

### **Novel blast resistance genes from a landrace rice variety in Myanmar**

The use of broad-spectrum resistance genes is an effective way to achieve durable resistance against rice blast (*Pyricularia oryzae* Cavara) in rice (*Oryza sativa* L.).

We previously surveyed the diversity of blast resistance in 948 rice varieties and found Haoru (International Rice Research Institute genebank acc. no. IRGC33090), a Myanmar rice landrace with broad-spectrum resistance against blast.

We examined the genetic basis of Haoru's broad-spectrum resistance using the standard blast differential system consisting of the standard isolates and differential varieties.

For genetic analysis, we used the BC<sub>1</sub>F<sub>1</sub> population and BC<sub>1</sub>F<sub>2</sub> lines derived from crosses of Haoru with a susceptible variety, US-2. Co-segregation analysis of the reaction pattern in the BC<sub>1</sub>F<sub>1</sub> population against the 20 standard isolates suggested that Haoru harbors three resistance genes.

Using bulk-segregant and linkage analysis, we mapped two of the three resistance genes on chromosomes 12 and 6, and designated them as *Pi58(t)* and *Pi59(t)*, respectively.

*Pi58(t)* and *Pi59(t)* were differentiated from other reported resistance genes using the standard differential system. The estimated resistance spectrum of *Pi58(t)* corresponded with that of Haoru, suggesting that *Pi58(t)* is primarily responsible for Haoru's broad-spectrum resistance.

In addition, *Pi59(t)* and the third gene were also proven to be new and useful genetic resources for studying and improving blast resistance in rice.

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Table 1. Reaction patterns of Haoru and segregation lines harboring new resistance genes to standard differential blast isolates

| Line   | Resistance gene       | Chr.      | Reaction patterns   |          |          |          |             |             |              |              |          |          |          |          |          |          |          |           |          |              |          |          |          |
|--|-----------------------|-----------|---|----------|----------|----------|-------------|-------------|--------------|--------------|----------|----------|----------|----------|----------|----------|----------|-----------|----------|--------------|----------|----------|----------|
|  |                       |           | Standard differential blast isolates from the Philippines |          |          |          |             |             |              |              |          |          |          |          |          |          |          |           |          |              |          |          |          |
|  |                       |           | PO6-6   | CA89     | 43       | CA41     | M64-1-3-9-1 | M39-1-3-8-1 | M39-1-2-21-2 | M36-1-3-10-1 | JMB8401  | IK81-25  | IK81-3   | BN111    | V850256  | V850196  | V86010   | JMB840610 | BN209    | MI01-1-2-9-1 | B90002   | C923-49  |          |
| Haoru  | -                     | -         | R   | R        | S        | R        | R           | R           | R            | R            | R        | S        | S        | R        | R        | R        | R        | R         | R        | R            | R        | R        | R        |
| US-2   | -                     | -         | S   | S        | S        | S        | S           | S           | S            | S            | S        | S        | S        | S        | S        | S        | S        | S         | S        | S            | S        | S        | S        |
| <b>BC<sub>1</sub>F<sub>2</sub> line (US-2/Haoru//US-2)</b> | <b><i>Pi58(t)</i></b> | <b>12</b> | <b>R</b>  | <b>R</b> | <b>S</b> | <b>R</b> | <b>R</b>    | <b>R</b>    | <b>R</b>     | <b>R</b>     | <b>R</b> | <b>S</b> | <b>S</b> | <b>R</b> | <b>R</b> | <b>R</b> | <b>R</b> | <b>R</b>  | <b>R</b> | <b>R</b>     | <b>R</b> | <b>R</b> | <b>R</b> |
| IRBL12-M   | <i>Pi12(t)</i>        | 12        | S   | S        | S        | S        | S           | S           | S            | S            | S        | S        | S        | S        | S        | M        | M        | R         | R        | R            | R        | R        | R        |
| IRBL19-A   | <i>Pi19(t)</i>        | 12        | S   | S        | S        | M        | S           | S           | S            | M            | M        | S        | S        | S        | S        | S        | S        | S         | S        | S            | S        | S        | S        |
| IRBLta-CP1   | <i>Pita</i>           | 12        | S   | S        | S        | R        | M           | M           | S            | S            | M        | R        | R        | S        | R        | R        | S        | S         | S        | M            | S        | M        | S        |
| IRBLta2-Pi   | <i>Pita-2</i>         | 12        | S   | S        | S        | R        | R           | R           | R            | R            | R        | R        | R        | R        | R        | R        | R        | R         | R        | R            | R        | R        | S        |
| IRBL20-IR24  | <i>Pi20(t)</i>        | 12        | S   | S        | S        | S        | S           | S           | R            | R            | S        | M        | M        | R        | S        | S        | R        | S         | S        | S            | R        | R        | R        |
| <b>BC<sub>1</sub>F<sub>2</sub> line (US2/Haoru//US2)</b>   | <b><i>Pi59(t)</i></b> | <b>6</b>  | <b>S</b>  | <b>S</b> | <b>S</b> | <b>S</b> | <b>R</b>    | <b>S</b>    | <b>S</b>     | <b>S</b>     | <b>S</b> | <b>S</b> | <b>S</b> | <b>S</b> | <b>S</b> | <b>S</b> | <b>R</b> | <b>R</b>  | <b>S</b> | <b>S</b>     | <b>R</b> | <b>R</b> | <b>R</b> |
| IRBLz-Fu   | <i>Piz</i>            | 6         | R   | M        | R        | M        | R           | R           | R            | R            | R        | R        | R        | S        | M        | R        | R        | M         | R        | M            | R        | M        | R        |
| IRBLz5-CA-1  | <i>Piz-5</i>          | 6         | R   | M        | M        | R        | M           | R           | R            | R            | R        | R        | R        | R        | R        | R        | M        | R         | S        | M            | M        | M        | M        |
| IRBLzt-T   | <i>Piz-t</i>          | 6         | S   | S        | S        | S        | R           | R           | S            | S            | S        | S        | S        | S        | S        | S        | R        | R         | S        | S            | R        | R        | R        |
| IRBL9-W  | <i>Pi9</i>            | 6         | R   | R        | R        | R        | R           | M           | R            | R            | R        | R        | R        | R        | R        | R        | S        | R         | R        | R            | R        | R        | R        |

R: Resistant, M: Moderately resistant, S: Susceptible

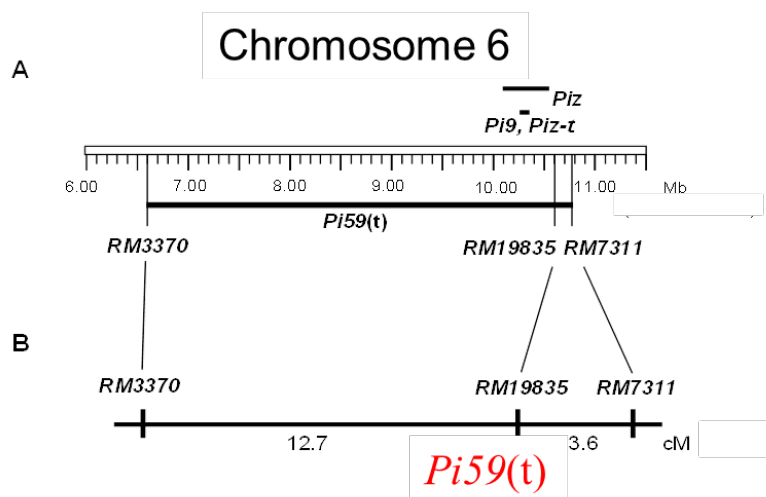


Fig. 1a. Position of resistance gene, *Pi59(t)*, on chromosome 6.

A: Physical map. Position based on the Nipponabare's genome sequence.

B: Genetic map. Genetic distances between the gene and markers were estimated using the BC<sub>1</sub>F<sub>2</sub> lines of US-2/Haoru//US-2 (n=55).

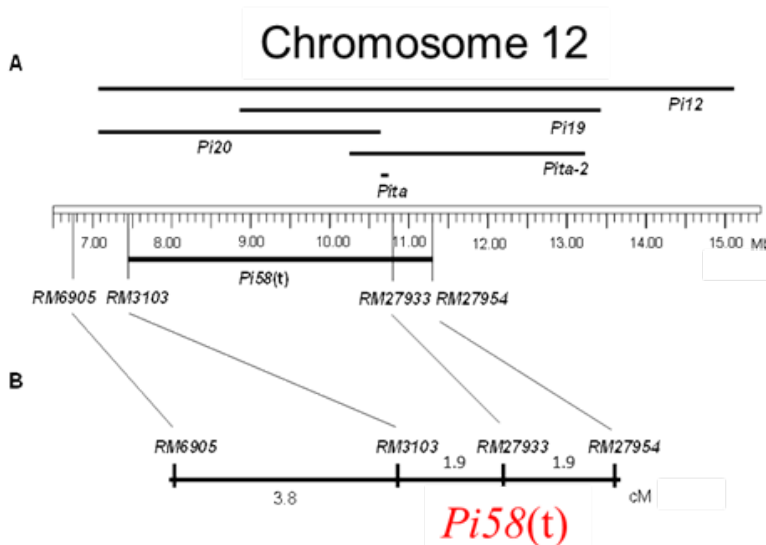


Fig. 1b. Position of resistance gene, *Pi58(t)*, on chromosome 12.

A: Physical map. Position based on the Nipponabare's genome sequence.

B: Genetic map. Genetic distances between the gene and markers were estimated using the BC<sub>1</sub>F<sub>2</sub> lines of US-2/Haoru//US-2 (n=106).