

DURUM WHEAT GENETIC ARCHITECTURE EVOLUTION THROUGH MORPHOLOGICAL, KERNEL QUALITY-RELATED TRAITS AND ASSOCIATION MAPPING STUDIES

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Durum wheat (*Triticum durum* Desf.) is a worldwide staple crop cultivated mainly in the Mediterranean basin. In South Italy, the durum wheat cultivation has a long-time tradition of growing and breeding but the selection of high-yielding varieties caused a loss of variability. The aim of this study was to provide a more comprehensive view of durum wheat genetic architecture evolution through morphological, kernel quality-related traits and association mapping analyses. One-hundred and twenty-three Italian durum wheat accessions from different geographical areas including landraces, old and elite varieties were phenotyped and genotyped. The accessions were grown in South Italy in two areas, Metaponto (MT, Basilicata) and Foggia (Apuglia) in 2018-19. The morphological characterization was carried out using 33 plant and kernel traits, including the UPOV descriptors. Highly significant differences, between environments (E), genotypes (G) and GxE interaction, were detected by ANOVAs for 18 morphological traits except for the number of kernels/spikes, kernels roundness and thickness. Principal Component Analysis (PCA) in the first two dimensions explained 48.75 % of the total variance. Fifteen UPOV traits, according to descriptors for durum wheat, were analysed to determine genetic diversity and differences among groups (landraces, old and modern varieties) with the normalized Shannon index (H'). H' average value ranged from 0.85 (Foggia) to 0.82 (Metaponto). All UPOV traits were significant for χ^2 test except brush hair length in seed dorsal view and awn colour. Kernel quality-related trait statistics between environments and among groups were higher in the old varieties and landraces than in the elite varieties. A huge variability was detected at morphological level, with landraces being more diversified than elite varieties. Genetic loci related with agromorphological, phenological and kernel quality-related traits were investigated using single nucleotide polymorphisms markers (15K wheat Illumina SNP chip). Significant marker-trait associations were identified for the phenotypes analysed and thus provides an opportunity for supporting the protocol for official examination of Distinctness, Uniformity and Stability (DUS) of varieties of durum wheat entered for National Variety List (NVL) and Plant Breeders' Rights. Furthermore, the phenotypic and genotypic data acquired for the genetic materials under threat of genetic erosion (i.e. landraces and old varieties) could be

used to start the administrative procedure for the registration to the NVL as "conservation variety"

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