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"Bridging the gap between increasing knowledge and decreasing resources"

Would Combination of Drought QTLs and Rice Xa Genes Be Suitable to Control Bacterial Blight under Climate Change?

C. Sylvestre Gerbert Dossa[1], M. Casiana Vera Cruz[1], Amelia Henry[1], Rolando Torres[1], Arvind Kumar[1], Ricardo Oliva[1], Edgar Maiss[2], Kerstin Wydra[3]

[1] *International Rice Research Institute (IRRI), Philippines*
[2] *Leibniz Universität Hannover, Inst. of Plant Diseases and Plant Protection, Germany*
[3] *Erfurt University of Applied Sciences, Horticulture - Plant Production and Climate Change, Germany*

Abstract

Environmental changes, such as water scarcity and high temperature negatively affect plant growth, production and response to biotic stress. Drought and high temperature in the future will considerably influence rice R gene's response to bacterial blight (BB) caused by *Xanthomonas oryza* pv. *oryzae* (Xoo). To understand the outcome of the interaction between rice, drought and bacterial blight, comparative analysis of single and double stress responses by field and greenhouse studies were conducted. Sixteen rice genotypes (drought QTLs, Xa-genes, Xa-gene + drought QTLs and drought/BB susceptible check) were screened under field drought and irrigated conditions with Xoo strains PXO61 and PXO86 (field) and PXO61, PXO86, PXO99 and PXO145 (greenhouse). Our results showed lines with drought QTLs being susceptible to BB under drought and irrigated conditions although disease severity was less in drought treatment compared to irrigated one. Near isogenic lines carrying Xa-genes revealed effective under drought except Xa4 which showed disease increase with PXO61 (avrXa4 strain). Combination of drought QTLs and Xa4 gene revealed more effective compared to drought QTLs genotypes. Our results also showed significant difference between disease severity at 14 and disease severity at 21 days post inoculation. Evaluation of the response of 5 out of the 16 genotypes to bacterial blight under different soil moisture (SM) conditions showed BB resistance NIL IRBB4 less effective under 50 % SM compared to 70 % SM. Under drought stress, leaf water potential and plant canopy temperature did not influence rice bacterial blight growth in plant and drought QTLs varieties with no Xa-gene revealed susceptible under both treatments. Our results suggests that rice single gene Xa4 effectiveness is affected by drought and improving rice tolerance to stress may require targeting a combination of biotic and abiotic stress resistance traits. Furthermore, IRBB67 (Xa4+Xa7) revealed the most resistant variety against the double stresses (Xoo + drought), demonstrating that combination of Xa4+Xa7 with drought QTLs in rice varieties will be suitable under the future climate situations.

Keywords: Bacterial blight, climate changes, drought QTLs, rice, Xa-genes

Contact Address: Kerstin Wydra, Erfurt University of Applied Sciences, Horticulture - Plant Production and Climate Change, Leipziger Str. 77, 99085 Erfurt, Germany, e-mail: kerstin.wydra@fh-erfurt.de