Researchers discover immune metabolism hub in broad-spectrum rice blast resistance

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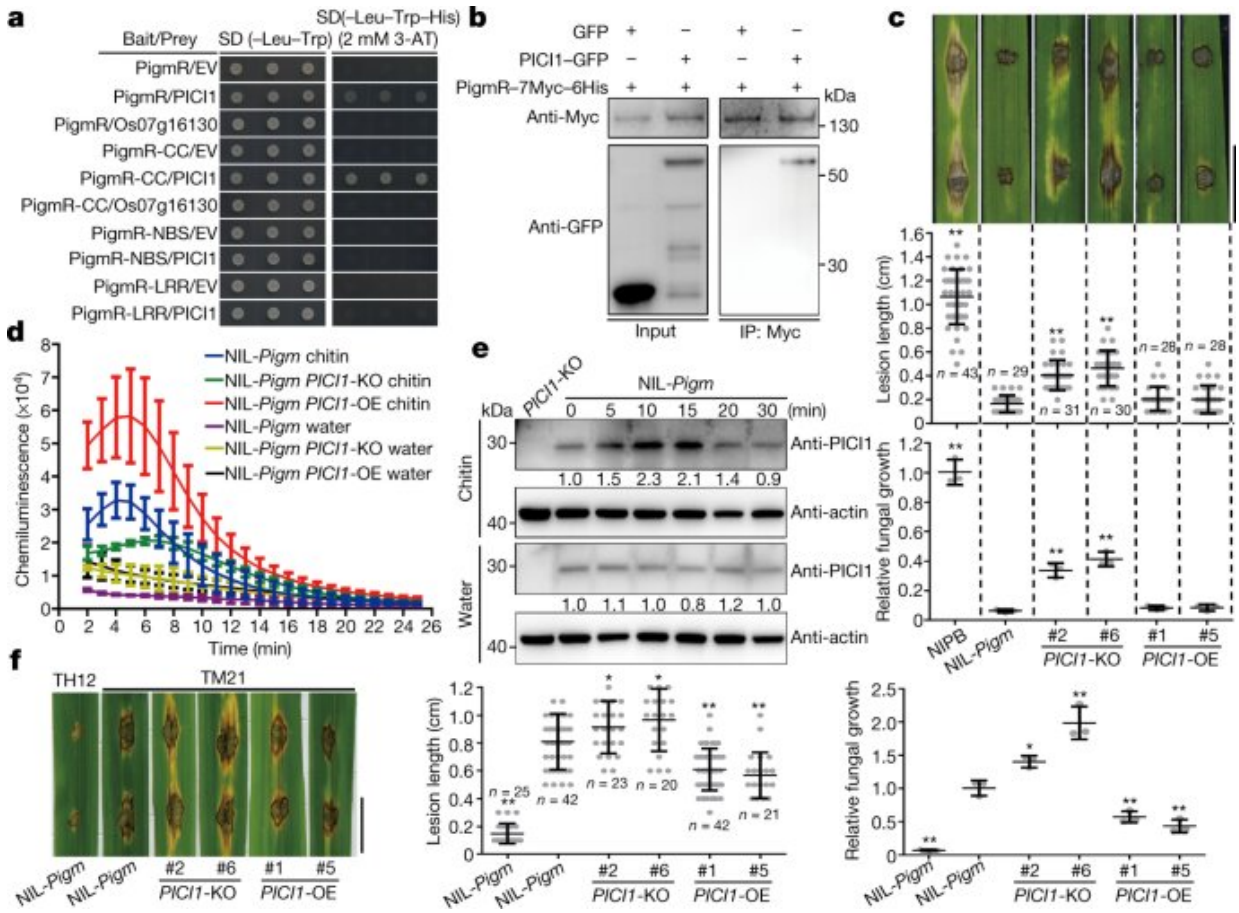

Fig. 1: PICI1 interacts with PigmR and regulates PigmR-mediated blast resistance and PTI responses. Credit: DOI: 10.1038/s41586-021-04219-2

Rice production is critical to food security worldwide. However, the rice

blast fungus Magnaporthe oryzae (M. oryzae) causes destructive disease and huge yield loss worldwide. Exploiting and breeding rice with broad-spectrum resistance to rice blast is therefore of great value for ensuring global food production.

In a study published in *Nature*, a research group led by He Zuhua from CAS Center for Excellence in Molecular Plant Sciences (CEMPS) of the Chinese Academy of Sciences reported a novel immune-metabolic regulatory network, and made a breakthrough regarding the genetic and molecular mechanism that confers rice broad-spectrum resistance against the blast fungus.

In 2017, He's group identified the broad-spectrum blast resistance gene Pigm. In this study, they discovered for the first time that the immune protein PigmR governs an arms race with the fungal virulent effector proteins with a competitive mode that hinges on a critical metabolic pathway of defense molecule production, which synchronize basal defense (PTI) and race-specific defense (ETI).

The researchers first identified a novel plant deubiquitinase, PICI1, as an immune hub for PTI and ETI in rice. PICI1 deubiquitinates and stabilizes methionine synthetases to activate methionine-mediated immunity principally via biosynthesis of the defense phytohormone, ethylene. However, PICI1 is targeted for degradation by blast fungal virulent effectors, to dampen immunity. In turn, NLR immune receptors, such as PigmR, protect PICI1 from effector-mediated degradation to reboot the methionine-ethylene cascade that operates plant immunity.

Therefore, they uncovered a previously unknown plant host immune proteins-mediated arms race with pathogens, which safeguards primary metabolite biosynthesis and immune operation in plants.

Additionally, the researchers found that the natural variation of PICI1

contributes to divergence in field blast resistance between rice subspecies indica and japonica, providing a potential breeding target for broad-spectrum blast resistance in crops.

More information: Keran Zhai et al, NLRs guard metabolism to coordinate pattern- and effector-triggered immunity, *Nature* (2021). DOI: 10.1038/s41586-021-04219-2

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