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## High-Density Molecular Characterisation and Association Mapping in Ethiopian Durum Wheat Landraces Reveals High Diversity and Potential for Wheat Breeding

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### Abstract

Durum wheat (*Triticum turgidum* subsp. *durum*) improvement and adaptation to emerging environmental and climatic threats is hampered by the limited amount of allelic variation included in its elite breeding pool. It is therefore a priority to identify adaptive traits by exploring germplasm from different parts of the world, particularly centres of origin or diversity. Here we report the extensive molecular and phenotypic characterisation of hundreds of Ethiopian durum wheat landraces and improved lines, with the underlying assumption that new allelic diversity will provide novel loci to international wheat breeding through quantitative trait loci (QTL) mapping. We score 30,155 single nucleotide polymorphisms and use them to survey the structure and molecular diversity available in the panel. We report the uniqueness of Ethiopian germplasm using a siding collection of Mediterranean durum wheat accessions. We phenotype the Ethiopian panel for ten agronomic traits in two highly diversified Ethiopian environments for two consecutive years, and use this information to conduct a genome wide association study. We identify several loci underpinning agronomic traits of interest, both confirming loci already reported and describing new promising genomic regions. These loci may be efficiently targeted with molecular markers already available to conduct marker assisted selection in Ethiopian and international wheat. We show that Ethiopian durum wheat represents an important and mostly unexplored source of durum wheat diversity. We propose this panel as a novel resource for accumulating QTL mapping experiments on the superior diversity of Ethiopian durum wheat, providing the initial step for a quantitative, methodical exploitation of untapped diversity in producing a better wheat.

**Keywords:** Association mapping, Durum wheat, Ethiopia, QTL