BOOK OF ABSTRACTS

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7–9 November 2023

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6 November 2023

Wernigerode, Germany

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CONTENTS

Effect of *PPD-D1*, photoperiod sensitivity gene on yield related traits under stress-free conditions in wheat

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The dynamics of plant development not only has an impact on ecological adaptation but also contributes to the realization of genetically determined yield potentials in various environments. Dissecting the genetic determinants of plant development becomes urgent due to the global climate change, which can seriously affect and even disrupt the locally adapted developmental patterns. In order to determine the role plant developmental loci played in local adaptation and yield formation, a panel of 188 winter and facultative wheat cultivars from diverse geographic locations were characterized with the 15K Illumina Single Nucleotide Polymorphism (SNP) chip and functional markers of several plant developmental genes, and included into a multi-season field experiment. Genome-wide association analyses were conducted on five consecutive developmental phases spanning from the first node appearance to full heading together with various grain yield–related parameters. The panel was balanced for the *PPD-D1* photoperiod response gene, which facilitated the analyses in the two subsets of photoperiod-insensitive and -sensitive genotypes in addition to the complete panel. *PPD-D1* was the single highest source, explaining 12.1%–19.0% of the phenotypic variation in the successive developmental phases. In addition, 21 minor developmental loci were identified, each one explaining only small portions of the variance, but, together, their effects amounted to 16.6%–50.6% of phenotypic variance. Eight loci were independent of *PPD-D1*. Seven loci were only detectable in the *PPD-D1* insensitive genetic background, and six loci were only detectable in the sensitive background. The combination of *PPD-D1* insensitivity and sensitivity with the extremities of early or late alleles in the corresponding minor developmental loci resulted in significantly altered and distinct plant developmental patterns with detectable outcomes on some yield-related traits.

In conclusions, the contrasting combination of the early-late alleles of the minor loci with *PPD-D1* insensitivity–sensitivity alleles may lead to a series of developmental range that may be utilized to ensure a greater ecological plasticity of plant development. *PPD-D1* together with the minor loci also contribute to several morphological traits, but their effects on yields and yield-related traits depend more on the environment. The indirect effects of *PPD-D1* on yield-related traits may appear mostly as causal consequences of altered plant developmental patterns under unfavourable growing conditions that may occur randomly from the start of the intensive stem elongation for any of the two *PPD-D1* allele phases.

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