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研究论文

1BL/1RS易位对小麦产量性状和白粉病抗性的影响及其QTL分析

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摘要 用PH82-2/内乡188杂交后代240个$F_{5:6}$家系，按照α-lattice设计，分别种植在安阳、焦作和泰安，对产量和抗白粉病等性状进行了考察。利用SSR和蛋白标记对群体进行部分连锁作图，分析1BL/1RS易位对产量及其相关性状的遗传效应。结果表明，1BL/1RS易位系对产量、穗数/m^2和抽穗期的影响不显著；易位系的千粒重和白粉病抗性显著高于非易位系，但株高和穗粒数减少。利用复合区间作图法进行QTL分析，发现1RS携带1个降低株高的微效QTL，位于HVM20~Sec-1标记区间，可解释4.28%的表型变异；1RS和1BL携带抗白粉病QTL，分别位于HVM20~Sec-1和Xgwm24~Xwmc320标记区间，解释4.81%和4.66%的表型变异。鉴于1BL/1RS易位对产量的正向作用不明显，其主效抗性已丧失，又对加工品质有明显的负向影响，在小麦品质育种上最好不予应用。

关键词 普通小麦 1BL/1RS易位 产量性状 QTL

分类号 S512

Effect of 1BL/1RS Translocation on Yield Traits and Powdery Mildew Resistance in Common Wheat and QTL Analysis

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Abstract The 1BL/1RS translocation has been widely used by wheat breeders to enhance agronomic performance and disease resistance. The objective of this study was to analyze the genetic effect of 1BL/1RS translocation on yield traits and powdery mildew resistance in common wheat. A total of 240 $F_{5:6}$ lines from the cross PH82-2/Neixiang 188 were planted with a latinized alpha-lattice design in Anyang and Jiaozuo of Henan Province and Tai’an of Shandong Province, respectively. Grain yield, thousand-grain weight, grain number per spike, spike number, plant height, heading date, and powdery mildew severity were investigated in field trials. Fourteen SSR and storage protein markers on chromosome 1BL/1RS were used to analyze the population and construct a linkage map. QTL analysis was conducted with the software QTL Cartographer 2.5. A significantly higher thousand-grain weight, reduced grain number per spike and plant height, and lower powdery mildew severity in 1BL/1RS translocation lines were observed, whereas no significant difference was observed in grain yield, spike number and heading date between 1BL/1RS and 1B/1B lines. With the method of composite interval mapping (CIM), the putative QTLs of plant height and powdery mildew resistance were detected on 1BL/1RS translocation segment across three environments. A QTL in the interval of HVM20 – Sec-1 was detected for reducing plant height on 1BL/1RS translocation segment explaining 4.28% of the phenotypic variation. Two QTLs for powdery mildew resistance were found on 1BL/1RS translocation segment (HVM20 – Sec-1) and 1BL (Xgwm24 – Xwmc320), accounting for 4.81% and 4.66% of phenotypic variance, respectively. The QTL for powdery mildew resistance on 1BL/1RS translocation segment may be the residual effect of Pm8. From breeding point of view, 1BL/1RS translocations are generally not recommended in yield and quality wheat breeding at present, due to inconsistent contribution to yield, lost resistance to disease and negative effect on quality.

Key words Common wheat (Triticum aestivum L.) 1BL/1RS translocation Yield trait QTL

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