associated with Alangium salvifolium:

- **Antibacterial activity:** Studies have shown that various extracts derived from different parts of *Alangium salvifolium*, such as leaves, stem bark, and fruits, possess significant antibacterial activity. These extracts have demonstrated effectiveness against both Gram-positive and Gram-negative bacteria, including pathogens like Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Salmonella typhi.[6]
- **Antifungal activity:** *Alangium salvifolium* extracts have also exhibited antifungal properties against various fungal strains. The antifungal activity has been observed against pathogens like Candida albicans, Aspergillus niger, and Trichophyton mentagrophytes, indicating the potential of Alangium salvifolium in combating fungal infections.[7]
- **Antiviral activity:** Some studies have suggested that certain extracts of *Alangium salvifolium* possess antiviral properties. These extracts have demonstrated inhibitory effects against viruses such as Herpes simplex virus type-1 (HSV-1), Herpes simplex

virus type-2 (HSV-2), and Influenza A virus. These findings highlight the potential of *Alangium salvifolium* as a source of natural antiviral agents.[8]

- Wound Healing Properties: In addition to its direct antibacterial actions, *Alangium salvifolium* has historically been utilised in formulations for the treatment of wounds. It is thought that the plant extracts accelerate healing by reducing infection and promoting tissue regeneration. As a healthy wound environment lowers the likelihood of bacteria colonisation, this indirectly adds to the antimicrobial component.[9]

Acorus calamus

Acorus calamus, commonly known as sweet flag or calamus, is a plant species belonging to the family Araceae. It has a long history of traditional medicinal use and possesses several antimicrobial properties. Here are some of the antimicrobial properties associated with Acorus calamus:

- **Antibacterial activity:** *Acorus calamus* extracts have demonstrated significant antibacterial activity against various strains of bacteria. Studies have shown that extracts derived from different parts of the plant, such as the rhizome and essential oil, exhibit inhibitory effects against both Gram-positive and Gram-negative bacteria. Common bacteria targeted include Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Salmonella typhi.[10]
- **Antifungal activity:** *Acorus calamus* extracts and essential oil have been found to possess antifungal properties against a range of fungal species. They have shown efficacy against pathogenic fungi such as Candida albicans, Aspergillus fumigatus, and Trichophyton rubrum. These antifungal properties make Acorus calamus a potential candidate for the treatment of fungal infections.
- **Antiviral activity:** Some studies have indicated that *Acorus calamus* exhibits antiviral activity against certain viruses. It has shown inhibitory effects against herpes simplex virus type-1 (HSV-1), herpes simplex virus type-2 (HSV-2), and human immunodeficiency virus (HIV). These findings suggest the potential of Acorus calamus in the development of natural antiviral agents.[11]
- **Antiprotozoal activity:** *Acorus calamus* extracts have also demonstrated antiprotozoal activity against parasitic protozoa such as Plasmodium falciparum, the causative agent of malaria. This suggests a possible role for Acorus calamus in the treatment or prevention of protozoal infections.[12]

Abutilon indicum

Abutilon indicum, commonly known as Indian mallow or country mallow, is a plant species belonging to the family Malvaceae. It has been traditionally used in various systems of medicine and possesses several antimicrobial properties. Here are some of the antimicrobial properties associated with Abutilon indicum:

- **Antibacterial activity:** Abutilon indicum extracts have demonstrated significant antibacterial activity against various strains of bacteria. Studies have shown that extracts derived from different parts of the plant, including leaves, flowers, and roots, exhibit inhibitory effects against both Gram-positive and Gram-negative bacteria. Common bacteria targeted include Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Salmonella typhi.[13]
- **Antifungal activity:** Abutilon indicum extracts have been found to possess antifungal properties against a range of fungal species. They have shown efficacy against pathogenic fungi such as Candida albicans, Aspergillus niger, and Trichophyton mentagrophytes. These antifungal properties suggest a potential role for Abutilon indicum in the treatment of fungal infections.[14]
- **Antiviral activity**: Some studies have indicated that Abutilon indicum exhibits antiviral activity against certain viruses. It has shown inhibitory effects against herpes simplex virus type-1 (HSV-1), herpes simplex virus type-2 (HSV-2), and influenza A virus. These findings highlight the potential of Abutilon indicum in the development of natural antiviral agents.
- **Antiparasitic activity:** Abutilon indicum extracts have demonstrated antiparasitic activity against various parasites. They have shown efficacy against parasites such as Leishmania donovani, Plasmodium falciparum, and Trypanosoma brucei. This suggests a possible role for Abutilon indicum in the treatment or prevention of parasitic infections.

Bombax ceiba

Bombax ceiba, commonly known as the silk cotton tree or red silk cotton, is a plant species belonging to the family Bombacaceae. While it is primarily valued for its timber, fiber, and medicinal uses, it also possesses certain antimicrobial properties. Here are some of the antimicrobial properties associated with Bombax ceiba:

Antibacterial activity: Studies have shown that extracts derived from various parts of Bombax ceiba, including the bark, leaves, and flowers, exhibit antibacterial activity against a wide range of bacteria. The extracts have been found to inhibit the growth of

both Gram-positive and Gram-negative bacteria, including Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Salmonella typhi.

- **Antifungal activity:** Bombax ceiba extracts have also demonstrated antifungal properties against different fungal species. They have shown efficacy against pathogenic fungi such as Candida albicans, Aspergillus niger, and Trichophyton rubrum. These antifungal properties suggest the potential of Bombax ceiba in combating fungal infections.
- **Antiviral activity:** Some studies have indicated that Bombax ceiba exhibits antiviral activity against certain viruses. Extracts from the plant have shown inhibitory effects against viruses such as herpes simplex virus type-1 (HSV-1), herpes simplex virus type-2 (HSV-2), and dengue virus. These findings suggest that Bombax ceiba may possess compounds with antiviral properties.
- **Wound healing properties:** In addition to its direct antimicrobial effects, Bombax ceiba has been traditionally used in wound healing formulations. The plant extracts are believed to accelerate wound healing by preventing infection and promoting tissue regeneration. This indirectly contributes to the antimicrobial aspect, as a healthy wound environment reduces the risk of microbial colonization.

Melaleuca alternifolia

Melaleuca alternifolia, commonly known as tea tree, is a plant species native to Australia. It is highly regarded for its potent antimicrobial properties, particularly in the form of its essential oil. Here are some of the antimicrobial properties associated with Melaleuca alternifolia

- **Antibacterial activity:** Tea tree oil has powerful antibacterial properties. It has been shown to inhibit the growth of various bacteria, including common pathogens like Staphylococcus aureus and Escherichia coli. Tea tree oil can disrupt the cell membranes of bacteria, leading to their destruction.
- **Antifungal activity:** Tea tree oil is effective against several fungal species, including Candida albicans and Trichophyton species. It can inhibit the growth and spread of fungi responsible for various skin infections, such as athlete's foot and fungal nail infections.

  Antiviral activity: Tea tree oil exhibits antiviral properties against certain viruses. It has been found to inhibit the replication of herpes simplex virus type-1 (HSV-1) and herpes simplex virus type-2 (HSV-2). Tea tree oil can help alleviate symptoms and promote healing in viral skin conditions like cold sores

- **Antiprotozoal activity**: Tea tree oil has been shown to possess antiprotozoal activity against parasites like Giardia lamblia. It can help reduce the growth and survival of these parasites, which cause gastrointestinal infections.
- **Wound healing properties**: In addition to its direct antimicrobial effects, tea tree oil is known to promote wound healing. It can accelerate the closure of wounds, reduce inflammation, and prevent infections, contributing to a faster healing process.
- **Acne treatment:** Tea tree oil is commonly used as a natural remedy for acne due to its antimicrobial properties. It can help reduce acne-causing bacteria on the skin and alleviate inflammation associated with acne breakouts.
- **Dental hygiene:** Tea tree oil is used in oral care products like toothpaste and mouthwash due to its antimicrobial properties. It can help combat bacteria responsible for dental plaque, gum disease, and bad breath.

Origanum vulgare

Origanum vulgare, commonly known as oregano, is an aromatic herb widely used in culinary and traditional medicine. It possesses strong antimicrobial properties attributed to its active compounds, particularly essential oils. Here are some of the antimicrobial properties associated with Origanum vulgare

- **Antibacterial activity:** Oregano essential oil has been found to exhibit potent antibacterial properties against various bacteria. It has shown efficacy against both Gram-positive and Gram-negative bacteria, including Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Salmonella species. The active compounds in oregano oil, such as carvacrol and thymol, are believed to be responsible for its antibacterial effects.
- Antifungal activity: Oregano essential oil has demonstrated strong antifungal properties against several fungal species. It has been effective against Candida albicans, Aspergillus species, and dermatophytes like Trichophyton and Epidermophyton. Oregano oil's antifungal activity is attributed to its constituents, including thymol, carvacrol, and terpinene.
- **Antiviral activity**: Studies have shown that oregano oil possesses antiviral properties against certain viruses. It has exhibited inhibitory effects against herpes simplex virus type-1 (HSV-1), respiratory syncytial virus (RSV), and rotavirus. The antiviral activity of oregano oil is attributed to its components, including carvacrol and thymol.

- **Antiparasitic activity**: Oregano oil has demonstrated antiparasitic properties against various parasites. It has shown efficacy against parasites like Giardia lamblia, Leishmania donovani, and Trypanosoma cruzi. The active compounds in oregano oil contribute to its ability to combat these parasitic infections.
- **Food preservation:** Oregano and its essential oil have been used as natural preservatives in food products due to their antimicrobial properties. They can help inhibit the growth of foodborne pathogens and spoilage-causing microorganisms, thereby extending the shelf life of food.

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