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CHLOROPHYLL FLUORESCENCE AS A PROXY TO IDENTIFY QTLS FOR HEAT-STRESS TOLERANCE IN DURUM WHEAT

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Heat stress (HS) is one of the main constrains to durum wheat (Triticum turgidum L. var. durum Desf.) production worldwide, particularly in Mediterranean countries. Furthermore, it is a complex quantitative trait quite laborious to evaluate. Chlorophyll fluorescence (CF) measured as photochemical efficiency ratio (Fv/Fm) has been used as a proxy to evaluate HS tolerance in wheat. This genome-wide association study (GWAS) was performed in order to identify QTLs for CF under both normal and heat-stressed conditions and verify their coincidence with QTLs for HS tolerance. A panel of 183 cultivars of T. durum elite cultivars suitable for GWAS was evaluated in greenhouse based on a randomized block design with three reps. Each experimental unit (3-L pot) included 12 plants. All pots were kept in well-watered conditions at 23/20 °C (168 h light/dark). The HS treatments (5 and 7 days at 38/28 °C in 16/8 h light/dark) were applied at the 4-leaves unfolded stage (Zadoks, 1974). After that, stressed plants were returned to control conditions for recovery (3 days). Chlorophyll fluorescence was measured with the Light-Induced Fluorescence Technique device, on both control and HS plants (i) 5 and 7 days after the start of the HS treatment, and (ii) 3 days after the end of the HS treatment. GWAS analysis based upon the Illumina iSelect wheat 90K SNP assay identified 21 main loci with significant effects (-log10 > 3.0) on Fv'/Fm'. GWAS confirmed a highly significant region on Chr. 6B which was highlighted in all experimental conditions, hence suggesting the likely presence of a constitutively expressed QTL. In the same way, one QTL on chr. 3B region was detected in all stressed conditions suggesting the presence of a major QTL affecting HS tolerance in durum wheat.

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