Evaluation of the antimicrobial activity of the stem bark extracts of *Bridelia micrantha* against *MDR salmonella typhimurium*

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ABSTRACT

Objectives: It is still necessary to evaluate the antibacterial potential of medicinal plants, which could result in the development of broad-spectrum antimicrobial molecules. In underdeveloped nations; traditional medicine is one of the most widely accessible forms of treatment. Objective of present study was evaluation of the antimicrobial activity of the stem bark extracts of *Bridelia micrantha* against *MDR salmonella typhimurium*

Methods: In this study, the agar-well diffusion method was used to test the antibacterial activity of *Bridelia micrantha* stem bark extract of *Bridelia micrantha* and chloramphenicol against *MDR Salmonella typhimurium.*

Results: Brielia micrantha's crude extract was found to be effective against MDR salmonella typhimurium. The crude extract of *Bridelia micrantha* was shown to have minimum inhibitory concentration (MIC) and zone of inhibition values of 1.25 mg/ml and 17.50 ±0.50 mm to 23.50 ±0.00 mm, respectively.

Conclusions: The results of this study show that *Bridelia micrantha's* crude extracts have *In-vitro* antibacterial activity, which serves as preliminary scientific support for the plant's usage in treating *MDR* infections.

Keywords: Minimum inhibitory concentration, *Salmonella Typhimurium*, Multidrug resistance, *Bridelia micrantha*, zones of inhibition.

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1. Introduction

One of the most frequently isolated food-borne diseases is salmonella. It is a global public health problem that results in 155,000 fatalities annually and 93.8 million cases of foodborne disease. More than half of the more than 2500 Salmonella serotypes that have been described to date which account for the majority of human Salmonella infections belong to the subspecies Salmonella Enterica [**7].** Drugs used to treat enteric fever include fluoroquinolones, ampicillin, and chloramphenicol since they are antimicrobials and have been shown to be the most successful treatments **[16].** Without antibiotic medication, the case fatality rate is predicted to be 20%–30%, but wi'ljihhth the right course of treatment, it drops to 2%–4% **[11].** However, excessive and unreasonable prescribing and usage of these medications have caused drug resistance, also known as multidrug resistance (MDR), to evolve and spread in the pathogenic strains of Salmonella **[10].** Treatment failures, a limited selection of medication regimens, and an increase in severity and mortality are all caused by MDR strains **[8].** When the traditional first-line medications (chloramphenicol, ampicillin, and trimethoprim-sulfamethoxazole) stopped working due to

antibiotic resistance, clinicians were forced to turn to quinolones, particularly ciprofloxacin, which is when the early emergence of drug resistance among Salmonella isolates began to occur **[12].** However, the recent global upsurge in quinolone resistance could have severe consequences for the spread of infectious illnesses worldwide **[17].**

Different plants have been utilized as traditional medicines from the beginning of human civilization. Because of its better compatibility with the human body and lower risk of side effects, herbal medicine continues to be the primary source of primary healthcare for 70–80% of the world's population, primarily in underdeveloped nations **[2].** Plants include a variety of intricate chemical components that support the body's natural healing processes. The therapeutic benefits of plants have been demonstrated to treat a variety of illnesses, from cancer to infectious disorders like malaria and tuberculosis. However, the need of looking for alternatives in medicine has been highlighted by the increase in diseases that are multidrug resistant and the well-documented negative effects of some prevalent medications.

2. Material and methods

2.1 Materials and bacterial sample:

The plant samples were gathered from scientific plant vendor from the Nagpur. The Department of Pharmacognosy, PWCOP at Yavatmal verified the taxonomic identity of plant materials. The test bacteria obtained from five regions of the state of Maharashtra were sampled for samples of chicken flesh, roadside water, and roadside soil. Biochemical, microbiological analysis, multidrug resistance pattern and Molecular identification of salmonella typhimurium were carried out at PWCOP Yavatmal. Separately air dried *Bridelia micrantha* stem bark were then finely powdered using a Mortar and Pistol. The plating medium employed in this investigation, including nutrient agar, nutrient broth, and Muller Hinton agar, were acquired commercially from local vendors as dehydrated media of Hi-Media Laboratories Limited, India. Analytical-grade chemicals and reagents were also used.

2.2 Extraction of antibacterial compounds in methanol:

Bridelia micrantha stem bark powder (500 g) was cold macerated in 2.5 litres of 70% v/v methanol with periodic shaking for 72 hours at 28°C. Whatman filter paper was used to filter the extract (No. 1). The filtrate was lyophilized and kept at 4°C in a refrigerator after being concentrated at 40°C under decreased pressure in a rotary evaporator **[13].** Bridelia micrantha dry methanol stem bark extract was weighed, preserved in Falcon tubes, and dried out before use. The yield of the extract was 4.21% w/w referenced to the powdered plant material from *Bridelia micrantha*.

2.3 Determination of the antimicrobial activity:

The sensitivity testing was carried out on plates of sterile Mueller Hinton Agar (pH -7.3). The test cultures were swabbed onto the Mueller Hinton Agar plate after being incubated at 37°C for a few hours to achieve turbidity equal to 0.5 McFarland's standard. After 15 minutes, wells were created with a 6mm diameter, sterile cork borer, 15mm apart from one another. Using a micropipette, different quantities (10, 20, 40 and 80) of the extracts were aseptically dispensed in 10 µl of 0.1M phosphate buffer with a pH-7. The plates were incubated in an upright position at 37°C for 24 hours after being allowed to stand at room temperature for 30 minutes. Using a ruler, the diameters of the zone of inhibition (ZOI) were determined. Each test system had the appropriate controls **[5].**

2.4 Determination of MIC:

The crude extract was produced as 0.5mg/ml stock solutions. In sterile nutritional broth, the corresponding crude extract was serially diluted. Serial dilution was carried out in 5ml of broth, and 2.5ml was then transferred into the following tube in the series. To challenge approximately 5X105 CFU/ml of test bacteria, standard inoculum (0.5 McFarland Standard) was generated and 100 µl of the culture was injected into each tube. The tubes were then incubated overnight at 37°C. 5 The tubes' development was monitored. 50 µl of the antimicrobial-treated culture broth were sub

cultured onto new nutrient agar plates for the measurement of fine growth, and the findings were analyzed **[14].**

3. Results and analysis

3.1 Antimicrobial activity of methanol stem bark extract of Bridelia micrantha:

Antimicrobial activity in the *Bridelia micrantha* stem bark extract in methanol was dose-dependent. At test dosages of 80 and 10 mg/mL, respectively, *Bridelia micrantha* stem bark extract had the highest and lowest antibacterial activity against *salmonella typhimurium* with mean diameter zones of inhibition of 17.50 ±0.50 mm to 23.50 ±0.00 mm as showed in (Figure.1) *Bridelia micrantha* stem bark extract in methanol exhibited antimicrobial activity against Salmonella typhimurium with Minimum Inhibitory Concentration (MIC) of 1.25 mg/mL with 25mg/mL that of chloramphenicol mentioned in (Table.1)

Table 1: Mean diameter zones of inhibition and Minimum inhibitory concentration of *Bridelia micrantha* stems bark extract in methanol.

Test organisms	Concentration (mg/mL)	Mean diameter zones of inhibition (mm)	*Bridelia micrantha* stems bark extract in methanol	Control (Chloramphenicol)
Salmonella typhimurium	80	23.50±0.00	1.25 mg/mL	25mg/mL
	40	21.25 ±0.25		
	20	19.00 ±0.50		
	10	17.00 ±0.50		

Figure 1: Antimicrobial activity of *Bridelia micrantha* stems bark extract in methanol.

4. Discussion

According to numerous research, medicinal plants form the foundation of conventional medicine **[4,15].** Humans can benefit from plants' anti-inflammatory, antibacterial, anti-oxidant and anthelmintic properties. Finding novel and affordable methods to control infectious diseases has become necessary due to the rise in bacterial resistance to current medicines. It were demonstrated that medicinal plants are an excellent source for isolating active antimicrobials (Samie et al., 2005; Bessong et al., 2006). The antibacterial properties of the *Bridelia micrantha* stem bark's methanol extract was examined in this work. Based on information from ethnobotany, *Bridelia micrantha* was chosen for this investigation; the plant has a long history of use in ethnomedicine (Steenkamp et al., 2009). The synergistic activities or the discrete actions of the phytochemicals found in the stem bark may be related to the antibacterial capabilities demonstrated by the *Bridelia micrantha* extract **[3].** The concentration of *Bridelia micrantha* extract affected its antibacterial action. This is consistent with a study that discovered concentration-dependent efficacy against

Salmonella typhimurium in methanol extracts of *Bridelia micrantha* **[6].** This result is consistent with a study that looked into *Bridelia micrantha's* ability to modulate drug resistance **[9].** This study used the agar-well diffusion method to test extracts of the stem bark of *Bridelia micrantha* and chloramphenicol for antibacterial activity against strains of *Salmonella typhimurium*, which is consistent with previous studies **[1].**

5. Conclusion

The antibacterial properties of *Bridelia micrantha* extract could be attributed to the phytochemicals that are found in it. These results corroborate the traditional use of *Bridelia micrantha* extract as an antimicrobial. It was necessary to conduct additional research on the creation of natural alternative treatments for MDR *Salmonella Typhimurium*. Toxicology against human or animal cells, modes of action, in vivo effects, positive and negative interactions with popular antibiotics, and other topics should all be the subject of ongoing research.

Data availability statement

All data generated or analyzed during this study are included in this article.

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Competing interests

The authors declare no conflict of interest with this research.

Ethical approval

Since no animals were used in this study, ethical approval was not needed.

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