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Two Rice Major Xa Genes: Xa4 and Xa7 Showed Complementary Effects to Combined Stresses of Bacterial Blight and High Temperature

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Abstract

Ambient temperature is predicted to increase, and global warming with amplitude of heat episodes affects different physiological processes in crops. Rice is one of the most important cereal crops used as model crops for genomics and genetics studies. Although elevated temperature influences resistance (R) genes, the effect of heat on rice Xa-gene mediated resistance to *Xanthomonas oryzae* pv. *oryzae* (Xoo) remains to be elucidated. In this study, in IR24 near-isogenic-lines, IRBB4 (IR24+Xa4), IRBB7 (IR24+Xa7), and IRBB67 (IR24 +Xa4+Xa7) complementary effects of Xa4 on Xa7 in pyramided line IRBB67 were shown, and less effectiveness of single Xa4 gene to bacterial blight when ambient temperature increased from 29/21°C (day/night temperatures) to 35/31°C. The bacterial spread was limited in IRBB7 at high temperature, but no differences were observed between IR24 (no effective R gene) and IRBB4.

Time course transcriptome profiling of susceptible IR24 and resistant IRBB67 inoculated with PXO145 (avrXa4, avrXa7) under high (35/31°C) and low (29/21°) temperature at different time points (3, 24 and 120 h post-inoculation) showed 2-fold change expression pattern of 4608 genes. Interestingly, the temperature effect was observed on expression of genes from the nodulin-family in IR24. Our results suggest, that temperature affects plant defense responses to biotic stress under complex mechanisms. Genes involved in ethylene metabolism or regulation of known susceptibility genes might play a major role in the reduction of lesion length observed in IRBB67 under high temperature. Bacterial spread and growth quantification in the resistant IRBB67 and the susceptible IR24 are in progress and may also provide evidence on how the resistant line enhances its effectiveness to Xoo under high temperature.

Keywords: Bacterial blight, High temperature, rice, Xa4, Xa7

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