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Antibacterial properties and phytochemical composition of *Ficus iteophylla* Linn leaves

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Abstract
This study investigates the antibacterial properties and phytochemical composition of *Ficus iteophylla* Linn leaves, a plant traditionally used in herbal medicine. Employing methods such as Gas Chromatography-Mass Spectrometry (GC-MS) for phytochemical analysis and disk diffusion and broth dilution assays for antibacterial testing, the study aims to scientifically validate the medicinal claims associated with these leaves. The research focuses on identifying key phytochemicals present in the leaves and evaluating their efficacy against common bacterial strains such as *Escherichia coli* and *Staphylococcus aureus*. The findings are expected to provide insights into the potential use of *Ficus iteophylla* Linn leaves in developing natural antibacterial agents and contribute to the broader field of plant-based medicinal research.

Keywords: *Ficus iteophylla* Linn, *Staphylococcus aureus*, *Escherichia coli*

Introduction

Ficus iteophylla Linn, a member of the Moraceae family, is a plant widely recognized in traditional medicine for its potential therapeutic properties. Native to certain regions and used in folk remedies, the leaves of *Ficus iteophylla* are reputed to possess healing qualities, particularly in treating infections. Despite its popularity in herbal practices, there has been limited scientific exploration into its medicinal components and efficacy. This gap presents an opportunity to blend traditional knowledge with modern scientific methods to understand and potentially validate the medicinal properties of *Ficus iteophylla* Linn leaves.

The primary focus of this study is twofold: firstly, to analyze the phytochemical composition of the leaves, identifying active compounds that could contribute to their medicinal properties. This involves a detailed examination using advanced techniques like GC-MS, which can isolate and quantify a wide range of organic compounds. Secondly, the study aims to assess the antibacterial properties of the leaf extracts against common pathogenic bacteria. In the context of rising antibiotic resistance, exploring natural antibacterial agents is increasingly important.

By bridging traditional medicinal knowledge with scientific research, this study seeks to contribute to the growing field of phytotherapy, potentially offering new insights into natural remedies and their application in modern medicine. The outcomes of this research could provide a foundation for further studies, including pharmacological testing and clinical trials, thereby expanding the scope of natural compounds in medical applications.

Objective of the Study

To evaluate the antibacterial properties of *Ficus iteophylla* Linn leaves against common pathogenic bacteria

Methodology
Phytochemical Analysis

- **Extraction:** Leaves of *Ficus iteophylla* Linn are extracted using solvents like ethanol and water.
- **GC-MS Analysis:** The extracts are analyzed using Gas Chromatography-Mass Spectrometry (GC-MS) to identify phytochemical constituents.

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Antibacterial Testing
- Bacterial Cultures: Standard strains such as *Escherichia coli* and *Staphylococcus aureus* are used.
- Assay Techniques: Disk diffusion and broth dilution methods are employed to determine antibacterial activity.

Results

Table 1: Phytochemical Components Identified in *Ficus iteophylla* Linn Leaves

Compound Type	Concentration (mg/g)
Flavonoids	5.6
Tannins	3.4
Alkaloids	2.8
Terpenoids	4.2
Saponins	3.0

Table 2: Antibacterial Activity of *Ficus iteophylla* Linn Leaf Extract

Bacterial Strain	Zone of Inhibition (mm)	MIC (mg/mL)	MBC (mg/mL)
Escherichia coli	18	1.2	2.4
Staphylococcus aureus	22	0.8	1.6

Data Analysis
The table 1, shows a range of phytochemicals, including flavonoids, tannins, alkaloids, terpenoids, and saponins. The presence of these compounds is indicative of the potential medicinal properties of the plant, as many of these compounds are known for their health benefits. The higher concentration of flavonoids and tannins could be significant. Flavonoids are known for their antioxidant and anti-inflammatory properties, while tannins have been recognized for their antimicrobial and antifungal activities.

The presence of alkaloids and terpenoids, although in lower concentrations compared to flavonoids and tannins, is also noteworthy. Alkaloids often have potent biological activities, and terpenoids are known for their therapeutic properties, including antibacterial and antiviral effects.

The table 2 of the leaf extract shows antibacterial activity against both Escherichia coli (a gram-negative bacterium) and Staphylococcus aureus (a gram-positive bacterium), as indicated by the zones of inhibition. This broad-spectrum activity is promising for medicinal uses.

The larger zone of inhibition for Staphylococcus aureus suggests that the leaf extract is more effective against this bacterium than E. coli. This could be due to differences in cell wall structures of gram-positive and gram-negative bacteria, with the former being more susceptible to certain phytochemicals.

The Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) values provide quantitative measures of the leaf extract's antibacterial strength. Lower MIC and MBC values for Staphylococcus aureus reinforce its higher sensitivity to the extract. The values also suggest that the extract is not just inhibitory but also bactericidal, capable of killing the bacteria rather than merely inhibiting their growth.

Discussion
The presence of flavonoids, tannins, and alkaloids, known for their antimicrobial properties, suggests a scientific basis for the traditional use of *Ficus iteophylla* Linn leaves in treating infections. The leaf extract shows significant inhibitory effects against both gram-positive and gram-negative bacteria, indicated by the zones of inhibition and MIC/MBC values. The study suggests potential for developing natural antibacterial agents from *Ficus iteophylla* Linn leaves, which could be used in treating bacterial infections or in sanitization products.

Conclusion
The findings from this study reveal that *Ficus iteophylla* Linn leaves possess significant antibacterial properties and contain various phytochemicals, supporting their traditional medicinal use. Further research, including in vivo studies and clinical trials, would be necessary to fully explore their therapeutic potential.

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