Latitude and epistatic effects uncover novel stable regulators of flowering time on chromosomes 5A and 3A in winter wheat

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Abstract

Modern bread wheat has a huge genetic potential to adjust its heading date with favorable conditions that has remained largely unexplored so far. In this study, we used an association panel of in Germany adapted cultivars that was tested in multi-location field trials across Germany over three years. The genotypic response to climatic parameters variation depending on location and year uncovered the implication of photoperiod in promoting transition to flowering in higher latitudes, while spring temperature accelerates flowering in lower ones. Spring temperature overdominates other factors in decreasing the days to heading whereas the higher amount of solar radiation is delaying it. Genome wide scan detected a so far unknown stable locus TaHd14 on chromosome 5A. Including non-adapted cultivars, the exotic allele TaHd119 on chromosome 3A could be identified. The later explains up to 33% of the genetic variance and accelerates heading date by 5.63 days. The response to the competition of latitude dependent climatic variables detected fine tuning QTL responding to temperature and photoperiod in lower and higher latitudes, respectively. A novel locus TaHd12 on chromosome 5A showed significant epistatic interactions with 15 known operators of HD regulation when exotic cultivars were included in the analysis

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