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To cite this version:

HAL Id: hal-03123921
https://hal.univ-reims.fr/hal-03123921
Submitted on 9 Feb 2021
Bacillus subtilis PTA-271 mediated-ISR in Arabidopsis requires a primed SA-dependent camalexin response upon pathogen challenge

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Bacillus subtilis PTA-271 has been shown to induce ISR against the necrotroph Botrytis cinerea (Verhagen et al., 2011) and the hemibiotroph Neofusicoccum parvum (Trotel-Aziz et al., 2019) in grapevine. However, the mechanisms by which the bacterium activates the host’s immune response underlying ISR remain to be elucidated. In this study, we examined whether the extent of priming state could contribute to the PTA-271-induced ISR in Arabidopsis, by focusing on the camalexin response and CYP71A12 gene expression after B. cinerea and Pst DC3000 infection. Our data provide evidence that PTA-271 triggers ISR against both pathogens through priming camalexin synthesis in SA- and NPR1-dependent manner. This response was further compromised in pad3 mutant after pathogen infection, highlighting that camalexin plays a prominent role in P. subtilis-ISR against both necrotroph and hemibiotroph.

RESULTS

PTA-271 triggers ISR against B. cinerea and Pst DC3000 in Arabidopsis

Roots of wild-type plants Col-0 were inoculated with PTA-271 for 2 weeks, then leaves were infected with B. cinerea and Pst DC3000. ISR was determined at 4 days post infection.

+ B. cinerea

CTRL

PTA-271

PTA-271 significantly reduces the symptoms and disease incidence caused by B. cinerea and Pst DC3000.

Loss of camalexin synthesis in pad3 mutant compromises PTA-271-ISR against both B. cinerea and Pst DC3000

Primed camalexin accumulation contributes to PTA-271-ISR against B. cinerea and Pst DC3000

PTA-271 primes camalexin synthesis upon pathogen challenge

Priming of camalexin production and CYP71A12 gene expressions were analysed by UPLC and RT-qPCR, respectively. The samples were selected in different time of the pathogens infection.

PTA-271-primed camalexin is dependent on SA and NPR1 pathway

SA and NPR1 are required for priming camalexin after pathogen infection

CONCLUSION

Proposed model of camalexin priming by PTA-271 upon infection with B. cinerea and Pst DC3000

PTA-271 induces ISR against necrotrophic and hemibiotrophic pathogens by priming camalexin synthesis through CYP71A12 expression

PTA-271-primed camalexin is dependent on SA and NPR1 pathway

References