

**Research Article**

## Estimation of genetic diversity and population structure of ten scarce Eastern Himalayan *Rhododendron* species

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### ABSTRACT

Ten rare, threatened, and endangered *Rhododendron* species were collected from different altitudinal ranges starting from 2247masl to 3580masl. of Eastern Himalaya (particularly Darjeeling Hills) were studied by polymerase chain reaction (PCR) using randomly amplified polymorphic DNA sequences (RAPD) to measure the degree of the genetic diversity and relationship among the species which are urgently needed to promote effective conservation and management activities. Initially, 19 decamer oligonucleotide primers were screened on ten samples for unambiguous and reproducible band patterns. Out of nineteen, six decamer oligonucleotide primers finally yielding the best results were selected and used for the analysis of present samples. Mean 61 alleles were amplified by using six primers, among ten samples. Total 126 were unique bands showing an average of 79.43% polymorphism. The Genetic Similarity Coefficient (GS) was ranging from 0.45455 to 0.93827. The present study shows an average low level of genetic diversity (PIC= 0.2096, Hs= 0.979, Ho= 0.986, Ht= 0.985, I= 3.973). The population of *Rhododendron* shows a negative value of inbreeding coefficients (Fis < 0) indicating heterozygotes produced by the population due to crosses happens in between genetically distant individuals but the value does not support that there is a chance of outbreeding depression and population bottleneck in recent future. Results of AMOVA show that variation among and within populations is 1% and 99% respectively. The mean inbreeding coefficient (Fst) within subpopulations is 0.006. A dendrogram based on RAPD markers using the neighbor-joining cluster analysis method produced from Jaccards estimates using Free Tree software divided nine (out of ten) *Rhododendron* species into two main sister groups this result also supported by Principal Coordinates Analysis (PCoA). The obtained RAPD analysis results also suggested that some rare, threatened, and endangered species of *Rhododendron* in the present study could maintain moderate levels of genetic diversity. STRUCTURE assessment ( $\Delta K= 5$ ) showed the selected species distributed distantly from each other and estimated that the *R. falconeri* genotype is the maximum level of admixture among the ten species. Results of Mantel's test show a positive correlation between geographical distance and genetic similarity or dissimilarity of ten *Rhododendron* species. Whereas the positive regression analysis value ( $R^2= 0.0809$ ) does not tally for the deep connection between geographical distance and genetic similarity or dissimilarity among the evaluated species. Based on the results, summarized that *Rhododendron* species of Eastern Himalaya are at a high risk of outcrossing depression, which will lead to a population bottleneck. Therefore, immediate conservation (*in-situ* and *ex-situ*) measures have to be taken for these rare, threatened, endangered, economically, and ethno-botanically important *Rhododendron* species.

**Key words:** *Rhododendron*, Genetic diversity, plant protection and conservation, outbreeding depression, population bottleneck

