Concurrent session 2: *Gene discovery and function*

Discovery of brown planthopper resistance gene in rice

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The brown planthopper (*Nilaparvata lugens* Stal; BPH) is an insect that feeds on the leaf sheath of rice (*Oryza sativa* L.) plants, ingesting nutrients specifically from the rice phloem using its stylet mouthparts. In the last decade, the BPH has frequently caused widespread destruction of rice crops and heavy losses of yields. The most economic and efficient method for controlling the BPH is to use the host resistance as part of IPM.

To date, more than 19 BPH resistance genes in rice have been reported. Resistance of *Bph1*, *bph2* and *Bph3* has been reported to be overcome by new biotypes of BPH. Wild rice germplasm is an important gene pool for rice breeding. Two major loci for BPH resistance, *Bph14* and *Bph15*, were detected in the F2 population and RIL population of Minghui63 X B5. Bph14 was mapped on the long arm of chromosome 3 and Bph15 on the short arm of chromosome 4. These loci were also found to confer resistance to the white-backed planthopper.

Analysis of recombination events in the *Bph14* region delimited the gene to genomic segment of 34-kb between SM1 and G1318. Two predicted genes encoding putative resistance proteins, designated *Ra* and *Rb* respectively, were identified after sequencing this region. Transgenic experiment showed that *Ra* confers the resistance phenotype and is the *Bph14* gene. The *Bph14* gene encodes a putative 1,323 amino acid protein containing a coiled-coil, nucleotide-binding and leucine-rich repeat (CC-NB-LRR) motif. Comparison analysis showed that in the LRR domain 54 residues and two deletions of *Bph14* were unique.

Electronic penetration graphs (EPG) revealed that BPH insects spent more time walking, but less time ingesting phloem, on the plants carrying resistance genes *Bph14* and *Bph15* than they did on susceptible plants. Tests with [^{14}C]sucrose showed that insects ingested much less phloem sap on the resistant plants than on susceptible plants. In the plants infested with the BPH, callose was found deposited on the sieve plates of the target sieve tubes, where the stylets had been inserted. Counts of the bright callose plugs revealed more callosic sieve plates in the resistant than in susceptible plants. Moreover, with prolonged BPH feeding, the callose deposition decreased quickly in susceptible plants. It was found that the genes encode for callose decomposing enzyme β-1,3-glucanase were differetially regulated in the resistant and susceptible rice plants. In the susceptible rice the β-1,3-glucanase gene *Osg1* and *Gns5* were enhanced, and thereby facilitated the BPH's continued feeding from the phloem in the susceptible plants, while in the resistant plants, these genes expression unchanged. As a result, BPH feeding on the resistant rice plants were suppresed.