ASSESSMENT OF THE ANTIBACTERIAL PROPERTIES OF SELECTED LOCAL PLANT SPECIES FROM FABACEAE, LAMIACEAE, AND ASTERACEAE AND GREEN SYNTHESIS OF NANOPARTICLES WITH ENHANCED ANTIBACTERIAL ACTIVITY

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Abstract

Antibiotic resistance has become a major global health issue showing the necessity of discovering novel antimicrobial agents. This is where the plant-based therapeutics can utilize as an alternative to commercial therapeutics. This study investigates the antibacterial potential of Sri Lankan medicinal plants from the Fabaceae (*Mimosa pudica*), Lamiaceae *(Ocimum tenuiflorum*), and Asteraceae (*Vernonia cinerea*) families and their role in green synthesis of silver nanoparticles (AgNPs) for enhanced antimicrobial activity. Initial phytochemical screening revealed the presence of alkaloids, flavonoids, terpenoids, resins, and phenolic compounds in *M. pudica* and *O. tenuiflorum*, whereas *V. cinerea* lacked flavonoids. Aqueous and methanolic leaf extracts were evaluated individually and in combinations against Gram-positive *Staphylococcus aureus* (ATCC 25923) and Gram-negative *Escherichia coli* (ATCC 25922) using the agar well diffusion method. Individual extracts and their synergistic combinations exhibited inhibitory activity only against *S. aureus*, with zones of inhibition ranging from 9.34 ± 0.34 mm to 12.0 ± 0.6 mm, while no antibacterial activity was observed against *E. coli*. To enhance antimicrobial efficacy, green synthesis of AgNPs was performed using *M. pudica* leaf extract and 1 mM $AgNO_3$ at 1:1, 1:2, and 1:5 ratios which were selected based on ratios reported in previous studies. Successful nanoparticle formation was indicated by a color change from pale yellow to brown and confirmed by UV–visible spectroscopy with a characteristic peak at 450 nm. Prepared AgNPs were characterized using XRD and average crystallite size was 150 nm. The AgNPs exhibited significant antibacterial activity against both bacterial strains. Inhibition zones ranged from 1.17 ± 0.07 cm to 1.33 ± 0.12 cm for *E. coli* and 1.73 ± 0.07 cm to 1.87 ± 0.03 cm *for S. aureus*. These findings show that plant-mediated AgNPs improve antibacterial performance compared to crude extracts, highlighting their potential as eco-friendly antimicrobial agents for future biomedical and pharmaceutical applications.

Keywords: antimicrobial, nanoparticles, phytochemical, therapeutics, well diffusion