

中国小麦品种对白粉病的抗性反应与抗病基因检测

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Response to Powdery Mildew and Detection of Resistance Genes in Wheat Cultivars from China

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摘要

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摘要 利用来自不同生态区的8个白粉病菌株对20世纪80年代以来国家审定(认定)品种、近期参加国家区域试验的品系和核心种质等小麦材料进行抗病性评价,同时利用与*Pm4a*、*Pm8*和*Pm21*基因连锁的分子标记检测了相关抗病基因的存在。在148个国家审定品种中有16.9%的品种能够抗多个菌株,其中大多是近10年选育的品种。不同年代审定的品种中感病品种的频率均超过50%。各个小麦生产区抗病品种的频率高低与该地区白粉病的严重性和育种的关注程度有一定关系。在1160份小麦核心种质中抗E09菌株的地方品种和育成品种的比例只有3.4%和4.2%。西南冬麦区和新疆冬麦区入选的品种抗病频率较高,华南冬麦区、东北春麦区和北方春麦区没有发现抗E09菌株的品种。多菌株鉴定结果表明,263份微核心种质中33.7%的品种表现抗病性,其中大多数品种能够抗1~2个菌株,因此在核心种质的利用中应注意选用抗性强的品种作为轮回亲本,同时有必要构建抗白粉病的应用核心种质,以提高核心种质的利用效果。根据抗病基因分子标记检测结果,我国小麦品种有43.2%含有*Pm8*基因,该基因在区域试验参试品种中的频率也很高,特别是在黄淮海区培育的品种中频率仍高达50%;*Pm4a*和*Pm21*基因主要出现在长江流域培育的品种中。有些抗性突出的品种可能含有其他抗病基因。

关键词: 小麦 抗病性 白粉病 抗病基因 *Pm8* *Pm4* *Pm21*

Abstract: Wheat powdery mildew caused by *Blumeria graminis* (DC.) f. sp. *tritici* E.O. Speer is one of the major epidemic diseases threatening production of wheat (*Triticum aestivum* L.) in China. It is necessary to establish information on resistance to the disease in wheat cultivars and germplasm lines for parental selection in breeding, deployment of resistant germplasm, and application of resistant cultivars for controlling the disease. In this study, reactions to eight isolates of *B. graminis* (DC.) f. sp. *tritici* E.O. Speer were tested in commercial wheat cultivars, wheat lines involved in the national yield trials, and core collections. The presence of genes *Pm4a*, *Pm8*, and *Pm21* for resistance to powdery mildew was detected using the gene-specific markers. Among 148 commercial wheat cultivars released since the 1980s, 16.9% exhibited resistance to multiple isolates, most of which were released in the 2000s. Over 50% of the cultivars released in different decades were susceptible to all the isolates tested. The frequencies of resistant cultivars from different wheat producing regions seemed to be associated with the significance of powdery mildew epidemic in a given region. Out of 1160 entries in the core collection, the proportions of entries resistant to isolate E09 were 3.4% and 4.2% in the landrace and improved cultivars, respectively. The Southwestern Autumn-Sown Spring Wheat Zone and the Xinjiang Winter-Spring Wheat Zone had higher percentages of E09-resistant cultivars than other wheat zones. None of the cultivar from the Southern Autumn-Sown Spring Wheat Zone, Northern Winter Wheat Zone, and Northern Spring Wheat Zone was resistant. The results of multiple-isolate test demonstrated that 33.7% were resistant among the 263 mini-core collection entries, most of which were resistant to one or two isolates. This indicates that there is a need to select resistant entries as recurrent parents for efficient use of existing core collection and to construct applied core collection for resistance to powdery mildew. Using the markers specific for resistance genes, the results of molecular detection demonstrated that 43.2% of the commercial cultivars contained gene *Pm8*. This gene was detected in the wheat lines involved in the national wheat yield trails at a high frequency. Genes *Pm4a* and *Pm21* were detected mainly in the wheat lines or cultivars that were developed in the Yangtze River region. Some cultivars highly resistant to powdery mildew may possess other resistance genes that warrant further determination.

Keywords: Wheat Disease resistance Powdery mildew Resistance gene *Pm8* *Pm4* *Pm21*

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