

## Multidisciplinary Approaches to the Study of High-Altitude Biodiversity: A Case Study on *Artemisia eriantha* in the Central Apennines, Italy

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### Abstract

The conservation of high-altitude biodiversity requires multidisciplinary approaches integrating botanical, genetic, ecological, and microbiological perspectives to understand species' resilience, evolutionary dynamics, and ecological interactions in extreme environments. These integrated methods are crucial for identifying factors influencing species' survival in fragile, high-altitude ecosystems threatened by harsh conditions and climate change. Genetic studies reveal population structure and diversity, microbiological analyses explore plant-microbe interactions, and ecological assessments examine habitat conditions. Together, these approaches provide a comprehensive understanding of the factors shaping species adaptation and persistence. The present study investigates the genetic diversity and rhizosphere microbiota related to *Artemisia eriantha*, a glacial relict endemic to the Central Apennines. Plant and soil samples were collected from three sites in the Abruzzo region: Monte Corvo, Monte Portella (Gran Sasso massif), and Monte Focalone (Majella massif). Genetic analysis using Amplified Fragment Length Polymorphism (AFLP) markers revealed high within-population variability typical of outcrossing species and distinct population clustering. Rhizosphere microbiota diversity, analyzed via 16S rRNA metabarcoding, showed site-specific differences, with Monte Portella exhibiting lower diversity and the presence of unique genera, such as *Streptomyces* and *Solirubrobacter*, further underscore the localized adaptation of microbiota to site-specific conditions. The findings highlight how environmental factors shape plant genetic structure and associated microbiota, emphasizing the importance of multidisciplinary approaches. This integrated analysis provides a framework for targeted *in-situ* and *ex-situ* conservation strategies for endangered alpine species.

**Keywords:** plants, microorganisms, mountain environment.