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Mapping of QTLs Controlling Carbon Isotope Discrimination in the Photosynthetic System using Recombinant Inbred Lines Derived from a Cross between Two Different Rice (*Oryza sativa* L.) Cultivars

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Abstract: Carbon isotope discrimination (Δ) occurring in the process of photosynthesis, shows variation among rice (*Oryza sativa* L.) cultivars. Elucidation of specific traits associated with the extent of this discrimination under irrigated conditions may be useful to improve photosynthetic ability in rice plants. We measured leaf photosynthesis and Δ in Milyang 23 and Akihikari, and conducted quantitative trait loci (QTL) analysis on Δ at heading stage using a population of 126 recombinant inbred lines (RILs), derived from a cross between the two cultivars. While the two parental cultivars showed a similar Δ , the RILs showed a wide variation in Δ including transgressive segregation. Seven QTLs were detected for Δ ; four on chromosomes 2 (two regions), 7, and 11 were those for Δ that is increased by the Milyang 23 allele, whereas the other three on chromosomes 1, 2, and 6 were those for Δ that is increased by the Akihikari allele. These results suggest that ^{13}C in Milyang 23 may be discriminated through a photosynthetic process different from that in Akihikari. Milyang 23 showed a higher stomatal conductance and a higher ratio of intercellular to ambient CO_2 concentration (C_i/C_a), while Akihikari showed a higher carboxylation efficiency but a lower C_i/C_a . According to the theory that a higher C_i/C_a leads to a higher Δ , the QTLs for Δ that is increased by the Milyang 23 allele might be

related to a higher stomatal conductance. However, the theory provided no persuasive factors to explain the QTLs for Δ that is increased by the Akihikari allele. Plausible factors associated with these QTLs are discussed.

Keywords: [Carbon isotope discrimination \(\$\Delta\$ \)](#), [Photosynthesis](#), [Quantitative trait locus \(QTL\)](#), [Rice \(*Oryza sativa* L.\)](#)

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