Analysis of the phytochemicals and antimicrobial properties of several extracts from *Alestonia scholaris*

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Abstract: **Different solvent extracts of *Alestonia scholaris* were examined using the agar diffusion method for their antibacterial efficacy against *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumonia*, and *Staphylococcus aureus*. The minimum inhibitory concentration (MIC) of each organism was determined using individual plant extracts. The entire *Alestonia scholaris* plant was examined using a number of solvent extracts for qualitative phytochemical analysis. *Staphylococcus aureus* (MIC: 121 µg/ml) and *Pseudomonas aeruginosa* (MIC: 139 µg/ml) were both extremely susceptible to *Alestonia scholaris* ethanol extract's have antibacterial effects. The ethanol extract of *Alestonia scholaris against Escherichia coli* (164 µg/ml) and *Klebsiella pneumonia* (259 µg/ml) were each showed antibacterial properties. The chloroform extract of *Alestonia scholaris* with (MIC: 407 µg/ml) exhibited the lowest antibacterial activity.**

Key words: Antibacterial activity, *Alestonia scholaris*, agar diffusion method, phytochemical analysis

INTRODUCTION

Herbal remedies have become more well-liked in recent years not just in a lot of other countries but also in industrialised nations. 80 percent of people worldwide already use herbal medication for various types of basic healthcare, according to the World Health Organisation (Iqbal Ahmad et al., 1998). In ethnomedicine, a lot of the plants are utilized to treat a variety of illnesses. Antimicrobial drugs either eradicate or prevent the growth of microorganisms. Disinfectants are antibacterial substances applied to nonliving or external areas of the body. In the production of bioactive small molecules from natural sources for the treatment of various diseases and the development of potent drugs, microorganisms are essential. Microbes have developed resistance as a result of a variety of drugs, which poses a significant therapeutic challenge in the treatment of infectious conditions. The overuse of commercially available antimicrobials, which are routinely used to treat illnesses, led to the development of the bacteria' tolerance (Anand and Tandu, 2022). Researchers have been urged to explore into different sources, notably herbal resources, in order to identify novel antibacterial compounds.

MATERIALS AND METHODS

Plant material:
The plant *Alestonia scholaris*, which was obtained from the Bhokar area of the District of Nanded, was recognized and validated by a taxonomist from Yeshwant Mahavidyalaya, Nanded-431602, Maharashtra.

Preparation of Plant extracts:
A collection of Alestonia scholaris plant stem bark was made, and it was let to dry in the shade. The stem bark plant was ground into a fine powder using a mixer grinder after drying. The plants were extracted from the fine powder using the Soxhlet device and a number of solvents, namely ethanol, chloroform, and ethyl acetate. Following extraction, the material was concentrated and put in refrigerator to use in various tests.

Preliminary Phytochemical analysis:
Alestonia scholaris whole plant extracts were subjected to standardised phytochemical analysis deploying a number of solvents extracts of plants. (Yadav and Agarwala, 2011).

Test microorganisms:
In the current investigation, test organisms include *Escherichia coli* (MTCC-739), *Pseudomonas aeruginosa* (MTCC-2453), *Klebsiella pneumonia* (MTCC-2653), and *Staphylococcus aureus* (MTCC-96). They received from the S. R. T. M. University in Nanded, Maharashtra's cultural collecting centre,

School of life sciences. The received cultures subsequently regularly subcultured for the current experiment.

Antimicrobial activity by agar diffusion method:
Using the agar diffusion technique, the antibacterial potency of several *Alestonia scholaris* solvent extracts was evaluated. A subcultured microbial suspension (100 µl) was made for diffusion on agar medium. Measurements of antibacterial activity were made using a variety of concentrated varying extracts. (Alade & Irobi, 1993). After adding the sample to the plates, it was allowed for an hour so that 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 examined with those of traditional antibacterial medication.

RESULTS AND DISCUSSION

A preliminary phytochemical analysis revealed that all of the extracts from the *Alestonia scholaris* included saponin, phenols, tannins, glycosides, terpenoids, flavonoids, alkaloids, and coumarins. With the exception of the absence of saponins, phenol, and coumarins in the ethyl acetate extract. Table 1 presents the findings of the phytochemical investigation. The presence of a significant amount of phytochemicals in the plant results in a higher level of biological activity. Table 2 summarises the antibacterial qualities of several extracts of *Alestonia scholaris* made using different solvents. The ethanol extract of *Alestonia scholaris* had the highest antimicrobial activity with MIC (121 µg/ml) against the *Staphylococcus aureus*, (139 µg/ml) against the *Pseudomonas aeruginosa*, (164 µg/ml) against the *Escherichia coli* and (259 µg/ml) against the *Klebsiella pneumonia*. The various extracts of *Alestonia scholaris* tested against *Escherichia coli* and showed considerable MIC results in Chloroform extract (222 µg/ml), ethyl acetate extract (380 µg/ml). The results were compared with standard Cephalosporins as reference compounds with MIC (54 µg/ml). The different extracts of *Alestonia scholaris* were checked against the *Pseudomonas aeruginosa* and exhibited significant MIC values in water extract chloroform extract (310 µg/ml) and ethyl acetate extract (204 µg/ml). The obtained results were compared with Cephalosporins with MIC (42 µg/ml). The individual extract of *Alestonia scholaris* was checked against *Klebsiella pneumonia* and found impressive MIC values in chloroform extract (398 µg/ml), ethyl acetate extract (407 µg/ml). The different solvent extract of *Alestonia scholaris* was evaluated against Staphylococcus aureus and found impressive MIC values in chloroform extract (206 µg/ml), ethyl acetate extract (236 µg/ml). The gentamicin (31 µg/ml) was used as a standard compound. The range of phytochemicals included in the extract may potentially contribute to a significant inhibitory zone. Bactericidal effects are present in many flavonoids, alkaloids, terpenoids, phenols, saponins, and coumarins. (Murugan & Salim, 2021). High quantities of phytochemicals and bioactive substances are regarded to have a greater potential for treating a range of pathogenic bacteria, according to many scientific research. Historically, a range of chronic ailments, including gastrointestinal disorders, urinary tract infections, skin conditions, and other respiratory problems, have been treated with a variety of plants and their various parts. (Darah & Halim, 1993). It is possible to prevent and treat a number of chronic diseases brought on by different bacteria by using plant-based treatments. Ethnomedicines are still used by many communities to heal ailments and conquer challenges without having any unfavourable side effects. Herbal preparations have therapeutic benefits because they include a variety of phytoconstituents, such as alkaloids, flavonoids, coumarins, saponins, polyphenols, tannins, and terpenoids. (Al-Zoreky, 2009). Secondary metabolites inhibit the development of pathogenic germs that cause severe illnesses. (Alzoreky & Nakahara, 2003). 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 range of microbes. (Arora & Kaur, 1999). In vitro cell cytotoxicity test is used to assess the dose-dependent values since larger concentrations of crude extracts can induce cytotoxicity in individuals. If ingested in excess, plant-based medications have much less negative effects than commercial antibiotics. (Berahou et al., 2007). Around the world, 80 percent of all drugs are made from plant-based ingredients and are effective in treating all chronic diseases.

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. To find and purify compounds that might be utilised as natural medicines in place of synthetic commercial ones, more research must be done on the entire plant extract of *Alestonia scholaris*.

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Table 1. Preliminary phytochemical analysis of stem extract of *Alestonia scholaris*

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

Table 2. Antimicrobial activity of the stem extract of *Alestonia scholaris*

Sr. No.	Microorganism	Minimum inhibitory concentration (MIC)				
		Whole plant extract of *Alestonia scholaris* (µg/ml)				
		Ethanol extract	Chloroform extract	Ethyl acetate extract	Gentamicin (µg/ml)	Cephalosporins (µg/ml)
1	*Escherichia coli*	164	222	380	ND	54
2	*Pseudomonas aeruginosa*	139	310	204	ND	42
3	*Klebsiella pneumonia*	259	398	407	ND	37
4	*Staphylococcus aureus*	121	206	236	331	ND