

植物诱变育种 · 农业生物技术

水稻细胞质雄性不育恢复性的等位基因分化

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摘要: 选用WA型、Y型和DA型3种细胞质的4个不育系(博白A、珍汕97A、协青早A和Y华农A)对6个单片段代换系、8个双片段聚合系和华粳74的恢复力进行测交鉴定,结果表明:(1)6个单片段代换系、8个双片段聚合系和华粳74对于4个不育系的恢复力存在显著的不同,携带有 *Rf3* 基因座位的单片段代换系的恢复力均低于携带有 *Rf4* 基因座位的单片段代换系,并且低于对照品种(华粳74);单片段代换系S6对这3种不育细胞质均具有较强的恢复力,单片段代换系S5对珍汕97A(WA)、协青早A(DA)具有较强的恢复力。(2)在华粳74的遗传背景下,4个不育系可恢复性存在差异,程度依次为:协青早A > 博白A > 珍汕97A > Y华农A,即Y华农A的不育性最难恢复,而协青早A的不育性最易恢复。(3)在恢复基因 *Rf3* 和 *Rf4* 基因座分别鉴定出4个等位基因,由弱到强依次命名为 *Rf3*¹、*Rf3*²、*Rf3*³、*Rf3*⁴ 和 *Rf4*¹、*Rf4*²、*Rf4*³、*Rf4*⁴,受体亲本华粳74的基因型为 *Rf3*⁴*Rf3*⁴/*Rf4*²*Rf4*²,即华粳74携带的 *Rf3* 基因的恢复性很强,携带的 *Rf4* 基因恢复性却比较弱。(4)携带有较弱恢复性基因(*Rf3* 和 *Rf4*)的单片段代换系聚合为双片段聚合系后恢复力有减小的趋势。本研究结果将为水稻三系的选育和恢复基因的转移奠定基础。

关键词: 水稻 单片段代换系 双片段聚合系 质核互作雄性不育系 恢复力

ALLELIC DIFFERENTIATION OF FERTILITY RESTORATION GENES FOR CYTOPLASMIC MALE STERILITY IN RICE

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Abstract: To investigate the restoring abilities of different *indica* chromosome single segment substitution lines (SSSLs), double segment pyramiding lines (DSPLs) and Huajingxian74 (HJX74, an elite *indica* cultivar from China) to different cytoplasm male sterile lines, HJX74, six SSSLs and eight DSPLs were crossed to four cytoplasmic male sterility (CMS) lines, i.e., BobaiA (BbA, WA), Zhengshan 97A (ZsA, WA), XieqingzaoA (XqA, DA) and Y-HuanongA (HnA, Y), respectively. The results were as following: (1) There were wide differences in restoring abilities among the 6 SSSLs, 8 DSPLs and HJX74. The restoration abilities of SSSLs carrying *Rf3* locus were weaker than that of SSSLs with *Rf4* locus and HJX74. SSSL S6 appeared to be strong restoring ability to WA-, Y- and DA-CMS, whereas SSSL S5 showed strong restorer ability to ZsA and XqA. (2) In the background of HJX74, the restorable extents of four CMS lines were divergent. According to the phenotyping for spikelet fertility value, the increasing order of restorabilities for four CMS lines would be XqA > BbA > ZsA > HnA. The genetic relationship among the three cytoplasmic male sterility indicated that the cytoplasmic effects of DA type were much smaller than that of Y and WA types, the cytoplasmic effects of Y type were the biggest. (3) Fertility of the test-cross F₁ plants showed that four *Rf* alleles at *Rf3* and *Rf4* loci, respectively, named *Rf3*¹, *Rf3*², *Rf3*³, *Rf3*⁴ and *Rf4*¹, *Rf4*², *Rf4*³, *Rf4*⁴ with restoring abilities from weaker to stronger were found by testcrosses between HJX74, 6SSSLs, 8 DSPLs and A-lines. HJX74 carried genotype *Rf3*⁴*Rf3*⁴/*Rf4*²*Rf4*² and showed that the effect of *Rf3* was larger than that of *Rf4*. (4) The restoration ability of DSPLs showed weaker than that of corresponding SSSLs with weaker *Rf* loci. These studies have led to the development of new approaches to alloplasmic line breeding, and the transfer of *Rf3*⁴ and *Rf4*⁴ alleles into adapted cultivars through backcrossing in an active hybrid rice breeding program.

Keywords: *Oryza sativa* L. single segment substitution lines double segment pyramiding lines cytoplasmic male sterility line restoring ability

收稿日期 2011-10-28 修回日期 2012-01-18 网络版发布日期

DOI:

基金项目:

国家863计划项目(2006AA100101-2);安徽省教育厅高校自然科学基金项目(KJ2010B155)

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