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Evaluation of Antimicrobial Activity of Methanol Extract of *Abrus precatorius* Leaf Against Selected Clinical Isolates (*Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus and Candida albican*)

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Abstract **Original Research Article**

Abrus precatorius is one of the herbal plants that have been reported to have medicinal properties. The leaves is widely used for the treatment of cough, cancer and swollen tonsils. *Abrus precatorius* is also known for its abundant chemical constituents that could be very important antibacterial agent. This study evaluated the antimicrobial activity of *Abrus precatorius* leaf extracts against isolated clinical bacteria and fungi. The study employed agar disc diffusion method of antimicrobial sensitivity testing (50 µg/mL, 100 µg/mL, 200 µg/mL and 400 µg/mL), and Minimum Inhibitory Concentration (MIC) model. The results showed a dose dependent antimicrobial potential of *Abrus precatorius* leaf extract against the test organisms with zone of inhibition ranging from 4 – 18mm against *Escherichia coli*, 6 – 19mm against *Pseudomonas aeruginosa*, 4 -22mm against *Staphylococcus aureus* and 2 – 15mm against *Candida albican*. The extract also showed an MIC of 25mg/ml for *Staphylococcus aureus*, 50mg/ml for *Escherichia coli* and *Pseudomonas aeruginosa* and the least MIC of 100mg/ml for *Candida albican.* The outcome of the study suggest that *Abrus precatorius* leaf extract exert broad spectrum antibacterial activity against both Gram-positive and Gram-negative bacteria. These findings validate the use of the plants for the treatment of infections, and indicate the potential roles of the plants in drug development programs of the pharmaceutical industry.

Keywords: *Abrus precatorius*, antimicrobial activity, infections, micro-organisms, Minimum Inhibitory Concentration.

INTRODUCTION

It is well known that antibiotics provide the main basis for the therapy of bacterial infections. Since the discovery of these antibiotics and their uses as chemotherapeutic agents there was a belief in the medical fraternity that this would lead to the eventual eradication of infectious diseases. However, over use of antibiotics has become the major factor for the emergence and dissemination of multi-drug resistant strains of several groups of microorganisms (Harbottle *et al.*, 2006), bacteria have the genetic ability to transmit and acquire resistance worldwide emergence of Escherichia coli, Klebsiella pneumoniae, Haemophilus and many other ß-lactamase producers has become a major therapeutic problem. Multi-drug resistant strains of E. coli and K. pneumoniae are widely distributed in hospitals and are increasingly being isolated from community acquired infections (Khan and Musharraf, 2004).

Abrus precatorius Linn, a woody twinning plant belonging to the family Fabaceae (Leguminosae) with characteristic toxic red seeds with a black mark at the base is well known for its medicinal potential. It is native to India, at altitudes up to 1200 m on the outer Himalayas, and is now naturalized in all tropical subtropical regions such as Nigeria and China (Mensah *et al.*, 2011). The leaves of the herb are used to cure fever, cough and cold. The roots are used to treat jaundice and haemoglobinuric bile. Paste of roots is used to cure abdominal pains, tumors and also for abortion. Root is chewed as a snake bite remedy. Hot water extract of fresh root is an anti-malarial and anti-convulsant. Decoction of dried root is used to treat bronchitis and hepatitis. For graying of hair, a paste of leaves and seeds is applied (Garaniya and Bapodra, 2014). Dry seeds of *Abrus precatorius* are used to cure worm infection.

Several scientific reports on A. precatorius have shown numerous biological activities including antioxidant activity (Kaur *et al*., 2022), antidiabetic activity (Boye *et al*., 2020), neuroprotective effect (Premanand and Ganesh, 2010), anti-convulsant (Shenoy *et al*., 2012), and antimicrobial activities (Bobbarala and Vadlapudi, 2009). Sunday *et al*., (2016) demonstrated the antibacterial activity of A. precatorius against clinical isolates. The pathogens were susceptible to aqueous extracts of the leaf, stem and root of A. precatorius at 50 mg/mL, while their susceptibilities at concentrations of 40, 30 and 20 mg/mL varied. A. precatorius has also been reported to be rich in tannins, saponins, alkaloids, flavonoids, terpenoids, steroids and phenols which could effectively contribute to their biological activities (Sunday *et al*., 2016). Because the sustainability of antibiotics in the treatment of infectious diseases requires that there must be replenishment of new drugs and new drug classes as existing therapies are losing their effectiveness, there is need to unravel more antimicrobial agents especially from natural products. This present study evaluated the antimicrobial activities of A. precatorius against selected clinical isolates.

MATERIALS AND METHODS

Plant Collection and Identification

The leaves of *Abrus precatorius* was collected from Obagwa Oforola in Owerri West Local Government of Imo State. The leaves was identified by a plant taxonomist, Dr. C. Duru, in the Department of Science laboratory Technology, Environmental Biology Option, Federal Polytechnic Nekede Owerri.

Preparation of Extract

The leaves of *Abrus precatorius* were washed with clean tap water and dried at room temperature for 4 weeks. After drying, the leaves were pulverized into fine powder using a pulverizing machine and stored in an air tight container for further analysis.

Three Hundred and sixty gram (360g) of the powder was extracted with 1.5L of 80% Methanol using maceration process for 72 hours. The methanol was evaporated using rotary evaporator at 45^{o}c and the extract was refrigerated at 4^{o}c.

Antimicrobial assay

Abrus precatorius crude extract was evaluated for antibacterial and antifungal activities using the disc diffusion method as described in Ajileye *et al*., (2015) with slight modification. ciproflaxacin was used as a positive control. Microorganisms selected for this study were of local importance. The strains were obtained from stocks of culture collections maintained in the federal medical center, Owerri, Nigeria.

Microbial growth was determined as described by Ajileye *et al*., (2015). In this study, minimum inhibitory concentration (MIC) was defined as the lowest concentration of each of the *Abrus precatorius* samples that inhibited the growth of bacteria at 37 °C.

Test organisms

The strains of microorganisms used include clinical isolates comprising of Gram- positive and Gram-negative bacteria and fungi strains. The Gram-negative bacteria used were *Escherichia coli*, *Pseudomonas aeruginosa*, while the Gram-positive strains was *Staphylococcus aureus*. Bacteria were maintained both in cryopreservation medium and on nutrient agar slants and fungi (Candida albican) was maintained on Sabouraud Dextrose Agar slants at 4 °C.

RESULTS AND DISCUSSION

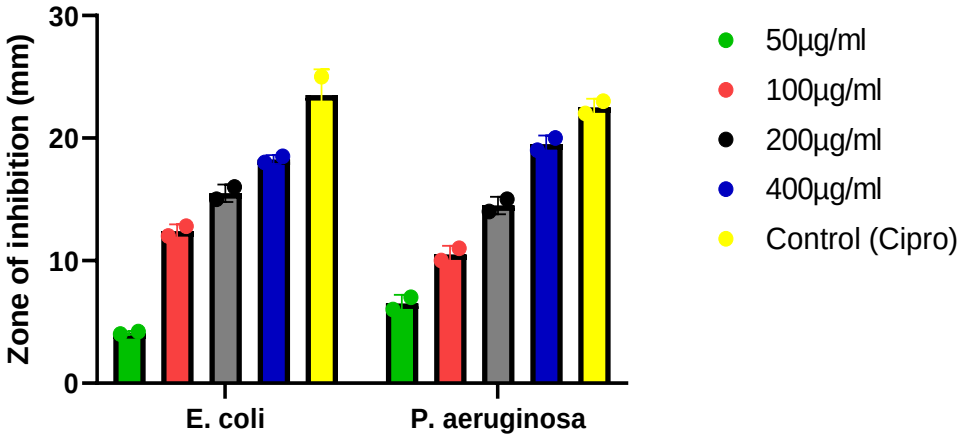

Fig 1: Antibacterial activity of *Abrus precatorius* crude extract against Gram negative bacteria

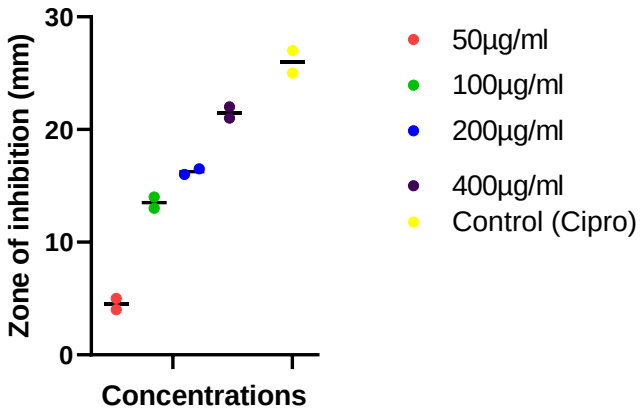

Fig 2: Antibacterial activity of *Abrus precatorius* crude extract against *S. aureus* (Gram positive bacterium)

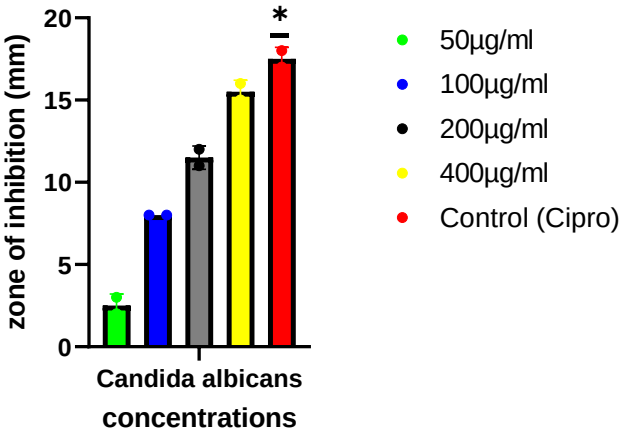

Fig 3: Antifugal activity of *Abrus precatorius* crude extract against *Candida albicans*

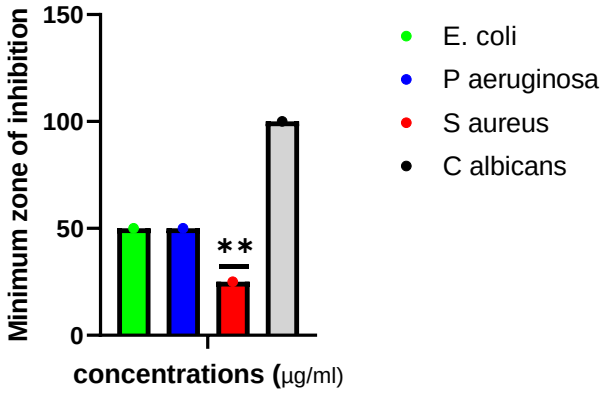

Fig 4: Minimum inhibitory concentration (MIC) of *Abrus precatorius* crude extract

DISCUSSION

The results obtained from antimicrobial tests are presented in figure 1 – 4. The degree of antimicrobial activities was dose dependent. *Abrus precatorius* leaf extract exhibited an appreciable level of antibacterial properties on the selected bacteria isolates used in this study. Its activity against the bacteria isolates was expressed both on the Gram positive and Gram negative organisms, thus depicting the leaf extract as a broad spectrum antimicrobial agent. This therefore supports the use of the plant in folklore remedy. All the bacterial isolates used in this study were susceptible to the leaf extract. In a study carried out by Oka and Nweze (2020), high levels of susceptibility of clinical bacterial wound

isolates to ethanol extract of A. precatorius was reported (Oka and Nweze, 2020). The antibacterial activity of A. precatorius seen in this present study was suggested to be as a result of the abundant phytochemical present in A. precatorius as reported by Sunday *et al*., (2016). Also, the inhibitory potential observed could be produced through the mechanism of action of certain phytochemical compounds contained in the leaves.

The mechanism of action of alkaloids which is a phytochemical found in Abrus precatorius against bacteria is reported to be by inhibition of the nucleic acid synthesis as well as inhibiting the dihydrofolate reductase enzyme. Also, the mechanism of action of flavonoids in inhibiting the growth of micro-organisms is based on inhibiting nucleic acid synthesis, inhibiting the function of the cytoplasmic membrane, and inhibiting the energy metabolism of the micro-organism. Alkaloids equally has similar action as flavonoids.

CONCLUSION

The antimicrobial activities *Abrus precatorius* leaf extract was effectively achieved in this study. The results offer a scientific credence for folklore use of *Abrus precatorius* extracts as a possible source new and effective herbal medicines for the treatment infections caused by microorganisms.

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