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Genetic resources and precise gene editing for targeted improvement of barley abiotic stress tolerance

Key words: CRISPR; Gene function; Drought; Genetic improvement; Transcription regulation; Breeding

Research Summary

This review provides a comprehensive gene pool that is responsible for abiotic stress tolerance in barley, along with a discussion on the use of modern biotechnologies such as CRISPR/Cas9 gene editing to improve plant resilience. Main focus is on:

- The economic losses in worldwide grain crop production due to abiotic stresses
- How to utilise current genetic resources for crop improvement
- The extension of gene editing strategies for precise breeding

Innovation points

- Candidate genes for improving barley abiotic stress tolerance through gene editing.

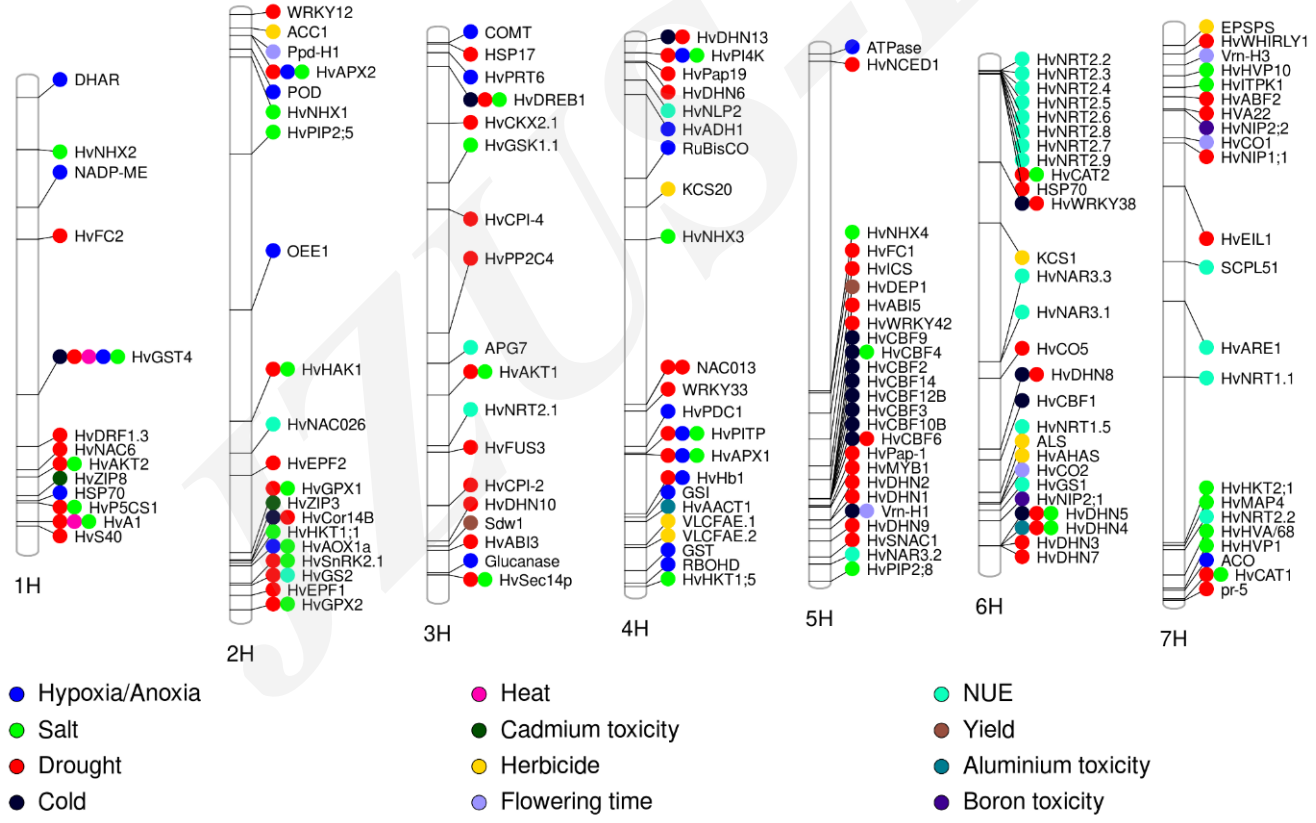

Figure 2

Innovation points

Comprehensive tables were generated to summarize the functional genes for abiotic stresses.

Table 1: Genetic resources including germplasms and functional genes with potential for barley improvement

Table S1: Detailed summary of more than 150 barley functional genes as a targeted collection for gene editing.

Innovation points

- CRISPR/Cas9 mediated multiplex gene editing, modification of the promoter, gene activation, base or prime editing are the key gene editing strategies.

- Validating the candidate gene through genetic studies or VIGS is proposed.

- Breaking the genotype dependency in transformation, by using virus-based vectors, nanoparticles or developmental regulators such as WUS2, WOX5 is suggested.