

Abstract

TO STUDY THE GENETIC DIVERSITY AND COMPARATIVE PHYTOCHEMICAL ANALYSIS IN *RHEUM* SPECIES

Rheum, a valued medicinal herb of Indian Himalayan Region is facing endangerment due to extensive pharmaceutical exploitation, exhibits remarkable antimicrobial, anticancer, antispasmodic, and neuroprotective properties. The present study employs the use of molecular markers, specifically Random Amplified Polymorphic DNA (RAPD) and Inter-Simple Sequence Repeat (ISSR), to assess the genetic diversity of nine *Rheum* populations across varying altitudes of Uttarakhand region. The Genomic DNA was isolated using a modified CTAB method with few modifications in modified protocol of Doyle and Doyle, DNA was visualized in 0.8% Agarose gel. The isolated DNA was found suitable for the extraction of desired quantity and quality of genomic DNA. The bands showed clear and sharp visible DNA bands DNA quality assessment, using spectrophotometry and gel electrophoresis, precedes genetic diversity analysis. RAPD analysis with 15 primers reveals substantial polymorphism (65.64%) among 142 fragments, emphasizing the plant's genetic diversity. ISSR markers also demonstrate high polymorphism (62.84%) among 189 fragments. The genetic structure, analyzed through Analysis of Molecular Variance (AMOVA), indicates low differentiation among populations. Overall the results indicate low population-level genetic diversity (average $h = 0.25$) but emphasize the species-level diversity. Molecular variance analysis shows minor inter-population differences (5.04% and 2.7%). Dendrogram analysis correlates genetic diversity with altitude, revealing distinct clusters. The maximum Conservation recommendations are proposed based on the obtained genetic data, although marker superiority and reproducibility remain unexplored. The study underscores the suitability of both RAPD and ISSR markers for assessing genetic variability in *Rheum species*, providing crucial insights for conservation strategies.

Phytochemical screening identifies various compounds, with high-altitude plants exhibiting richer phytochemical content. Thin-layer chromatography (TLC) quantifies emodin, a key compound, with antimicrobial properties. Antimicrobial activity against *S. aureus* and *Salmonella* is demonstrated in specific extracts. The study underscores the potential medicinal value of *Rheum emodi* and proposes conservation strategies based on genetic and phytochemical data. Systematic

cultivation is recommended to minimize exploitation and ensure a sustainable supply of plant material for pharmaceutical applications. The research contributes novel insights into the genetic diversity and medicinal properties of *Rheum species*, guiding conservation efforts and supporting the development of new drugs.

Keywords: Pharmacological activities, Genetic Diversity, Molecular Markers, RAPD, AMOVA, Cluster Analysis, Conservation