

研究论文

利用重组自交群体检测水稻抗亚铁毒胁迫的QTLs

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摘要 潜育性水稻田广泛分布于中国、斯里兰卡、印度、印度尼西亚、塞拉里昂、利比亚、尼日利亚、哥伦比亚和菲律宾等国, 其中我国南方稻区就有670万公顷低产潜育性水稻田。该类水稻田还原性强, 矿质营养失调, 尤以Fe²⁺ 过量积累, 对水稻生长发育产生不良的逆境胁迫作用。培育抗亚铁毒的水稻品种是简便、经济有效地提高稻谷产量的重要途径之一。本文利用Kinmaze / DV85 的81个重组自交家系 (RILs) 的作图群体, 采用水培鉴定方法, 在亚铁毒条件下, 检测叶片棕色斑点指数 (LBI)、株高 (PH) 的数量性状位点 (QTLs)。

结果表明, 控制叶片棕色斑点指数、株高的数量性状位点都位于第三染色体上, 各QTL的LOD值为3.79~5.89。检测到与亚铁毒胁迫直接有关的性状叶片棕色斑点指数QTL 2个, 分别位于第三染色体的X279-C25和X144-X362间, 对应的贡献率分别为17.38%和22.07%, 其中位于第三染色体X279-C25间的叶片棕色斑点指数QTL与水稻功能图谱第三染色体上的控制叶绿素含量的QTL位置一致; 另一个位于X144-X362间的叶片棕色斑点指数QTL与水稻功能图谱第三染色体上的另一个控制叶绿素含量的QTL连锁, 相距25.6 cM。表明在亚铁毒胁迫条件下, 水稻在其叶片表面出现棕色斑点, 叶片衰老, 产生一些叶绿素降解物或衍生物, 以提高叶片细胞对亚铁等重金属毒害的耐受力。

关键词 水稻 抗亚铁毒 重组自交 (RILs) 群体 数量性状位点 (QTLs)

分类号 S511

Detection and Analysis of QTLs Associated with Resistance to Ferrous Iron Toxicity in Rice (*Oryza sativa* L.), Using Recombinant Inbred Lines

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Abstract A mapping population of 81 F11 lines (recombinant inbred lines: RILs), derived from a cross between a japonica variety Kinmaze and an indica variety DV85 by the single-seed descent methods, was used to detect quantitative trait loci (QTLs) for leaf bronzing index (LBI) and plant height (PH) under Fe²⁺ stress condition. Two parents and 81 RILs were phenotyped for the traits by growing them in Fe²⁺ toxicity nutrient solution. A total of three QTLs were detected on chromosome 3, with LOD ranging from 3.79 to 5.89. Two QTLs controlling LBI was located at the region of X279-C25 and X144-X362, and their contributions to total variation were 17.38% and 22.07%, respectively. One QTL for PH was located at the region of R1468A-R1468B, with contribution rate 23.18%. Comparing with the other mapping results, the QTL for LBI located at the region of X279-C25 on chromosome 3 was identical with the QTL for chlorophyll content on a rice function map. Another QTL for LBI located at the region of X144-X362 linked with QTL for chlorophyll content which located at the region of C136-C944 on a rice function map, the genetic distance between the two QTLs is 25.6 cM. The results indicated that ferrous iron toxicity of rice is characterized by bronzing spots on the lower leaves, which spread over the whole leaves, causing the lower leaves to turn dark gray and product chlorophyll catabolites or derivatives which reduce cytotoxicity of some heavy metals, such as ferrous iron.

Key words Rice (*Oryza sativa* L.); Resistance to ferrous iron toxicity; Recombinant inbred lines (RILs) population; Quantitative trait loci (QTLs)

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