

## Development of a New Method for the Evaluation of Heat Tolerant Wheat Genotypes for Genetic Studies and Wheat Breeding

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**Abstract :** Heat is one of the major abiotic stresses limiting wheat production worldwide. To identify heat tolerant genotypes, a newly designed system involving a large plastic box holding many layers of filter papers positioned vertically with wheat seeds sown in between for the ease of screening large number of wheat geno types was developed and used to study heat tolerance. A collection of 499 wheat geno types were screened under heat stress (35°C) and non-stress (25°C) conditions using the new method. Compared with those under non-stress conditions, a substantial and very significant reduction in seedling length (SL) under heat stress was observed with an average reduction of 11.7 cm ( $P < 0.01$ ). A damage index (DI) of each geno type based on SL under the two temperatures was calculated and used to rank the genotypes. Three hexaploid geno types of *Triticum aestivum* [Perenjori (DI= -0.09), Pakistan W 20B (-0.18) and SST16 (-0.28)], all growing better at 35°C than at 25°C were identified as extremely heat tolerant (EHT). Two hexaploid genotypes of *T. aestivum* [Synthetic wheat (0.93) and Stiletto (0.92)] and two tetraploid genotypes of *T. turgidum* ssp *dicoccoides* [G3211 (0.98) and G3100 (0.93)] were identified as extremely heat susceptible (EHS). Another 14 geno types were classified as heat tolerant (HT) and 478 as heat susceptible (HS). Extremely heat tolerant and heat susceptible geno types were used to develop re combinant inbreeding line populations for genetic studies. Four major QTLs, HTI4D, HTI3B.1, HTI3B.2 and HTI3A located on wheat chromosomes 4D, 3B (x2) and 3A, explaining up to 34.67 %, 28.93 %, 13.46% % and 11.34% phenotypic variation, respectively, were detected. The four QTLs together accounted for 88.40% of the total phenotypic variation. Random wheat geno types possessing the four heat tolerant alleles performed significantly better under the heat condition than those lacking the heat tolerant alleles indicating the importance of the four QTLs in conferring heat tolerance in wheat. Molecular markers are being developed for marker assisted breeding of heat tolerant wheat.

**Keywords :** bread wheat, heat tolerance, screening, RILs, QTL mapping, association analysis

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