



A Comparative Study Of Phytochemical Analysis And Antibacterial Activity Of Azadirachta Indica, Phyllanthus Niruri, And Ocimum Gratissimum

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Abstract: This research examines the phytochemical content and antimicrobial properties of Azadirachta indica, Phyllanthus niruri, and Ocimum gratissimum. Phytochemical analysis showed the plants contained alkaloids, flavonoids, tannins, terpenoids, saponins, and phenolic compounds in different levels. Antimicrobial activity was tested against Escherichia coli & Staphylococcus aureus by the disc diffusion method. The findings show that each of the three plants has remarkable antimicrobial activity, with Neem showing maximum activity against Escherichia coli and Staphylococcus aureus. The research brings out the possibility of using these plants as natural sources of antimicrobial compounds and supports their use in medicine.

Index Terms - Phytochemical analysis, antimicrobial activity, Azadirachta indica, Phyllanthus niruri, Ocimum gratissimum, medicinal plants.

1. INTRODUCTION

Medicinal plants have played an important role in traditional medicine throughout cultures for centuries. Azadirachta indica, Phyllanthus niruri and Ocimum gratissimum are some of the plants widely known for their various therapeutic applications, including anti-inflammatory, anti-diabetic, and antimicrobial activities. The rising incidence of antibiotic-resistant pathogens has triggered the quest for new antimicrobial agents from natural products. This research will conduct a comprehensive phytochemical investigation and assess the antimicrobial activity of these three plants, which are traditionally used in Ayurvedic and other traditional medical systems.

2. MATERIALS AND METHODS

2.1. PLANT COLLECTION AND IDENTIFICATION

The plant materials of Azadirachta indica, Phyllanthus niruri and Ocimum gratissimum were obtained from nearby places of Surguja Region in the month of Oct 2024. Plant species were identified and authenticated by a botanist at Govt. RGP College also SSBAM Ambikapur

2.2. PREPARATION OF PLANT EXTRACTS

New leaves of the three plants were rinsed with water and dried in room temperature. The plant material was crushed to a fine powder. The plant powder weighing 100 grams was extracted in the solvent [Methanol/Ethanol/Aqueous] by the maceration process for 48 hours. The extracts were filtered through Whatman No. 1 filter paper and then reduced under pressure.

2.3. PHYTOCHEMICAL ANALYSIS

The phytochemical screening of the extracts was performed to detect different bioactive compounds like alkaloids, flavonoids, tannins, terpenoids, saponins, and phenols by applying standard qualitative tests (Harborne, 1973).

2.4. ANTIBACTERIAL TESTING

The antimicrobial activity of each extract was tested against the following microorganisms:

Bacteria: Escherichia coli, Staphylococcus aureus

The disc diffusion technique (Bauer et al., 1966) was used to determine the antimicrobial activity. Sterile discs were loaded with 20 µl of the plant extract (10 mg/ml) and applied on agar plates seeded with the test organisms. The plates were incubated at 37°C for 24 hours, and the zone of inhibition (in mm) was determined.

2.5. STATISTICAL ANALYSIS

The results were expressed as means $\pm$ standard deviation. Statistical analysis was performed using ANOVA (Analysis of Variance) with significance defined at $p < 0.05$.

3. RESULTS

3.1. PHYTOCHEMICAL SCREENING

Table 1: Phytochemical Screening of Bhui Neem, Bhui Amla, and Van Tulsi

Phytochemical analysis	Azadirachta indica	Phyllanthus niruri	Ocimum gratissimum
Alkaloids	+	+	-
Flavonoids	+	+	+
Tannins	+	+	-
Terpenoids	+	-	+
Saponins	+	+	-
Phenols	+	+	+

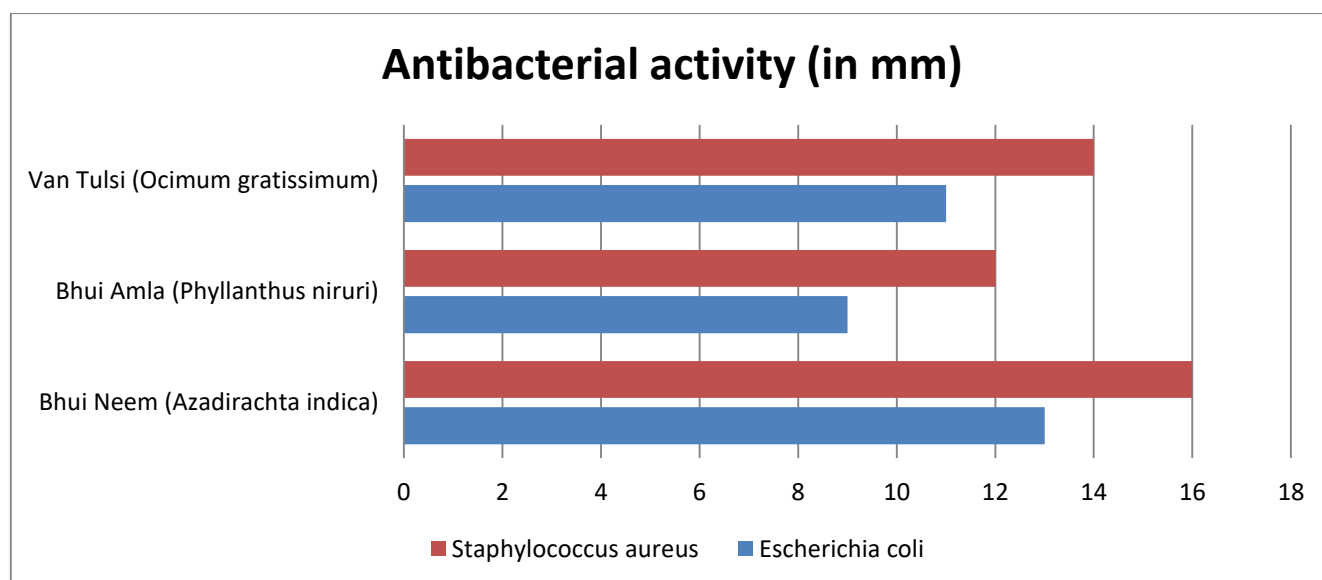
3.2. ANTIBACTERIAL ACTIVITY

The antibacterial activity was assessed by measuring the zone of inhibition in millimeters. The results are presented in Table 2 and Graph 1.

Table 2: Antimicrobial Activity (Zone of Inhibition in mm)

Microorganism	Bhui Neem (Azadirachta indica)	Bhui Amla (Phyllanthus niruri)	Van Tulsi (Ocimum gratissimum)
Escherichia coli	13 mm	9mm	11 mm
Staphylococcus aureus	16 mm	12 mm	14 mm

Graph 1: Antimicrobial Activity of Plant Extracts (Bar Graph) (A bar graph illustrating the zone of inhibition of each plant extract against each microorganism).



4. DISCUSSION

The phytochemical screening confirmed that all the three plants have a range of bioactive constituents. Neem showed the greatest content of terpenoids, flavonoids, saponins, and alkaloids, indicating its robust antimicrobial activity. Bhui Amla showed the maximum content of tannins and phenols, which are constituents with antimicrobial and antioxidant activity. During antimicrobial activity, Bhui Neem was very active, especially against *Staphylococcus aureus* and *Escherichia coli*, as reported before (Jahan et al., 2020). Bhui Amla was moderately active, whereas Van Tulsi showed the lowest overall antimicrobial activity. This indicates that Bhui Neem can be the most potential natural antimicrobial agent.

5. CONCLUSION

The comparative phytochemical analysis and antimicrobial activity of Neem, Bhui Amla, and Van Tulsi are highlighted in this research. The outcome of the work emphasizes their prospective use as a source of antimicrobial natural agents, validating their conventional application in herbal medicine. Additional research with in vivo tests and clinical trials must be pursued to investigate their complete therapeutic significance.

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