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Functional characterization of papain-like cysteine proteases genes in rice

Nino Marjohn[1], Nogoy Franz M.[1], Kim Me-Sun[1], Ouk Sothea[1], Yang Ju-Young[1], Lee Kye Dong[1], Jung Yu Jin[2], Kang Kwon Kyoo[2], Cho Yong-Gu[1]*

[1] *Department of Crop Science, Chungbuk National University, Cheongju, Korea*

[2] *Department of Horticultural Life Science, Hankyong National University, Ansung, Korea*

* *e-mail: ygcho@cbnu.ac.kr*

Papain-like cysteine proteases (PLCP) are key enzymes involved in cell death as response to biotic stress. Functional genetic investigation of cysteine protease family members has been performed in a fragmentary scale to understand its specific role in plants. Highlights of research milestone for these proteases provide strong evidence on their diverse and overlapping roles in basal immunity and effector-triggered immunity. The objective of this study was to provide useful insights into biological function of three cysteine protease genes, *OsCP2*, *OsCP3*, and *OsCP5*, in rice. Overexpression of rice cysteine protease attenuated the virulence of *Xanthomonas oryzae* pv. *oryzae* race K3a in all transgenic lines which displayed moderate resistance as indicated by shorter lesion lengths (OsCP2ox, 6.82 cm; OsCP3ox, 5.55 cm; and OsCP5ox, 5.40 cm) than wild type Dongjin (16.07 cm) whereas RNAi-mediated knockdown of *OsCP3* resulted in severe bacterial leaf blight symptoms (17.1 cm). Abiotic screening revealed the biological significance of these three cysteine protease genes, especially of *OsCP3*, against salinity stress for which rice exhibited moderate tolerance (salinity score = 5.0 to 5.2). This study provides experimental evidence for roles of papain-like cysteine protease in improving resistance of rich against *Xanthomonas oryzae* pv. *oryzae* and tolerance against salinity stress, suggesting that these genes could be used as a valuable resource to be employed in rice breeding program to improve its ability to withstand biotic and abiotic stresses.

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