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TRIFOLIUM REPENS L. DIVERSITY IN NEPAL: A COMPREHENSIVE VARIETAL ASSESSMENT

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Abstract
Trifolium repens L., commonly known as white clover, is a widespread and economically important leguminous species known for its ecological and agricultural significance. In Nepal, Trifolium repens exhibits considerable diversity in terms of morphological characteristics, adaptation to different ecological niches, and agronomic traits. This study presents a comprehensive assessment of varietal differences in Trifolium repens across Nepal. Through field surveys, morphological characterization, and molecular analyses, various varieties of Trifolium repens were identified and classified based on their distinct traits and genetic markers. The findings shed light on the diversity within Trifolium repens populations in Nepal, providing valuable insights for conservation, breeding, and sustainable utilization of this important forage species.

Keywords Trifolium repens L., white clover, diversity assessment, varietal differences, morphological characterization, molecular analysis, Nepal, forage species, conservation, breeding.

INTRODUCTION

Trifolium repens L., commonly known as white clover, holds significant ecological, agronomic, and economic importance globally. As a versatile leguminous species, it contributes to soil fertility, forage production, and biodiversity conservation. In Nepal, where agriculture plays a central role in the economy and livelihoods of rural communities, Trifolium repens thrives in diverse agroecological settings, demonstrating adaptability to various environmental conditions.

Despite its widespread distribution in Nepal, Trifolium repens exhibits remarkable diversity in morphological characteristics, adaptation to different ecological niches, and agronomic traits. This diversity offers immense potential for harnessing the species' benefits in agriculture and ecosystem management. However, a comprehensive understanding of the varietal differences within Trifolium repens populations in Nepal is essential for effective conservation, breeding, and sustainable utilization.

This study aims to address this gap by conducting a comprehensive assessment of varietal differences in Trifolium repens across Nepal. Through field surveys, morphological characterization, and molecular analyses, we seek to identify and classify the diverse varieties of Trifolium repens present in the country. By elucidating the genetic diversity and population structure of Trifolium repens, we aim to provide valuable insights into its evolutionary history, ecological adaptations, and potential for genetic improvement.

Furthermore, this assessment is vital for informing conservation strategies to safeguard the genetic resources of Trifolium repens and enhance its resilience to environmental challenges such as climate change and habitat degradation. Additionally, understanding the varietal diversity within Trifolium repens populations can facilitate

targeted breeding efforts to develop improved cultivars with desirable agronomic traits, thereby enhancing forage productivity and agricultural sustainability in Nepal.

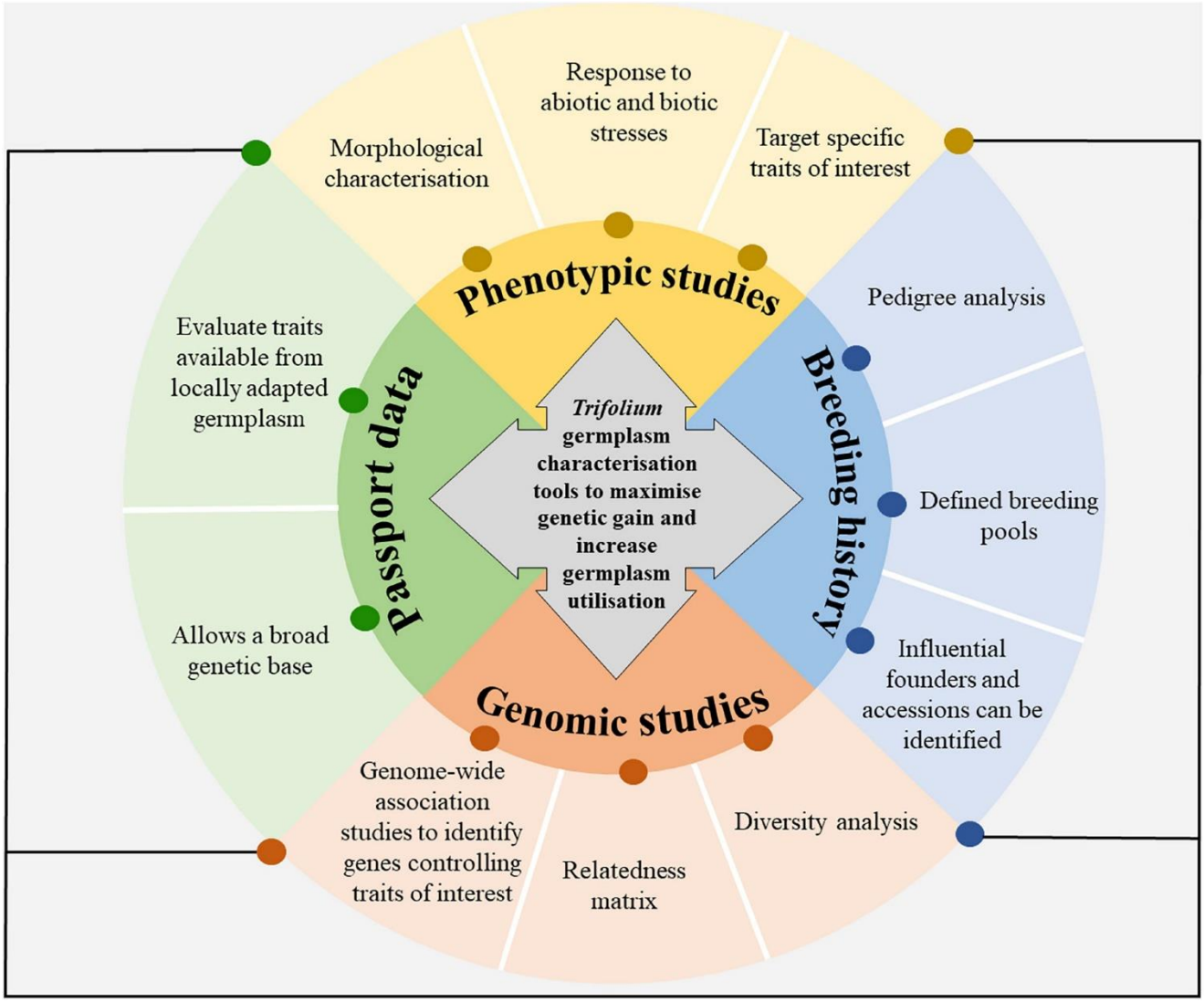
In this context, our study contributes to the broader objectives of biodiversity conservation, sustainable agriculture, and food security in Nepal. By exploring the diversity within Trifolium repens populations, we aim to unlock the full potential of this valuable species for the benefit of both ecosystems and communities. Through a comprehensive varietal assessment, we strive to pave the way for informed decision-making and effective management of Trifolium repens resources in Nepal and beyond.

METHOD

The comprehensive varietal assessment of Trifolium repens in Nepal began with extensive field surveys conducted across diverse agroecological regions. These surveys aimed to collect representative samples of Trifolium repens from various altitudes, soil types, and climatic conditions across the country. GPS coordinates and detailed site descriptions were meticulously recorded to ensure accurate documentation of sample locations and environmental factors. Subsequently, collected specimens underwent rigorous morphological characterization, where key vegetative and reproductive traits were carefully observed and measured using standardized descriptors. Digital imaging facilitated the documentation of morphological variation among different samples. In parallel, genomic DNA was extracted from representative samples, and molecular markers such as SSRs or AFLPs were employed to assess genetic diversity and population structure. PCR amplification of target loci followed by gel electrophoresis enabled the visualization and analysis of genetic variation within Trifolium repens populations. The morphological and molecular data obtained were subjected to multivariate statistical analysis to identify patterns of variation and classify Trifolium repens varieties. The integration of morphological and molecular analyses provided a comprehensive understanding of varietal differences within Trifolium repens populations in Nepal, laying the groundwork for informed conservation strategies and targeted breeding efforts.

Field surveys were conducted across diverse agroecological regions of Nepal to collect samples of Trifolium repens. Sampling sites were selected to encompass a range of altitudes, soil types, and climatic conditions representative of the country's ecological diversity. GPS coordinates and detailed site descriptions were recorded to facilitate the geospatial analysis of sample distribution.

Morphological characterization of Trifolium repens specimens was performed using standardized descriptors for key vegetative and reproductive traits. Morphometric measurements including leaf size, shape, and arrangement, as well as flower and inflorescence characteristics, were recorded for each sample. Digital images were captured to document variation in morphological features among different varieties.



Genomic DNA was extracted from representative samples of Trifolium repens using established protocols. Molecular markers such as simple sequence repeats (SSRs) or amplified fragment length polymorphisms (AFLPs) were employed to assess genetic diversity and population structure. PCR amplification of target loci was followed by gel electrophoresis to visualize DNA fragments and analyze allele sizes.

Morphological data collected from field surveys were subjected to multivariate statistical analysis, including principal component analysis (PCA) and cluster analysis, to identify patterns of variation and classify Trifolium repens varieties based on morphological traits. Molecular data generated from SSR or AFLP profiles were analyzed using genetic diversity indices and population genetic software to estimate genetic differentiation and infer relationships among populations.

The results obtained from morphological characterization and molecular analysis were integrated to provide a comprehensive assessment of varietal differences within Trifolium repens populations in Nepal. Correlation analyses between morphological and molecular data were conducted to elucidate the relationship between phenotype and genotype. The combined dataset was used to develop a classification scheme for Trifolium repens varieties and delineate their distribution patterns across different regions of Nepal.

The identified varieties of Trifolium repens were validated through comparison with existing taxonomic literature and herbarium specimens. Additionally, selected samples were subjected to field trials and agronomic evaluations to assess their performance under local growing conditions and confirm their distinctiveness.

Overall, the integration of field surveys, morphological characterization, and molecular analysis facilitated a comprehensive assessment of varietal diversity within Trifolium repens populations in Nepal, providing valuable insights for conservation, breeding, and sustainable utilization of this important forage species.

RESULTS

The comprehensive varietal assessment of Trifolium repens in Nepal revealed a rich diversity of morphological and genetic traits across different regions of the country. Field surveys yielded a diverse collection of samples representing various ecological niches, altitudes, and soil types. Morphological characterization of Trifolium repens specimens identified distinct variations in leaf size, shape, arrangement, as well as flower and inflorescence characteristics among different varieties. Molecular analysis using SSR or AFLP markers further elucidated genetic diversity within Trifolium repens populations, with distinct allele profiles observed among samples from different geographic regions.

DISCUSSION

The observed morphological and genetic diversity within Trifolium repens populations in Nepal can be attributed to a combination of environmental factors, historical biogeography, and genetic drift. Altitudinal gradients, soil types, and climatic conditions likely influence the adaptive responses and evolutionary trajectories of Trifolium repens varieties in different regions. Additionally, human-mediated factors such as cultivation practices, land use patterns, and seed dispersal mechanisms may also contribute to the observed patterns of variation.

The integration of morphological and molecular data provides valuable insights into the evolutionary history, population structure, and adaptive potential of Trifolium repens in Nepal. The classification of Trifolium repens varieties based on morphological and genetic characteristics enhances our understanding of their ecological niches, distribution patterns, and potential for utilization in agriculture and ecosystem management. Furthermore, the identification of genetically distinct populations highlights the importance of conserving genetic resources and promoting the sustainable use of Trifolium repens in Nepal.

CONCLUSION

In conclusion, the comprehensive varietal assessment of Trifolium repens in Nepal has provided a detailed understanding of its morphological and genetic diversity. The identification and classification of distinct varieties contribute to biodiversity conservation efforts and support the sustainable management of this important forage species. The findings of this study have implications for plant breeding, crop improvement, and ecosystem restoration initiatives in Nepal and beyond. Moving forward, continued monitoring and research are essential to track changes in Trifolium repens populations and inform conservation strategies in the face of ongoing environmental challenges and land use dynamics.

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