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研究论文

CIMMYT普通小麦籽粒硬度等位变异的检测

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摘要 籽粒硬度主要由5D染色体短臂的一对主效基因Ha控制，研究籽粒硬度等位变异有助于提高小麦的磨粉和食品加工品质。本试验对国际玉米小麦改良中心（CIMMYT）的138份历史品种和代表性高代品系的硬度基因型进行了研究。在用SDS-PAGE鉴定Pina-D1b/Pinb-D1a时，用10%甘油代替水配制分离胶，用PDA代替甲叉配制分离胶和浓缩胶，增强了PINA和PINB两种蛋白带型的分辨率。结果表明，与其他国家硬质麦中Pina-D1a/Pinb-D1b类型偏多的特点明显不同，CIMMYT硬质小麦中puroindoline a（PINA）蛋白缺失类型（或称Pina-D1b/Pinb-D1a）较多，为118个，占85.5%；Pina-D1a/Pinb-D1a（野生型）为11个，占8.0%；Pina-D1a/Pinb-D1b类型有9个，占6.5%。其中，PINA缺失对小麦籽粒硬度的影响最大，与其他2种基因型硬度值之间差异达5%显著水平。先前研究结果表明，PINA蛋白缺失类型的磨粉品质和面包烘烤品质均劣于Pina-D1a/Pinb-D1b类型，因此，建议CIMMYT多引进一些其他硬度变异类型的小麦种质，如Pina-D1a/Pinb-D1b类型等，以改善其硬度基因型过度单一的局面，从而减少PINA蛋白缺失带来的不利影响。同时，也提醒我国以其他用途如抗病、抗旱等为目的，引种CIMMYT小麦时，还应充分考虑PINA蛋白缺失对磨粉和加工品质的不利影响，以更合理引进和有效利用CIMMYT种质资源。

关键词 普通小麦 籽粒硬度 等位变异 puroindoline蛋白 STS标记

分类号 S512

Detection of Allelic Variation for Grain Hardness in CIMMYT Common Wheats

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Abstract Kernel hardness, controlled by a major gene Ha on the short arm of chromosome 5D, has a profound influence on milling performance and end-use quality of common wheat (Triticum aestivum L.). puroindoline protein, expressed by Ha gene and including puroindoline a and b (PINA and PINB), sets up the molecular and genetics basis of wheat kernel hardness. Evaluation of the allelic variation of grain hardness is beneficial to wheat quality improvement. A total of 138 CIMMYT historical cultivars and lines from 23rd Elite Spring Wheat Yield Trial (ESWYT) and 10th Semiarid Wheat Yield Trial (SAWYT) were examined by Single Kernel Characterization System (SKCS) and STS (sequence tagged site) marker to understand the distribution of grain hardness and its puroindoline alleles. Modified SDS-PAGE (sodium dodecyl-sulfate polyacrylamide gel electrophoresis) of Triton X-114 soluble protein, 10% glycerol substituting of water for resolving gels and PDA (piperiazine diacrylamide) substituting of N,N'-methylene bisacrylamide for gels, were used to distinguish PINA and PINB proteins for identifying Pina-D1b/Pinb-D1a allele (a null mutation of puroindoline a). Both serine-codon specific and non-specific primers were used to identify Pina-D1a/Pinb-D1b allele for confirming results of the PCR (polymerase chain reaction) amplification of genome DNA. The results indicated that Pina-D1b/Pinb-D1a was the most popular genotype in the CIMMYT common wheats, and the percentages of Pina-D1b/Pinb-D1a, Pina-D1a/Pinb-D1b and Pina-D1a/Pinb-D1a (wild type) were 85.5%, 6.5% and 8.0% in the surveyed wheats, respectively. SKCS hardness index for Pina-D1b/Pinb-D1a and Pina-D1a/Pinb-D1b genotypes were much higher than that for wild type Pina-D1a/Pinb-D1a. Genotype with Pina-D1b/Pinb-D1a allele showed significantly higher grain hardness than Pina-D1a/Pinb-D1b allele. It was previously reported that Pina-D1a/Pinb-D1b genotype was more desirable for milling and end products quality than Pina-D1b/Pinb-D1a genotype. Therefore, it is recommend that other types of puroindoline allele mutation for reducing the negative influence of the Pina-D1b/Pinb-D1a genotype on processing quality should be introduced in CIMMYT wheat breeding program. Meanwhile, when we introduce cultivars from CIMMYT for the purpose of improving some wheat characters, it is necessary to fully consider the negative effect of the Pina-D1b/Pinb-D1a genotype on milling and baking quality.

Key words Common wheat Kernel hardness Allelic variation puroindoline protein STS maker

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