Phytochemical analyses of *Ficus glomerata* stem bark and its antimicrobial efficacy

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Abstract: **The antibacterial activity of several solvent extracts of *Ficus glomerata* evaluated against *Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumonia,* and *Staphylococcus aureus* was investigated using the agar diffusion technique. Several solvent extracts of the stem bark of *Ficus glomerata* plant were examined for qualitative phytochemical analysis. The ethanol extract of *Ficus glomerata* demonstrated substantial antibacterial activity at the minimum inhibitory concentration (MIC) against *Escherichia coli* (162 µg/ml) and *Pseudomonas aeruginosa* (171 µg/ml). With (199 µg/ml of *Klebsiella pneumonia* and 203 µg/ml of *Escherichia coli*, the chloroform extract demonstrated antibacterial action. Hexane extract from *Ficus glomerata* with MIC (348 µg/ml) showed the lowest antibacterial activity.**

Index Terms Ficus glomerata **stem bark, antimicrobial activity, agar diffusion method, phytochemical analysis.**

INTRODUCTION

Herbal medicines have been more well-liked in recent years not just in a lot of foreign countries but even in developed nations. 80 percent of people worldwide presently use herbal medication for various types of basic healthcare, according to the World Health Organization. (Mazid et al. 2012).

Numerous plants are used to cure a range of diseases in ethnomedicine. Antimicrobial medications either eliminate or stop the development of infections. Antimicrobial compounds known as disinfectants are applied to non-living objects, outside surfaces, and body parts to stop the infection and pathogen spreading. In order to prevent a variety of diseases and develop powerful treatments, microorganisms are crucial in the production of bioactive small molecules from natural sources.

Microbes have developed resistance as a result of a variety of use of drugs, which poses a significant therapeutic challenge in the treatment of infectious disorders. The emergence of the bacteria's resistance was caused by the excessive use of commercially accessible antibacterials, that are regularly employed to prevent infection. (Almagboul et al., 1985). Researchers were encouraged to look into different sources, notably herbal resources, in order to uncover novel antibacterial compounds.

MATERIALS AND METHODS

Plant material:

The plant *Ficus glomerata* that was collected from the Purna area of the District of Nanded was recognised and validated by a taxonomist from Yeshwant Mahavidyalaya, Nanded-431602, Maharashtra.

Preparation of Plant extracts:

Ficus glomerata stem bark was gathered and allowed to air-dry in the dark. The dried, stem bark sample was ground to a fine powder to use a grinding machine. The plants were extracted from the fine powder using the Soxhlet extraction unit and a number of solvents, including water, ethanol, chloroform, ethyl acetate, and hexane. Following extraction, the obtained extract was concentrated and kept in refrigerator for various tests.

Preliminary Phytochemical analysis:

Different solvent extracts were utilized in a standard method to undertake phytochemical analysis on *Ficus glomerata* stem bark extracts. (Yadav and Agarwala, 2011).

Test microorganisms:

The test organisms employed in the current investigation were Escherichia coli (MTCC-739), Pseudomonas aeruginosa (MTCC-2453), Klebsiella pneumonia (MTCC-2653), and Staphylococcus aureus (MTCC-96). They were acquired from the culture collection center facility at the school of life sciences at S. R. T. M. University in Nanded, Maharashtra. The acquired cultures were periodically subcultured for the current experiment.

Antimicrobial activity by agar diffusion method:

Using the agar diffusion method, the stem bark of several Ficus glomerata solvent extracts were evaluated for their antibacterial effectiveness. A subcultured microbial suspension (100 µl) was made to spread agar medium.

Measurements of antibacterial activity were made using a variety of concentrated varying extracts. (Anesini and Perez, 1993). After adding the sample to the plates, it was allowed for an hour to allow the extract to diffuse. The inhibitory zone was measured in millimetres (mm) after the plates were kept in an incubator for 24 hours at 37°C. The outcomes are compared with those of traditional antibacterial medications.

RESULTS AND DISCUSSION

A preliminary phytochemical analysis revealed that phenols, tannins, glycosides, terpenoids, flavonoids, and alkaloids were present in all Ficus glomerata stem bark samples. In addition to the fact that no saponins and coumarins were found in any of the tested *Ficus glomerata* extracts. Table 1 presents the findings of the phytochemical investigation. The plant's significant amount of phytochemicals contributes to a higher amount of biological activity. Table 2 summarizes the antibacterial characteristics of several *Ficus glomerata* solvent-based extracts. With MICs of (162 g/ml) against *Escherichia coli*, (171 g/ml) against *Pseudomonas aeruginosa*, (176 g/ml) against *Klebsiella pneumonia*, and (188 g/ml) against *Staphylococcus aureus*, the ethanol extract of Ficus glomerata demonstrated the strongest antibacterial activity. The strongest antibacterial activity was found in the chloroform extract of *Ficus glomerata*, with MICs of (203 g/ml) against *Escherichia coli*, (211 g/ml) against *Pseudomonas aeruginosa*, (199 g/ml) against *Klebsiella pneumonia*, and (217 g/ml) against *Staphylococcus aureus*. The outcomes were compared with reference compounds having MIC of standard Cephalosporins (50 µg/ml). The MIC values of the ethyl acetate extract of *Ficus glomerata* (298 g/ml) against *Escherichia coli*, (275 g/ml) against *Pseudomonas aeruginosa*, (238 g/ml) against *Klebsiella pneumonia*, and (269 g/ml) against *Staphylococcus aureus* showed the strongest antibacterial activity. The obtained results were compared with Cephalosporins with MIC (45 µg/ml). The greatest antibacterial activity was demonstrated by the MIC values of the hexane extract of *Ficus glomerata* (311 g/ml) against *Escherichia coli*, (327 g/ml) against *Pseudomonas aeruginosa*, (348 g/ml) against *Klebsiella pneumonia*, and (301 g/ml) against *Staphylococcus aureus*. The gentamicin (35 µg/ml) was used as a standard reference compound. All the extracts of stem bark of *Ficus glomerata* exhibited presence of phenol, tannins, glycosides, terpenoids, flavonoids and alkaloids with exception of absence of saponins and coumarins in the different solvents extracts.

The range of phytochemicals included in the extract may potentially contribute to a significant inhibitory effect. Bactericidal properties are provided by the presence of various flavonoids, alkaloids, terpenoids, phenols, saponins, and coumarins. (Chandler *et al*, 1982). High quantities of phytochemicals and bioactive substances are regarded to have a greater potential for treating a range of pathogenic bacteria, according to several scientific research. Historically, a range of chronic ailments, including gastrointestinal disorders, urinary tract infections, skin conditions, and other breathing issues, have been treated with a variety of botanicals and their various parts (Ellof, 1998). Plant-based treatments may be used to prevent and treat a number of chronic diseases carried on by different microorganisms. Ethnomedicines are still used by many communities to heal ailments and conquer challenges without having any unfavourable side effects. The medicinal properties of herbal preparations are due to the presence of several phytoconstituents, such as alkaloids, flavonoids, coumarins, saponins, polyphenols, tannins, and terpenoids. (Ikram and Inamul, 1984). Secondary metabolites inhibit the development of pathogenic germs that cause severe illnesses. Many antibiotics that are extremely hazardous to humans are no longer effective against the bacteria. The researchers are employing plant-based medications to discover an alternative to conventional antibiotics to prevent dangerous infections caused by a diverse range of microbes (Kubo et al., 1992). Since larger concentrations of crude extracts can occasionally be harmful to people, in vitro cell cytotoxicity assays are used to calculate dose-dependent values. Plant-based medications have far less bad impacts than commercial antibiotics if used in excess (Matos et al., 1988). Eighty percent of all medications created worldwide are made from plant-based drugs and are useful in treating all chronic conditions.

CONCLUSION

The findings indicate that ethanol extract has the greatest potential, which may be due to the fact that it contains the bulk of phytochemical components and bioactive chemicals with antibacterial activity. It is necessary to do more research on the Ficus glomerata plant extract in order to find and purify compounds that might be utilised as natural medicines that are an alternative to synthetic modern ones.

Table 1. Preliminary phytochemical analysis of whole plant extract of *Ficus glomerata*

Sr. No.	Phytochemical Test	Whole plant extract of *Ficus glomerata*				
		Water Extract	Ethanol Extract	Chloroform extract	Ethyl acetate extract	Hexane extract
1	Saponins	-	+	+	+	-
2	Phenols	+	+	+	+	+
3	Tannins	+	+	+	+	+
4	Glycosides	+	+	+	+	+
5	Terpenoids	+	+	+	+	-
6	Flavonoids	+	+	+	+	+
7	Alkaloids	-	+	+	+	-
8	Coumarins	+	+	+	+	+

Table 2. Antimicrobial activity of the whole plant extract *Ficus glomerata*

Sr. No.	Microorganism	Minimum inhibitory concentration (MIC)						
		Whole plant extract of *Ficus glomerata* (µg/ml)						
		Water extract	Ethanol extract	Chloroform extract	Ethyl acetate extract	Hexane extract	Gentamicin (µg/ml)	Cephalosporins (µg/ml)
1	*Escherichia coli*	298	164	203	243	311	ND	50
2	*Pseudomonas aeruginosa*	275	171	211	268	327	ND	45
3	*Klebsiella pneumonia*	238	176	199	241	348	ND	39
4	*Staphylococcus aureus*	269	188	217	213	301	35	ND

The results summarized are the mean values of two parallel experiments.

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