Differential varieties (DVs) and blast isolates are essential for establishing a differential system as a tool for blast research and breeding programmes in rice. As an initial step, this study characterized the pathogenicity of 119 blast isolates collected from the Philippines using 19 rice DVs targeting 18 resistance genes. First, the isolates were classified into 31 groups based on their reactions to nine DVs targeting nine resistance genes: Pia, Pib, Pii, Pit, Pita, Pish, Piz-t, Pi3, and Piz-5. They were then subdivided into 70 pathotypes considering the reactions of the varieties to nine other resistance genes: Pik, Pik-h, Pik-m, Pik-p, Pik-s, Pita-2, Piz, Pi1, and Pi20(t). The findings suggest a wide variation in blast pathogens in the Philippines. Twenty isolates that had good differentiating ability, stable reaction and good sporulating ability were selected as standard isolates. The data on the pathogenicity of the blast isolates from the Philippines are useful for clarifying the differentiation and relationship between blast races and resistance genes. These isolates were then used to develop near-isogenic lines (NILs) as an ideal set of DVs for blast resistance.

Twenty-seven NILs with
the genetic background of indica variety CO 39, which is broadly susceptible to rice blast, were developed following six repeated backcrosses as an initial set of numerous DVs. This set of NILs included 14 resistance genes \[Pish, Pib, Piz-5, Piz-t, Pi5(t), Pik-s, Pik, Pik-h, Pik-m, Pik-p, Pi1, Pi7(t), Pita and Pita-2\] derived from 26 donor varieties. A second set of NILs containing 11 blast resistance genes \[Pib, Piz-5, Pi9, Pi3, Pia, Pik-s, Pik, Pik-h, Pi7(t), Pita and Pita-2\] derived from 19 donor varieties in the genetic background of the susceptible japonica variety Lijiangxintuanheigu (LTH) were also developed. The NILs were selected in each backcross generation using a specific avirulent blast isolate for each targeted resistance gene. The NILs showed reaction patterns identical to those of the corresponding monogenic lines (MLs) against 20 standard isolates from the Philippines, suggesting that the target resistance genes had been introduced successfully. Genome surveys using simple sequence repeat (SSR) markers showed that the NILs had a genetic composition similar to that of the recurrent parents, CO 39 and LTH. The introgression of targeted resistance genes was confirmed using SSR markers located within the chromosome regions to which the resistance gene had been mapped previously. The morphological characteristics of each NIL were generally similar to those of the recurrent parents. The developed NILs should be useful DVs for monitoring blast races and revealing the pathogenicity of blast isolates from both tropical and temperate regions, complementing the existing set of MLs, and should constitute an important genetic tool for studying blast resistance in indica and japonica rice varieties. In addition, these NILs are valuable genetic resources for determining blast resistance in rice breeding programmes involving indica and japonica types.

Using the differential system, wide variation in the resistance to disease caused by rice blast was found among 922 rice varieties collected mainly from Asia. These varieties were classified into clusters A–F using Ward’s hierarchical cluster analysis based on their reactions to the 20 standard blast isolates from the Philippines. The most susceptible clusters were B and C from the Far East (Japan). Varieties from East and South-East Asia were less frequent in clusters B and C than...
those from Japan, and were more frequent in clusters E and F, which were the most resistant of the cluster groups. Varieties from South Asia showed the widest variation, occurring in all clusters, although less frequently in cluster B. The cluster B varieties were predominantly Japanese, including a high frequency of isozyme type VI, corresponding to the japonica type. By contrast, isozyme types I, II, III and V, which dominated in South Asia, were less frequent in cluster B. The distribution of resistance corresponded to the geographic distribution of rice varieties and might be related to the differentiation into indica and japonica types. These findings provide useful information that improves our understanding of the variation in blast resistance at a global level.