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论文

水稻芽期与幼苗前期耐碱性状QTL定位

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1 沈阳农业大学农学院 / 水稻生物学国家重点实验室, 辽宁沈阳110161; 2 中国水稻研究所水稻生物学国家重点实 ▶PDF(334KB) 验室, 浙江杭州310006; 3 浙江大学农业与生物技术学院农学系, 浙江杭州310029 摘要:

利用包含120个株系的籼粳交来源(春江06/TN1)的加倍单倍体群体, 在Na,CO, 胁迫下, 以发芽期和幼苗前期的相 对发芽势等10个性状作为耐碱性评价指标, 进行水稻耐碱性的QTL定位。相关性分析表明, 相对发芽势和相对发芽 率显著正相关,相对苗高、相对根数和相对根长之间显著正相关。采用QTLNetwork统计软件共定位到14个加性 QTL和13个上位性QTL。在第3染色体RM251~RM3280间有2个QTL, 在第7染色体RM3286~RM1279区域有3个 QTL;在第1、2和7染色体同一位置同时检测到2个上位性QTL,在第12染色体RM1246~RM5199之间集中了4个上 位性QTL, 耐碱数量基因表现出一因多效或紧密连锁现象。耐碱性盐QTL可能包括两类, 一类与K+、Na+等离子胁 迫有关, 另一类与高pH胁迫有关。不同类型的水稻品种都具有一些耐碱基因, 可以通过有性杂交和分子标记辅助选 择的方法选育优良的耐碱品种。

关键词: 水稻 碱性盐胁迫 数量基因座位 DH群体

Mapping of QTLs Underlying Tolerance to Alkali at Germination and Early Seedling Stages in Rice

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Abstract:

A double haploid (DH) population including 120 lines derived from a cross between indica rice (Oryza sativa L.) TN1 and japonica rice CJ06 was used to detect quantitative trait loci (QTLs) for 10-trait relative values of alkali damage at germination period and early seedling stage under 0.15% Na₂CO₃ stress. Correlation analyses showed that alkali damage rate in germination period (ADG) had significant positive correlation with relative germination energy (RGE), relative germination rate (RGR) and relative germination index (RGI), and alkali damage rate at early seedling stage (ADS) had significantly correlation with relative seedling height (RSH), relative root length (RRL), relative root number (RRN) and relative seedling dry weight (RDW). ADG and ADS can be used as evaluation indexes of alkaline tolerance in rice. By using QTLNetwork 2.0 software, 14 additive QTLs and 13 epistatic QTLs controlling the tolerance to alkali were mapped. Two main effect QTLs were detected in same region, RM251-RM3280, on chromosome 3, and three main effect QTLs were mapped between RM3286 and RM1279 on chromosome 7. Epistasis analysis showed that some epistatic loci, like RM1-RM1195, RM1358-RM290, RM1279-RM505, and RM1246-RM519 on chromosome 1, 2, 7, and 12 respectively were important under alkali stress, included two or more epistatic QTLs, in-dicating that the QTLs displayed their effects through different ways of interaction. Among the key loci under alkali stress one may be pleiotropic or some closely linked each other. Comparing QTLs with those found in other researches, some alkali resistance QTLs were likely to be in the same region with some salt resistance QTLs. A presume was made that QTLs in this article might include two types, one for resistance to ions (K⁺ or Na⁺) stress and other for resisttance to high pH stress, the latter may play an important role for tolerance to alkali. Many rice varieties have different resistance QTLs for alkali stress; we can pyramid them through marker-assistant selection to breed varieties suitable to growth in saline-alkalized land.

Keywords: Rice Alkali stress Quantitative trait locus Double haploid population

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