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Phytochemical profiling, antimicrobial efficacy, and antioxidant potential of *H. indicum*, *T. terrestris*, *P. olaracea*, and *T. bagwensis* leaf extracts

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Microbial infections remain a global concern, and the emergence of drug resistance continues to hinder effective therapy. Most existing antimicrobial agents are derived from microorganisms and plants. This study evaluated the methanolic leaf extracts of *H. indicum*, *T. terrestris*, *P. olaracea*, and *T. bagwensis* for their phytochemical composition, antimicrobial activity, and *in vitro* antioxidant properties. Three extract concentrations (2000, 1000, and 500 µg/ml) were tested against *Staphylococcus aureus* using the agar well diffusion technique, with vancomycin as a standard. Qualitative and quantitative analyses revealed significant variations ($p < 0.05$) in the levels of saponins, tannins, total phenolics, cardiac glycosides, and terpenoids, with *H. indicum* showing the highest concentrations. Antibacterial activity increased proportionally with extract concentration, with *H. indicum* demonstrating the largest inhibition zones (20.60 ± 0.84 – 11.18 ± 0.28 mm at 2000 µg/ml), followed by *T. bagwensis*, *T. terrestris*, and *P. olaracea*. Vancomycin showed no inhibition, likely due to bacterial resistance. Antioxidant analysis revealed significant differences ($p < 0.05$) among the extracts, with *H. indicum* exhibiting the strongest DPPH radical scavenging activity (IC_{50} = 373.16 ± 3.94 µg/ml), followed by *T. bagwensis* (387.63 ± 4.25 µg/ml), *P. olaracea* (396.85 ± 4.45 µg/ml), and *T. terrestris* (401.00 ± 2.28 µg/ml), compared to ascorbic acid (IC_{50} = 359.73 ± 3.67 µg/ml). These findings indicate that *H. indicum* possesses the most potent antimicrobial and antioxidant activities, likely due to its high content of secondary metabolites. The study supports the potential use of these plant extracts as natural sources of antibacterial and antioxidant agents for therapeutic applications.

Keywords: Phytochemicals, Antimicrobial, DPPH, *H. indicum*, *T. bagwensis*, Drug Resistance, Antioxidant.