

Advanced back-cross QTL mapping of resistance to Fusarium head blight derived from *Triticum macha* (Georgian spelt wheat)

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Abstract

While many reports on genetic analysis of Fusarium head blight (FHB) resistance in bread wheat have been published during the past decade, only limited information is available on FHB resistance derived from wheat relatives. In this contribution we report the genetic analysis of FHB resistance derived from *Triticum macha* (Georgian spelt wheat). As the origin of *T. macha* is in the Caucasian region, it is supposed that its FHB resistance differs from other well-investigated resistance sources. In order to introduce valuable alleles from the landrace *T. macha* into a modern genetic background we adopted an advanced back-cross QTL mapping scheme (TANKSLEY and NELSON 1996). A backcross-derived recombinant-inbred line population of 321 BC₂F₃ lines was developed from a cross of *T. macha* with the Austrian winter wheat cultivar Furore. The population was evaluated for Fusarium resistance in seven field experiments during four seasons using artificial inoculations. In addition several plant morphological and developmental traits were evaluated, such as plant height, flowering date, and spike morphology. 300 lines of the population were genetically fingerprinted using SSR and AFLP markers. Map construction was done with an updated version of CarthaGène software (De GIVRY et al. 2005). For QTL mapping QGene software (NELSON 1997) was used.

The resulting linkage map covered 33 linkage groups with 560 markers. Five novel FHB-resistance QTL, all descending from *T. macha*, were found on four chromosomes (2A, 2B, 5A, 5B). These novel *T. macha* derived QTL appear valuable for broadening the genetic basis and diversity of FHB resistance in wheat. The major FHB resistance QTL at chromosome 5A is closely associated with the wild-type allele *q*, but it is currently unclear whether *q* has a pleiotropic effect on FHB resistance or is closely linked to a nearby resistance QTL. Although several QTL were associated with plant height, only the 2BL FHB resistance QTL co-located with a plant height QTL. Selected lines and markers linked to FHB resistance QTL from this study appear useful for practical resistance breeding because they carry novel QTL from the landrace *T. macha* in an already agronomically adapted background. In addition selected lines carrying *q* (spelt wheat ear type) could be useful as crossing partner for spelt wheat breeding. For further details see BUERSTMAYR et al. (2011).

Keywords

AB-QTL analysis, Fusarium head blight, morphological traits, spelt wheat, *Triticum macha*

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References

BUERSTMAYR M, LEMMENS M, STEINER B, BUERSTMAYR H, 2011: Advanced backcross QTL mapping of resistance to Fusarium head blight and plant morphological traits in a *Triticum macha* × *T. aestivum* population. *Theor Appl Genet* 123: 293-306.

De GIVRY S, BOUCHEZ M, CHABRIER P, MILAN D, SCHIEX T, 2005: CARTHAGENE: multipopulation integrated genetic and radiated hybrid mapping. *Bioinformatics* 21: 1703-1704.

NELSON JC, 1997: QGENE: Software for marker-based genomic analysis and breeding. *Mol Breed* 3: 239-245.

TANKSLEY SD, NELSON JC, 1996: Advanced backcross QTL analysis: a method for the simultaneous discovery and transfer of valuable QTLs from unadapted germplasm into elite breeding lines. *Theor Appl Genet* 92: 191-203.

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