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A Comparative Analysis On The Efficacy Of Different Plant Part's Extract Of Lantana Camara L. And Lantana Indica L. Against Certain Gram-Positive And Gram-Negative Bacteria

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Abstract
It has been demonstrated that plants provide great value in the fight against microbial infections due to their antibacterial properties and the growing concern for antibiotic resistance. The goal of this research is to analyze the antibacterial effect of various plant part extracts (stems, leaves, and seeds) of Lantana camara L. and Lantana indica L. Extracts from these plants were tested against two gram-positive bacteria (Bacillus subtilis and Staphylococcus aureus) and two gram-negative bacteria (Escherichia coli and Klebsiella pneumoniae) using the agar diffusion method. The results showed that both species of Lantana stem extracts had the strongest antimicrobial activity, whereas Lantana indica stem extracts had the largest zone of inhibition for Bacillus subtilis. Meanwhile, the seed extracts of both species demonstrated the least antimicrobial activity. This suggests that Lantana species has the potential for development as a source of natural antibacterial agents and pharmaceuticals, thus reducing the use of chemical drugs.

INTRODUCTION

The survival of any living organism on the earth cannot be imagined without the plants, as many of the plants are known for their medicinal values and their positive impact on human metabolism (Aslam & Ahmad, 2016). The Kingdom Plantae is one of the major and probably the greatest groups of all kingdoms. They are eukaryotic, autotrophic, and have complex cell structures. Looking out and pushing all known issues aside, every known living organism can be said to be a potential medicinal plant and can be conveniently termed as a medicinal herb. Many developing countries' healthcare systems remain largely based on traditional medicines made from plants. Medical practice, Chinese, Ayurveda, and Unani traditions have been using many plans for more than 3000 years (Aslam & Ahmad, 2016 and Zahara et al., 2020). This in turn, calls into mind the traditional medicine systems that have been used for a very long time in many countries to meet the health care needs in the world. They are still relevant in this new era, and it has been emphasized that they are best positioned to assist them shortly. 75-80% of the world's population use and depend very much on folk medicines that serve as a primary healthcare method (Mitra et al., 2011 and Wangkheirakpam, 2018).

The renowned scientist Linnaeus discovered this genus in the 17th century, primarily in 1753. Lantana is native to South America, and there are around 150 species in this genus. In his Species Plantarum, Carl Linnaeus was the first to recognize and catalog seven species of Lantana. He found one species from Ethiopia and six species native to America (Negi et al., 2019).

Often referred to as red sage or wild sage, this species is primarily a hybrid. It was brought to India from Sri Lanka in the 18th century and is primarily used as an ornamental plant. Girish, (2017) reported that the L. camara is commonly cultivated as an ornamental plant but has become a highly invasive weed in many regions worldwide. It grows at altitudes ranging from sea level to 2000 meters and flourishes in areas with annual rainfall between 750 and 5000 mm. The plant can reach a height of up to 3 meters. It is a woody, sprawling, evergreen shrub with an aromatic scent. The stems and branches may have thorns, and the leaves are arranged in opposite pairs. They are broadly oval, bright green, rough to the touch, with short hairs, and have finely serrated edges with numerous veins, giving the leaves a wrinkled appearance. The flower heads contain 20-40 blooms, typically about 2.5 cm in diameter.

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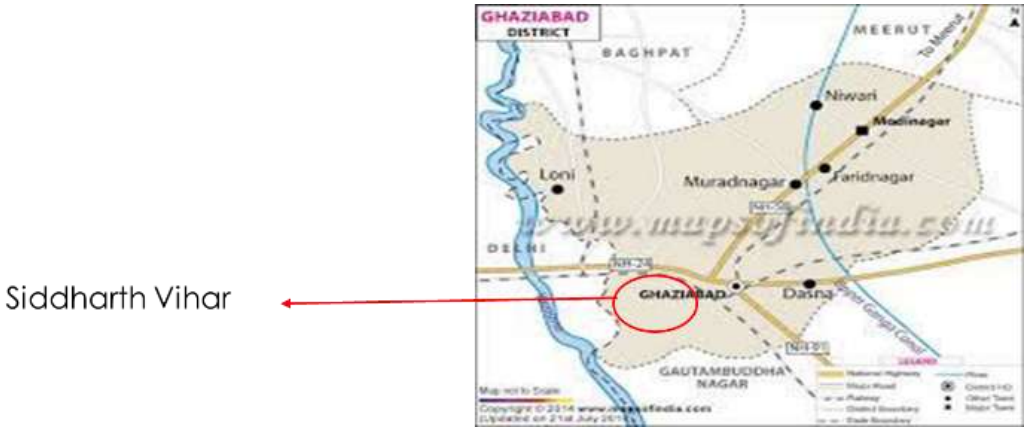
Several native species have been displaced by Lantana, which is mostly found in India from the northern Central Himalayas to the southernmost regions of the nation (Kannan et al., 2012). Since its discovery, this genus has spread worldwide.
Numerous bioactive substances, such as flavones, isoflavones, flavonoids, anthocyanins, coumarins, lignans, catechins, isocatechins, alkaloids, tannins, saponins, and triterpenoids, are known to be abundant in L. camara. Several researchers have documented the phytochemical details of L. camara, and numerous bioactive molecules have been isolated from various plant parts and essential oils (EOs) (Swamy et al., 2015; Girish et al., 2017).
As a sudorific, intestinal antiseptic, diaphoretic, and treatment for asthma, stomach issues, fever, cancer, catarrhal infections, chickenpox, eczema, hypertension, malaria, measles, swelling, rheumatism, tetanus, and ulcers, Lantana is used in ethnobotany for a wide range of medical conditions (Begum et al., 2006). Additionally, according to Ali et al. (2017), this genus possesses antipyretic, antithrombin, antimalarial, insecticidal, antibacterial, nematocidal, immunosuppressive, and anti-inflammatory qualities.

The leaves and flowers of Lantana have demonstrated significant antibacterial properties against Pseudomonas aeruginosa, Bacillus subtilis, and Escherichia coli (Ashok et al., 2007). Previous studies reported that the methanolic extract of leaves of L. camara was subjected to antimicrobial activities against ten bacteria and five fungi by the disc-diffusion method. This activity showed great results against Bacillus cereus and Salmonella typhi. (Badakhshan et al., 2009). Lantana camara showed the strongest growth inhibitory effect against Pseudomonas aeruginosa, followed by Serratia marcescens and Staphylococcus aureus, according to a study done in 2023 by Szu et. al. While the earthworm extract needed a higher concentration of 200 µg/mL to inhibit bacterial growth, the plant extract had a minimum inhibitory concentration (MIC) of 150 µg/mL. Our results show that compared to the earthworm extract, the ethanol extract of L. camara exhibited greater antimicrobial activity (Lourenço et al., 2021).
In 2021, Thorat et al, have conducted research against E. coli, Staphylococcus aureus, and Pseudomonas aeruginosa, and the extract showed maximum inhibition in the case of Staphylococcus aureus. The present study aimed to carry out the antimicrobial activities of Lantana camara and Lantana indica plant extracts.

1. MATERIALS AND METHODS

A. Plant Collection and Identification

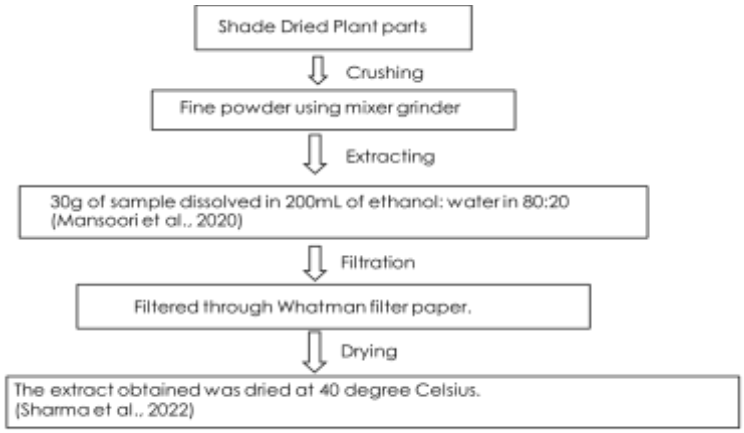
The plant material of the genus Lantana, i.e., Lantana camara, was collected from the region of Uttar Pradesh (Ghaziabad), in April 2024.



Lantana indica was collected from the region of Dharamshala (Himachal Pradesh) in May 2024.

B. Preparation of Extracts

Shade drying - By properly controlled drying, nutrients, as well as color and fragrance, can be retained in the dried leaves. (Tiwari and Krishanu., 2023 and Tadesse et al., 2017).



Powdered leaves Seeds Powdered stem

Micro-organisms used: Bacillus subtilis, Staphylococcus aureus, Escherichia coli, and Klebsiella pneumoniae

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ANTIMICROBIAL ACTIVITY ASSAY

To check the in vitro antibacterial efficacy of Lantana camara and Lantana indica, against Gram-positive and Gram-negative bacteria, we selected two genera of each, i.e., Bacillus subtilis, Staphylococcus aureus, as Gram-positive bacteria and Escherichia coli, & Klebsiella pneumonia as Gram-negative bacteria. The plant extract's antibacterial property was tested by the disc diffusion method. The extract was prepared at a concentration of 1 mg/mL in DMSO (dimethyl sulfoxide). Bacterial cultures were spread on plates containing the suitable growth media. Paper filter discs were soaked in 10 mL of the extract solution and placed on the bacterial lawn. A positive control was performed using erythromycin. The discs were incubated for 24 hours at 37 degrees Celsius and measured for inhibition zones after. The procedures were done in triplicates to allow for reproducibility. (Musyimi et al., 2017; Thorat et al., 2021).

RESULT AND DISCUSSION:

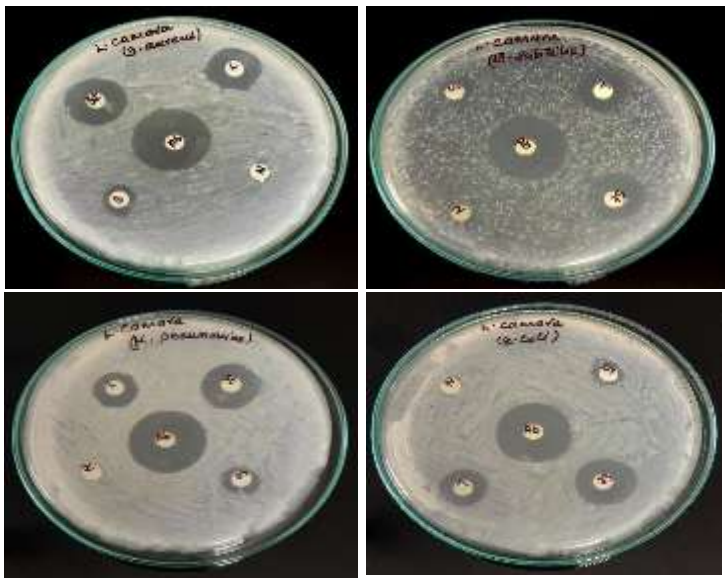

Fig1: Antimicrobial activity of different plant parts of *Lantana camara* L. against Gram-Positive and Gram-Negative Bacteria

Antibacterial activity of different plant parts of Lantana camara L.			
	Stem	Leaves	Seeds
Test organisms	Zone of inhibition (mm)	Zone of inhibition (mm)	Zone of inhibition (mm)
Bacillus subtilis	17	13	08
Staphylococcus aureus	18	15	12
Escherichia coli	17	14	08
Klebsiella pneumoniae	17	19	12

Table 1: Zone of inhibition (mm) during Antibacterial activity of different plant parts of Lantana camara L against Gram-Positive and Gram-Negative Bacteria

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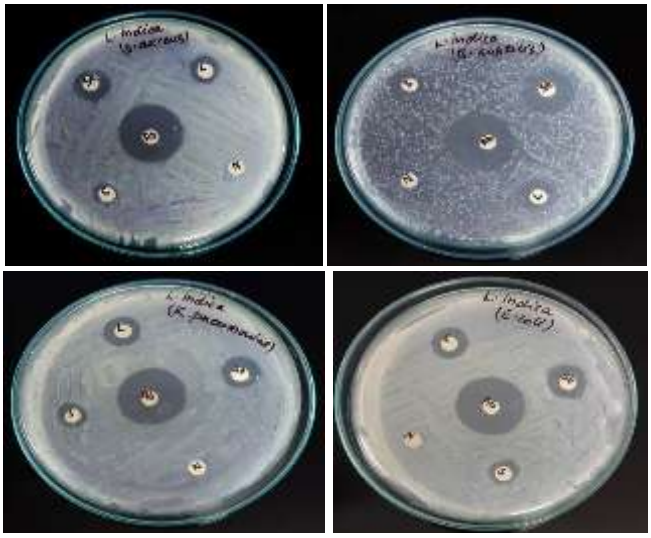
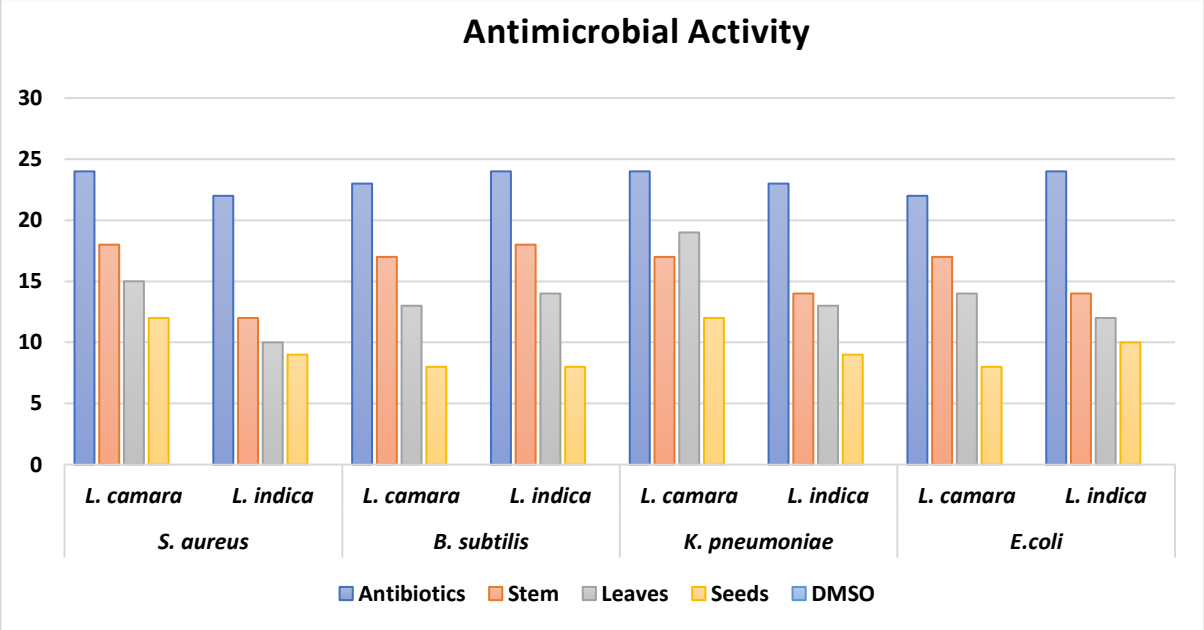


Fig. 2: Zone of inhibition during the Antimicrobial activity of different plant parts of Lantana indica L. against Gram-Positive and Gram-Negative Bacteria

Table: 2. Zone of inhibition (mm) during Antibacterial activity of different plant parts of Lantana indica L against Gram-Positive and Gram-Negative Bacteria

Antibacterial activity of different plant parts of Lantana indica L.			
	Stem	Leaves	Seeds
Test organisms	Zone of inhibition (mm)	Zone of inhibition (mm)	Zone of inhibition (mm)
Bacillus subtilis	18	14	08
Staphylococcus aureus	12	10	09
Escherichia coli	14	12	10
Klebsiella pneumoniae	14	13	09



Graph 1: Comparison chart between the antibacterial activity of Plant part extract of L. Camara and L. indica against four bacterial species.

CONCLUSION

The comparative study of the antimicrobial activity of Lantana camara L. and Lantana indica L. reveals them to be excellent sources of antimicrobial agents from natural sources. Stem extracts of both the species exhibited the greatest inhibition against the tested strains of bacteria, and the extract of the stem of Lantana indica was especially effective against Bacillus subtilis. The extracts taken from the leaves of both species were also active, while extracts from the seeds were less effective. The results presented in the study strengthen the ethnobotanical use of Lantana species in traditional medicine and also indicate their potential in the development of plants with antimicrobial agents. Deeper studies are suggested on the different bioactive compounds or the fractions that confer the antibacterial property under consideration for possible use in the pharmaceutical industry.

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