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Identification of a Novel QTL for Chlorate Resistance in Rice

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[Introduction]
Nitrogen (N) is one of the key elements in crop production, but excessive application of N source fertilizers results in the increase of greenhouse gas emission (GHG). Nitrogen use efficiency (NUE) has been shown to correlate with the increase or decrease in GHG emission in rice. To evaluate the NUE in higher plants, chlorate sensitivity is commonly used as one of the strategies. In rice, the japonica ssp. is typically known for having a higher degree of resistance to chlorates compared to indica ssp.

[Materials and Methods]
In this study, we investigated the degree of chlorate sensitivity of 117 rice doubled haploid lines exposed to 0.1% potassium chlorate (KClO3) at seedling stage.

[Results and Discussion]
The results revealed that the parental rice lines P1 (93-11, indica) and P2 (Miryang352, japonica) showed an extreme distinctive phenotypic response. P1 scored highly sensitive (0% survival) and P2 resistant (66.7% survival). Furthermore, we detected a putative QTL for chlorate resistance on chromosome 3 (qCHR3, 136 cM, LOD: 4.11) using KASP markers (LeftCI: ah03001094, 126.5 cM; RightCI: id3005168, 146.5 cM). The additive effect (-11.97) and PEV (14.92%) indicate that allele from P2 explained the observed phenotypic variation. In addition, the shoot and root growth shows a differential inhibition pattern of shoot and roots among the DH lines irrespective of their sensitivity levels to KClO3. Further investigations are undertaken to elucidate the findings and study NUE in the sensitive and resistant DH lines with regard to their respective genotypes, at molecular, biochemical and physiological levels.

Keywords: Chlorate sensitivity, nitrogen use efficiency, greenhouse gas reduction, doubled haploid, rice.

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