

14th International Conference on

Agriculture & Horticulture

August 15-16, 2019 | Rome, Italy

Two QTLs controlling clubroot resistance identified from bulked segregant sequencing in pakchoi (*Brassica campestris* ssp. *chinensis* Makino)

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Clubroot, caused by *Plasmodiophora Brassicae*, is a serious soil-borne disease in worldwide. In recent years, progression of clubroot is rapid and serious in Shanghai, China. In this study, The inheritance of clubroot resistance (CR) were determined in pakchoi using F₂ segregation population that were developed by crossing highly resistant line 'CR38' and susceptible line 'CS22'. Two novel QTLs, *qBrCR38-1* and *qBrCR38-2*, was identified by BSA-seq (Bulked Segregant Sequencing) resistant to *P. brassicae* physiological race 7. Two significant peak *qBrCR38-1* and *qBrCR38-2* were observed by three statistical methods between interval of 19.7-20.6Mb in chromosome A07 and 20.0-20.6Mb in chromosome A08, respectively. In addition, Polymorphic SNPs identified within target regions were converted to kompetitive allele-specific PCR (KASP) assays. In target regions of *qBrCR38-1* and *qBrCR38-2*, there were twenty SNP sites identified, eleven KASP markers of which are significantly associated to CR ($P < 0.05$). Seven candidate genes were identified and found to be involved in disease resistance (TIR-NBS-LRR proteins), defense responses of bacterium and fungi and biotic/abiotic stress response in the target regions harboring the two QTLs. Two novel QTLs and candidate genes identified from the present study provide insights into the genetic mechanism of CR in *B.rapa*, and the associated SNPs can be effectively used for marker-assisted breeding.



Figure 1. phenotype of the parents: CR38 (Clubroot resistance) and CS22 (Clubroot susceptible). Plants were inoculated with 7th physiological race of *P. brassicae*.

Recent Publications

1. Phukan, U. J., Jeena, G. S. & Shukla, R. K. Wrky Transcription Factors: Molecular Regulation and Stress Responses in Plants. Front Plant Sci. 7, 760 (2016).

2. Zhang, H. et al. Resistance to Plasmodiophora Brassicae in Brassica Rapa and Brassica Juncea Genotypes From China. *Plant Dis.* 99, 8-14 (2015).
3. Feng, J., Jiang, J., Feindel, D., Strelkov, S. E. & Hwang, S. F. The Gene Cr811 is Present Exclusively in Pathotype 5 and New Emerged Pathotypes of the Clubroot Pathogen Plasmodiophora Brassicae. *Eur J Plant Pathol.* 145, 615-620 (2016).
4. Van, O. G. et al. Structure-Function Analysis of the Nb-Arc Domain of Plant Disease Resistance Proteins. *J Exp Bot.* 59, 1383 (2008).
5. Phukan, U. J., Jeena, G. S. & Shukla, R. K. Wrky Transcription Factors: Molecular Regulation and Stress Responses in Plants. *Front Plant Sci.* 7, 760 (2016).

Biography

Hongfang Zhu has working on Shanghai Academy of Agricultural Sciences since 2009. She has mainly engaged in the collection, arrangement and evaluation of pakchoi and Chinese cabbage germplasm resources, the selection of new varieties, the breeding of good species, the study of cultivation techniques, and the demonstration and promotion of the germplasm.

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