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研究论文

小麦抗白粉病新基因的AFLP和SSR标记及其染色体定位

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摘要 M53 (YAV2/TEZ//Ae.squarrosa 249) 是硬粒小麦与粗山羊草的双二倍体合成种，携带一个抗白粉病新基因，暂命名为Pm-M53，该基因对北京地区白粉病优势生理小种15号表现免疫抗性。本研究利用来源于杂交组合M53/宛7107的一个F2群体,在苗期采用白粉病15号小种（Blumeria graminis f. sp. tritici）接种，抗病反应型鉴定表明，抗感比例符合3∶1，说明其抗性受显性单基因控制；对部分F2植株的F3株系的抗病鉴定进一步证明了F2鉴定的可靠性；利用AFLP和SSR标记技术结合F2分离群体对目的基因进行了遗传作图，将目的基因定位在5D染色体的长臂上。其中AFLP标记P16M16-109(Apm109)和P5M16-161(Apm161)与目的基因的遗传距离分别为1.0和3.0 cM。SSR标记Xwmc289b、Xgwm583和Xgwm292与目的基因的遗传距离分别为20.0、33.0和24.0 cM。这些标记位于目的基因的两侧。利用中国春遗传背景的缺-四体和双端体结合AFLP标记Apm109确证了SSR标记定位的可靠性，进一步证明该基因是一个新的抗白粉病基因。

关键词 小麦 白粉病 新基因 遗传作图 染色体定位

分类号 S512

Mapping of a Novel Gene Conferring Resistance to Wheat Powdery Mildew Using AFLP and SSR Markers

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Abstract Powdery mildew caused by Blumeria graminis f. sp. tritici (Bgt) is one of the most serious diseases in wheat. DNA markers such as AFLP and SSR have been very effective for defining and mapping new resistance genes in plants. M53 (YAV2/TEZ//Ae. squarrosa 249) is a synthetic wheat of Triticum durum and Aegilops tauschii. This synthetic wheat carries a resistance gene, tentatively designated Pm-M53, conferring resistance to the No.15 isolate of Bgt that has been prevailing in wheat fields in Beijing area and endangering the local wheat production in recent years. In the present study, the resistance pattern of a F2 population (118 individuals) derived from cross of M53 and Wan7107 was analyzed through inoculation with No.15 isolate. The response patterns showed that the R∶S segregation ratio fits 3∶1, suggesting that the gene of interest be a single dominant gene, which was confirmed by F3 progeny test. AFLP and SSR markers were then used to search genetically linked markers to the target gene. Using JoinMap V3.0 with Kosambi’s function and other options left at default values, two AFLP markers P16M16-109 (Apm109) and P5M16-161 (Apm161) were identified to be tightly linked to Pm-M53, with genetic distances of 1.0 and 3.0 cM, respectively, and three SSR markers, Xwmc289b, Xgwm583 and Xgwm292, all assigned to the long arm of chromosome 5D, were also found to be associated with the gene, with genetic distances of 20.0, 33.0 and 24.0 cM, respectively. These markers flanked Pm-M53. Apm161, Xwmc289b and Xgwm583 were placed at one side, Apm109 and Xgwm292 at the opposite. From proximal to distal in order, the arrangement of the gene and its coupling markers on the long arm of chromosome 5D was Xgwm583, Xwmc289b, Apm161, Pm-M53 Apm109 and Xgwm292. Physical location of the gene was carried out using two Chinese Spring nullisomic-tetrasomic lines CSN5BT5D and CSN5DT5B, and two ditelosomic lines CSDT5DS and CSDT5DL by means of tightly linked AFLP marker APm109. The results therefore corroborate the allocation of the gene to chromosome arm 5DL. The specific position on the chromosome indicated Pm-M53 was a new powdery mildew resistance gene. It could play an important role in wheat breeding programs for powdery mildew resistance. The relationship of the gene with other reported resistant genes to powdery mildew on the D genome was discussed.

Key words Wheat Powdery mildew Resistance gene Molecular mapping Physical location

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