A natural allele of *Bsr-d1* in rice confers broad-spectrum blast resistance

Subject Code: C14

With support from the National Natural Science Foundation of China, a collaborative research group led by Prof. Chen Xuewei (**陈学伟**) of the Rice Research Institute, Sichuan Agricultural University, published an article entitled "A natural allele of a transcription factor in rice confers broad-spectrum blast resistance" in *Cell* (2017, 170: 114—126).

Rice blast caused by *Magnaporthe oryzae* (*M. oryzae*) is the most devastating disease. It greatly reduces yield and grain quality. The use of host resistance is the most effective and economic way to control rice blast. Isolation of resistance-related genes is the basis and premise of more efficient use of host resistance. Most studies on blast resistance-related genes have focused on *Pi* gene (also known as *R* genes) that usually mediate effector-triggered immunity (ETI). However, the resistance mediated by *R* genes is often limited to a few races of the pathogen and not durable because pathogen effectors evolve quickly, though it confers strong resistance to *M. oryzae*. Therefore, deployment of genes conferring broad-spectrum, durable resistance is highly favored by breeders. However, only several genes conferring broad-spectrum blast resistance have been isolated.

This research group isolated a natural allele, named *bsr-d1*, from the Digu rice variety that carries durable, board-spectrum, high-level resistance, by the genome-wide association study. The *bsr-d1* allele, encoding a C_2H_2-type transcription factor, confers non-race-specific resistance to blast and is present in 10% of 3,000 surveyed rice varieties. Compared to susceptible varieties carrying *Bsr-d1*, *bsr-d1* accumulates H_2O_2 quickly at the infection site upon blast infection by directly regulating expression of peroxidase genes, resulting in impaired *M. oryzae* growth at early stages and blockage of its growth at later stages.

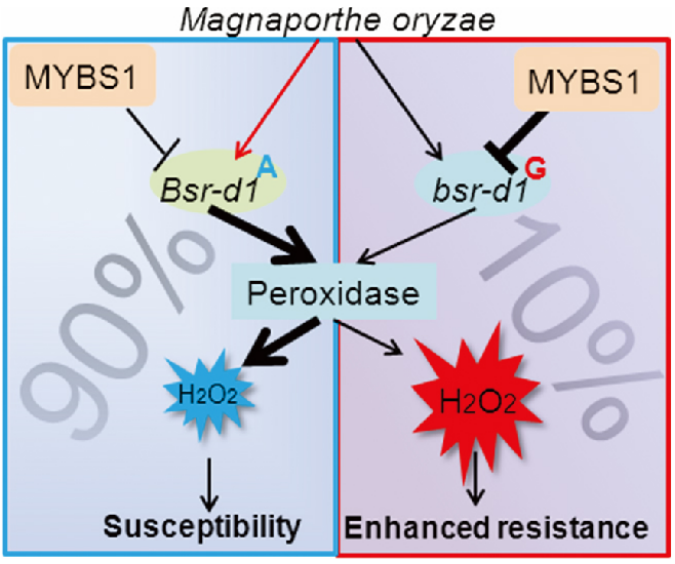

Figure A natural allele in rice, *bsr-d1*, confers blast resistance.

Compared to *Bsr-d1*, a single base conversion (A^{Bsr-d1} to G^{bsr-d1}) in the *bsr-d1* promoter results in stronger binding to MYBS1 (a MYB family member) and repression by MYBS1. Therefore, while *Bsr-d1* expression is induced by *M. oryze*, *bsr-d1* expression is not, due to MYBS1 binding.

These findings provide a novel allele, *bsr-d1*, which confers broad-spectrum resistance to *M. oryzae*, and a strategy for breeding durable resistance in rice. However, more studies are needed to completely understand mechanisms of the *bsr-d1*-mediated resistance to the blast disease.