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NAC transcription factor ONAC066 positively regulates disease resistance by suppressing the ABA signaling pathway in rice

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Plant Molecular Biology

Abstract

Key message This is the first time to dissect the mechanism of NACs-mediated disease resistance in plants using metabolomic approach and discover the involvement of ABA signaling pathway in NACs-mediated disease resistance.

Abstract NAC transcription factors have been validated as important regulators in stress responses, but their molecular mechanisms in plant disease resistance are still largely unknown. Here we report that the NAC gene *ONAC066* (*LOC_Os01g09550*) is significantly activated by rice blast infection. *ONAC066* is ubiquitously expressed and this protein is localized in the nucleus. Overexpression of *ONAC066* quantitatively enhances resistance to blast disease and bacterial blight in rice. The transcript levels of PR genes are also dramatically induced in *ONAC066* overexpressing plants. Exogenous abscisic acid (ABA) strongly activates the transcription of *ONAC066* in rice. Further analysis shows that overexpression of *ONAC066* remarkably suppresses the expression of ABA-related genes, whereas there are no obvious differences for salicylic acid (SA) and jasmonic acid (JA)-related genes between wild-type and *ONAC066* overexpressing plants. Consistently, lower endogenous ABA levels are identified in *ONAC066* overexpressing plants compared with wild-type plants before and after blast inoculation, while no significant differences are observed for the SA and JA levels. Yeast one-hybrid assays demonstrate that *ONAC066* directly binds to the promoters of *LIP9* and *NCED4* to modulate their expression. Moreover, the metabolomics study reveals that the *ONAC066* overexpressing plants accumulated higher contents of soluble sugars and amino acids both before and after pathogen attack, when compared to wild-type plants. Taken together, our results suggest that *ONAC066* positively regulates rice resistance to blast and bacterial blight, and *ONAC066* exerts its functions on disease resistance by modulating of ABA signaling pathway, sugars and amino acids accumulation in rice.

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