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Quantitative Trait Locus Analysis of Microscopic Phenotypic Characteristic Data Obtained Using Optical Coherence Tomography Imaging of Rice Bacterial Leaf Blight Infection in the Field

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[Introduction]
QTL mapping of the BLB resistance gene is typically performed using subjective data, such as changes in the lesion length or phenotype after bacterial inoculation. In this study, we used swept-source (SS)-OCT for non-destructive morphological characterization of rice leaf specimens, which generates accurate and standardized data. To the best of our knowledge, this is the first study to map BLB resistance genes in rice using SS-OCT technology. We measured leaf layer thickness, internal lower mid-vein angle, and leaf angle, including the external bi-directional angles between the lower epidermis layer and lower mid-vein by SS-OCT imaging to screen for BLB resistance genes.

[Materials and Methods]
In this study, diseases were accurately diagnosed using OCT Imaging, and QTL mapping was performed using leaf thickness and leaf angles after *Xoo* inoculation. After *Xoo* inoculation of a 120 Cheongcheong/Nagdong double haploid (CNDH) population, QTL mapping was performed using the leaf layer thickness, internal lower mid-vein angle, and leaf angle, including the external bi-directional angles between the lower epidermis layer and lower mid-vein by SS-OCT imaging.

[Results and Discussions]
We developed high-throughput OCT technology to observe the microscopic traits of plants. Using micro-traits data for QTL analysis, we successfully screened out WRKY transcription factor 34, which confers resistance to BLB. Additionally, other candidate genes for related resistance in different intervals were screened out. Moreover, our QTL results showed that the target interval identified using the QTL results before and after the BLB inoculation coincided perfectly with those obtained using OCT microscopic trait data. These findings demonstrate that the application of microscopic traits is effective and accurate for QTL analysis and molecular breeding.

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