Plasmopara viticola effector PvRXLR131 suppresses plant immunity by targeting plant receptor inhibitor BKI1

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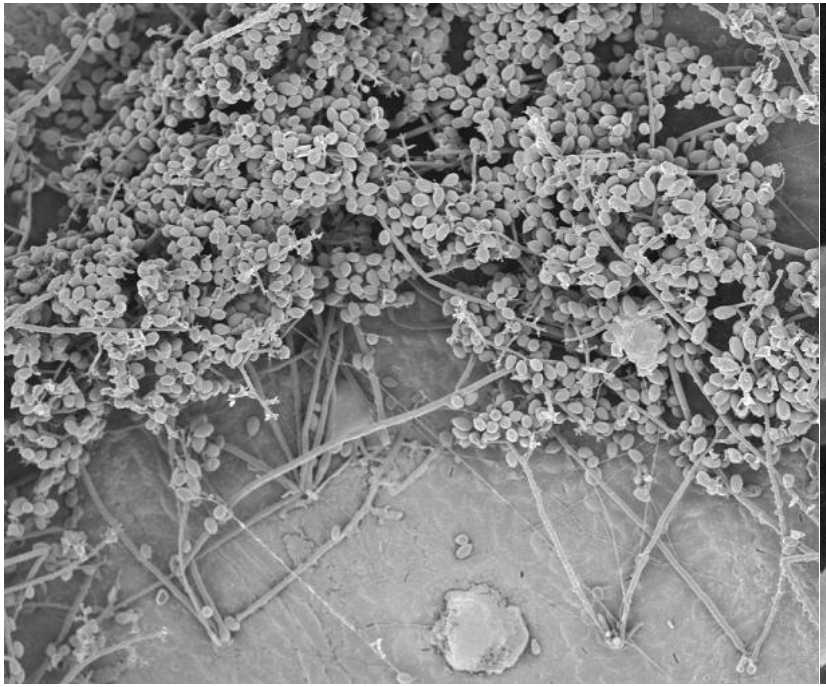
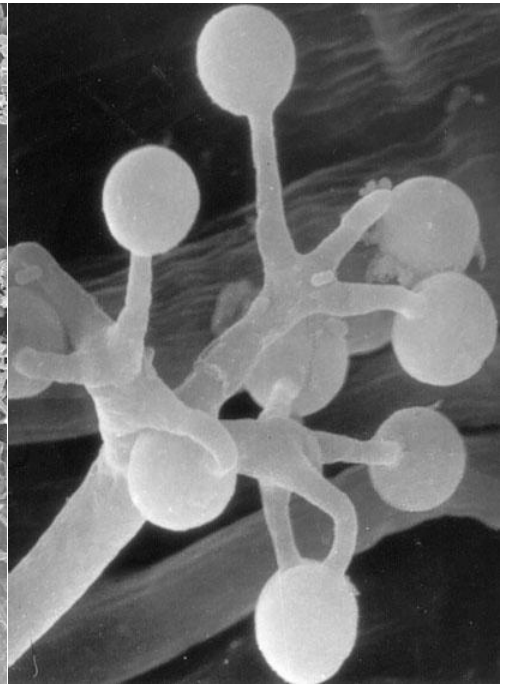
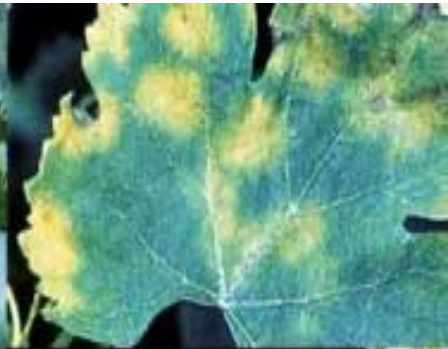
Grapevine Breeding and Genetics
Functional Genomics
Interaction of Pathogen and Grapevine

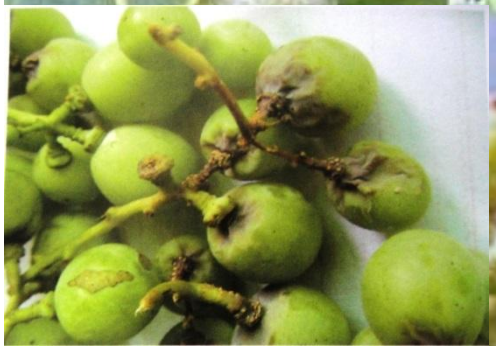
Plasmopara viticola



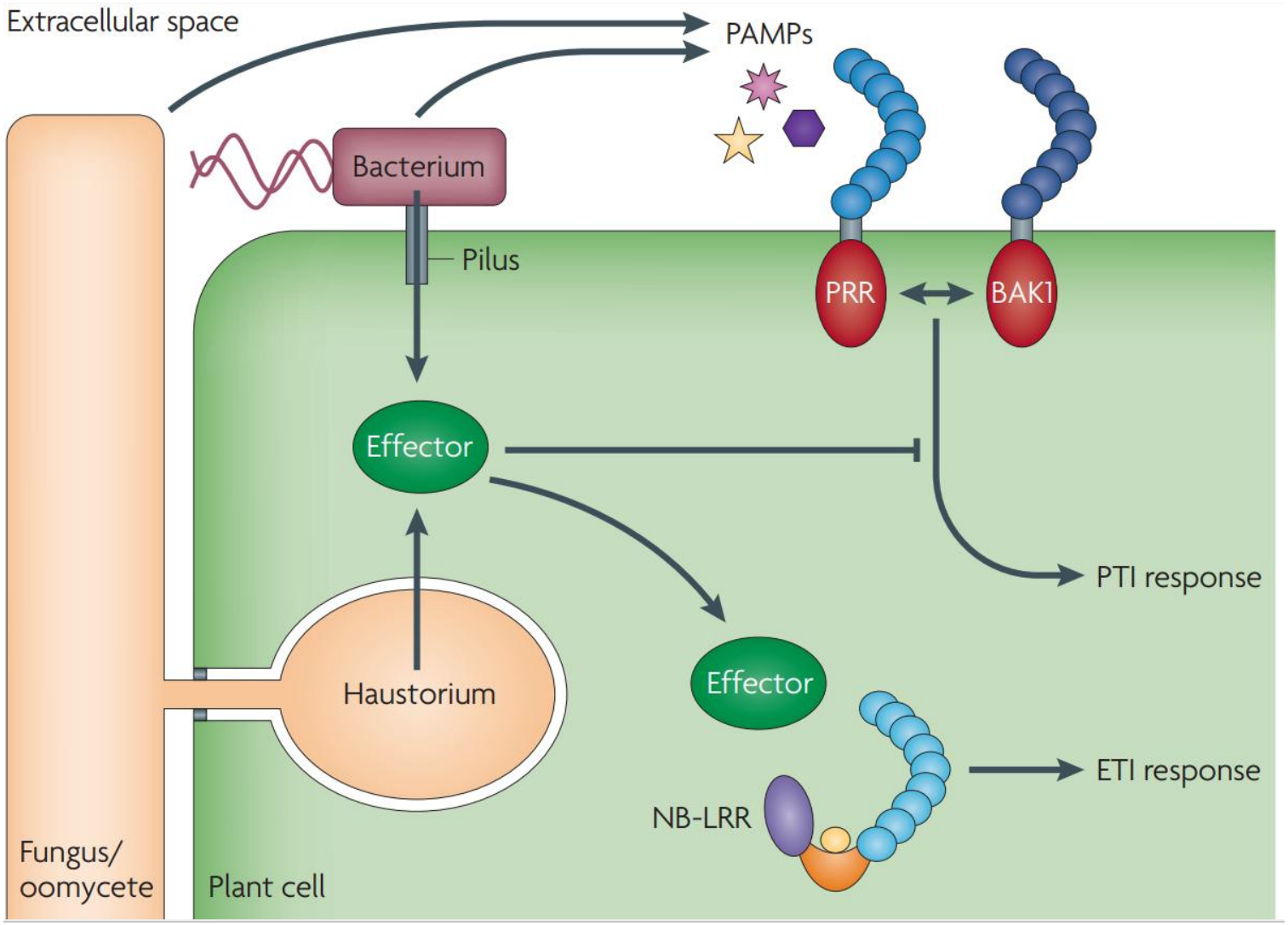


Symptom of downy mildew





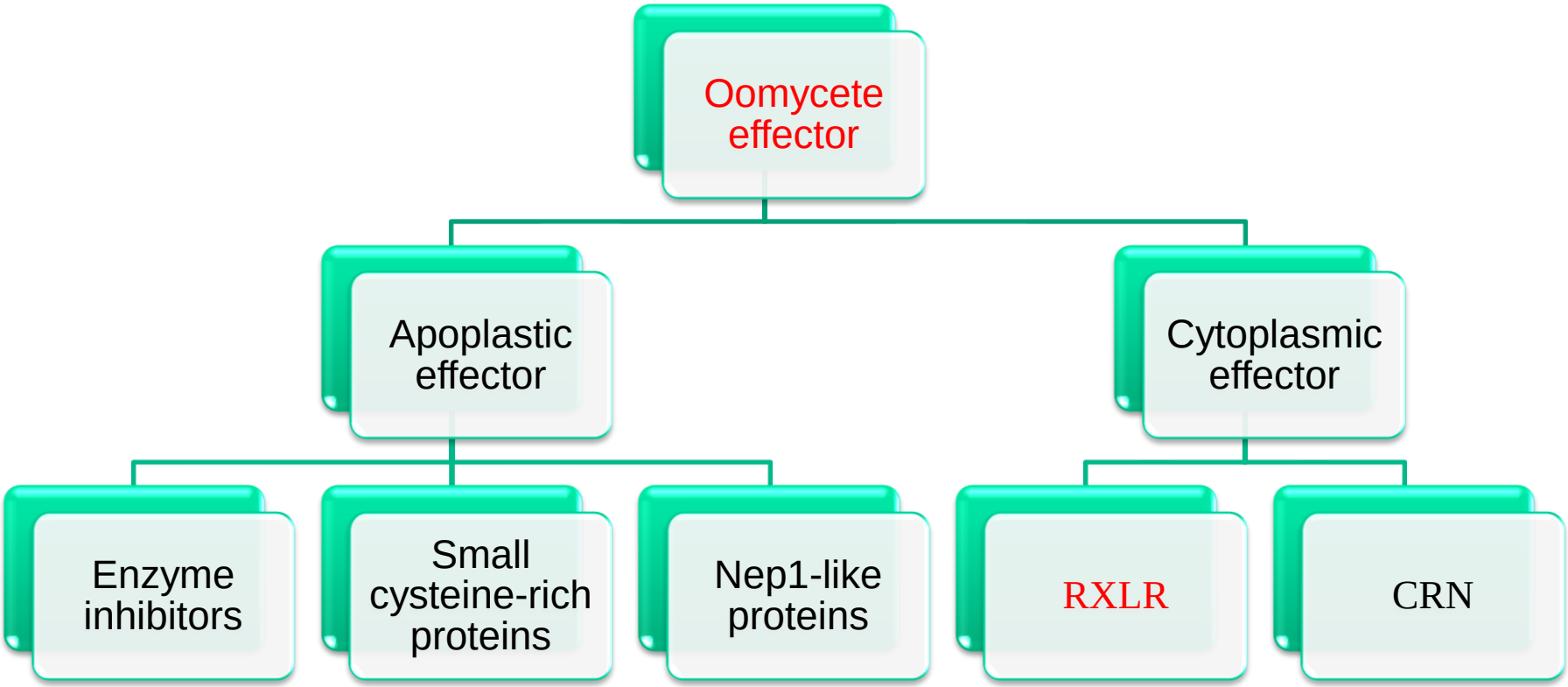
Plant-pathogen interactions



(Dodds and Rathjen, 2010)

The principles of plant immunity

Oomycete effector



Research on *P. viticola* RXLR effectors

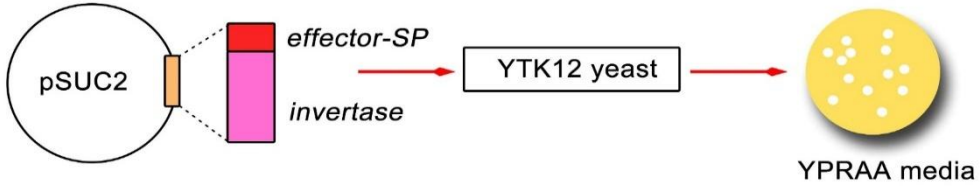
Strain	RXLR	Research content	Reference
“SC”	2	Expressed Sequence Tags (ESTs)	Mestre et al., 2012
“ZJ-1-1”、“JL-7-2”、“CSIRO-L-2”	51	Transcriptome and genome sequencing; Preliminary functional analysis	Yin et al., 2015
“SC”、 “SL”	50	Transcriptome sequencing	Mestre et al., 2016
“ZJ-1-1”	23	Subcellular localization analysis，Preliminary functional analysis	Xiang et al., 2016,2017
“JL-7-2”	102	Genome sequencing; Subcellular localization analysis，Preliminary functional analysis	Yin et al., 2017 Liu et al., 2018
“PvitFEM01”	58	Transcriptome and genome sequencing; Gene function analysis	Brilli et al., 2018

Characterizing the Pv RXLR Effectors

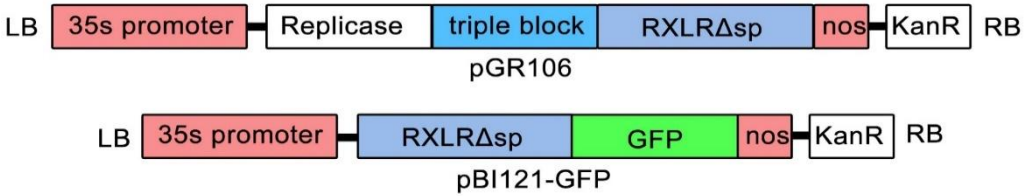
(i) *Genomic DNA preperation*

(ii) *Amplification of effector genes*

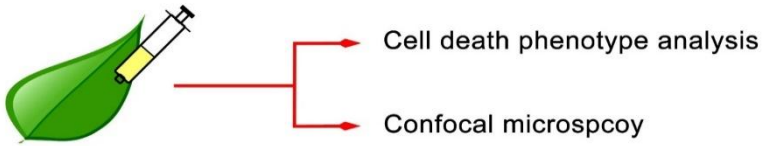
(iii) *Validation of signal peptide*



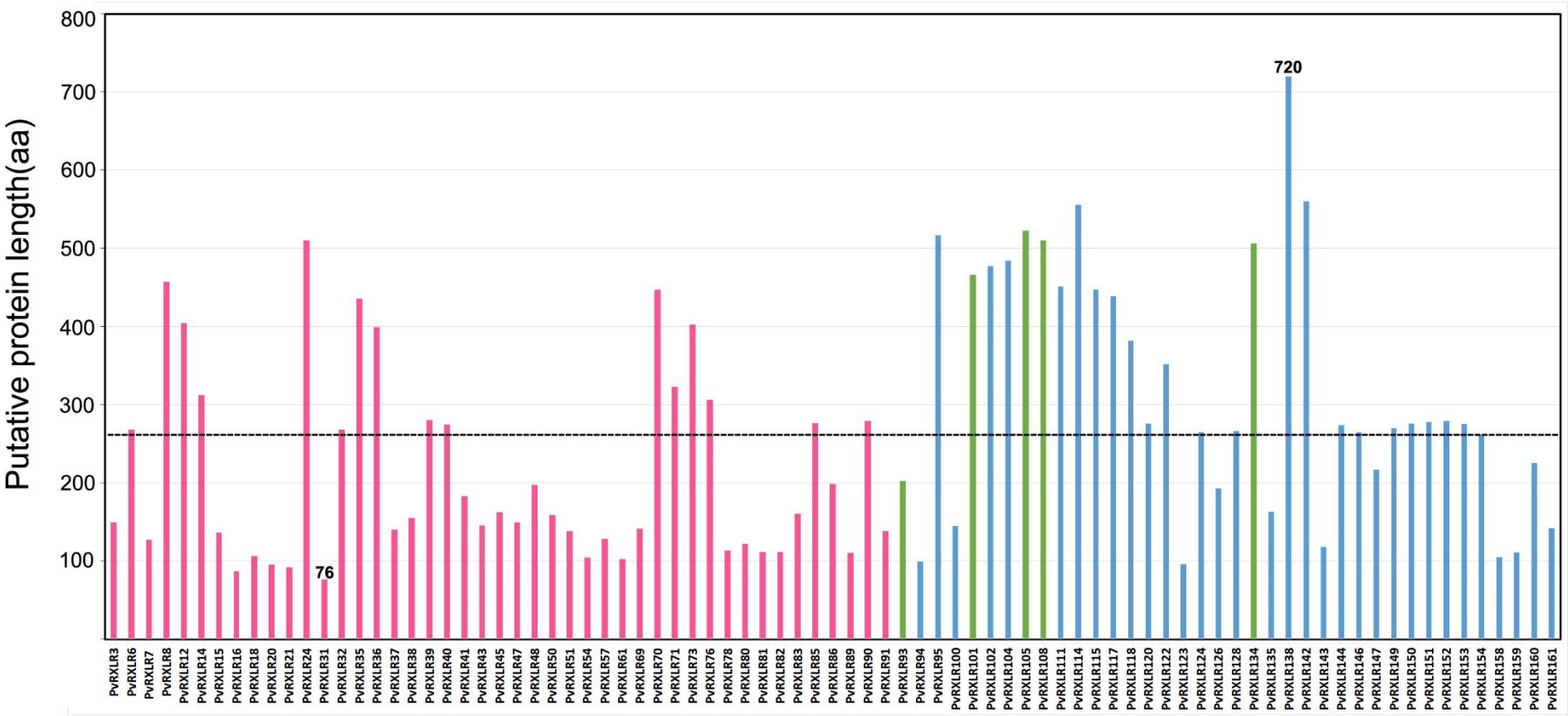
(iv) *Vector construction*



(v) *Argobacterium-mediated transient expresion in N. benthamiana*

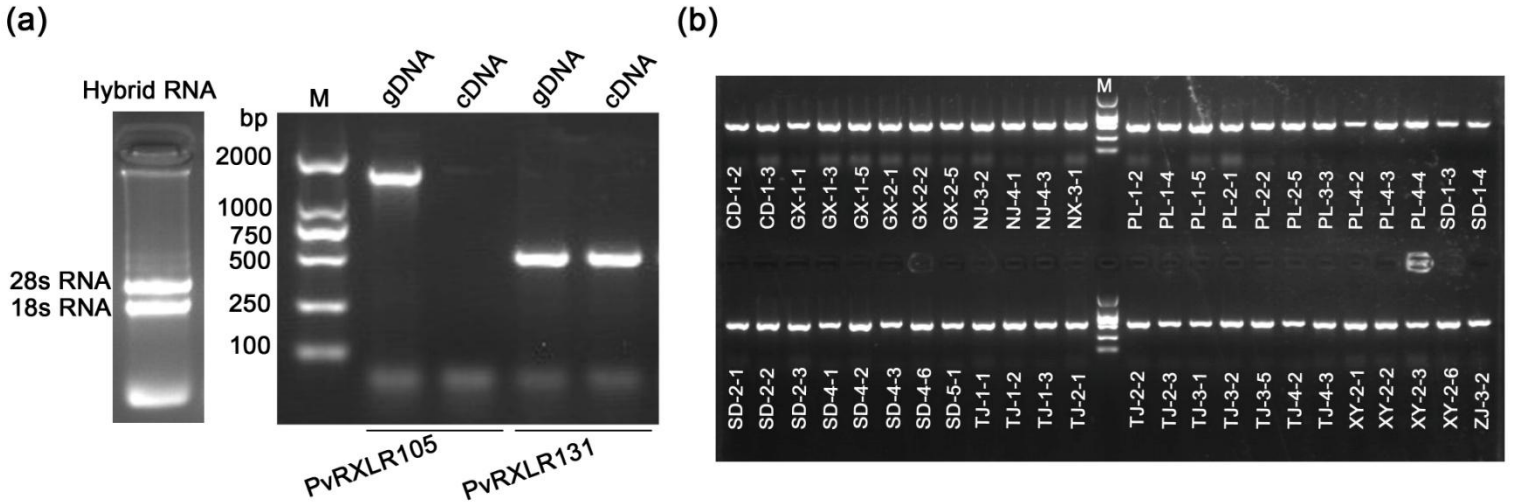


Cloning candidate PvRXLR effectors

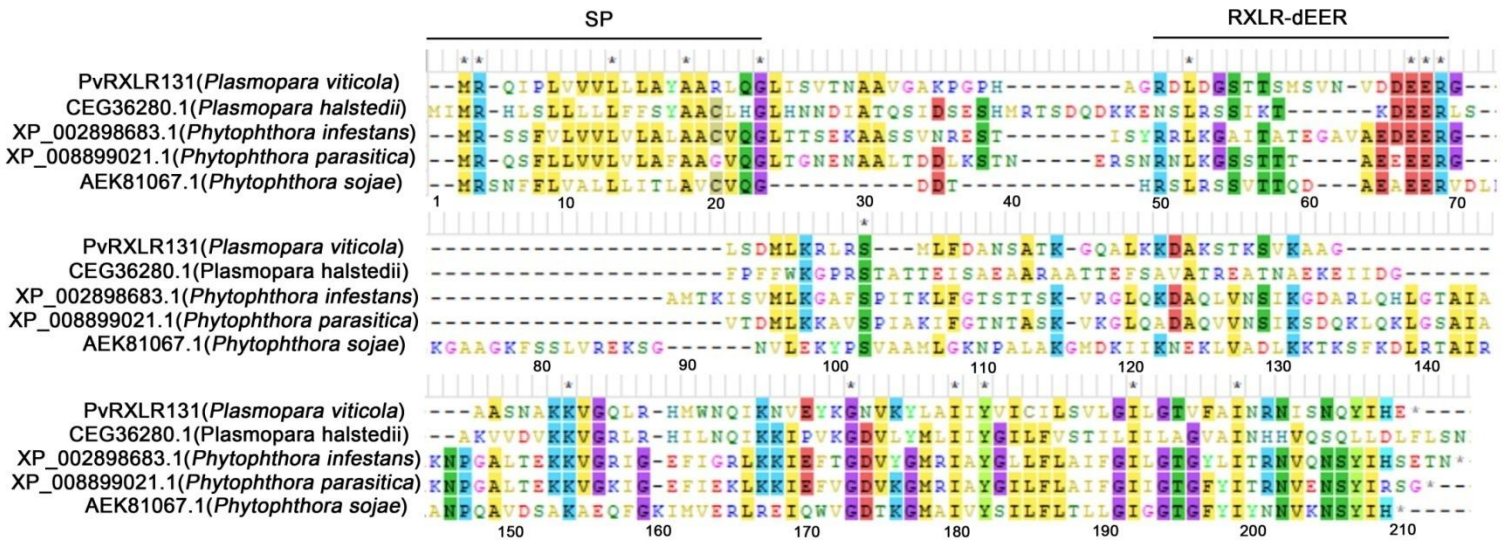


~100 RXLR effectors were cloned and characterized from *P. vitcola* isolate "JL-7-2" genome

PvRXLR131 is conserved in oomycetes

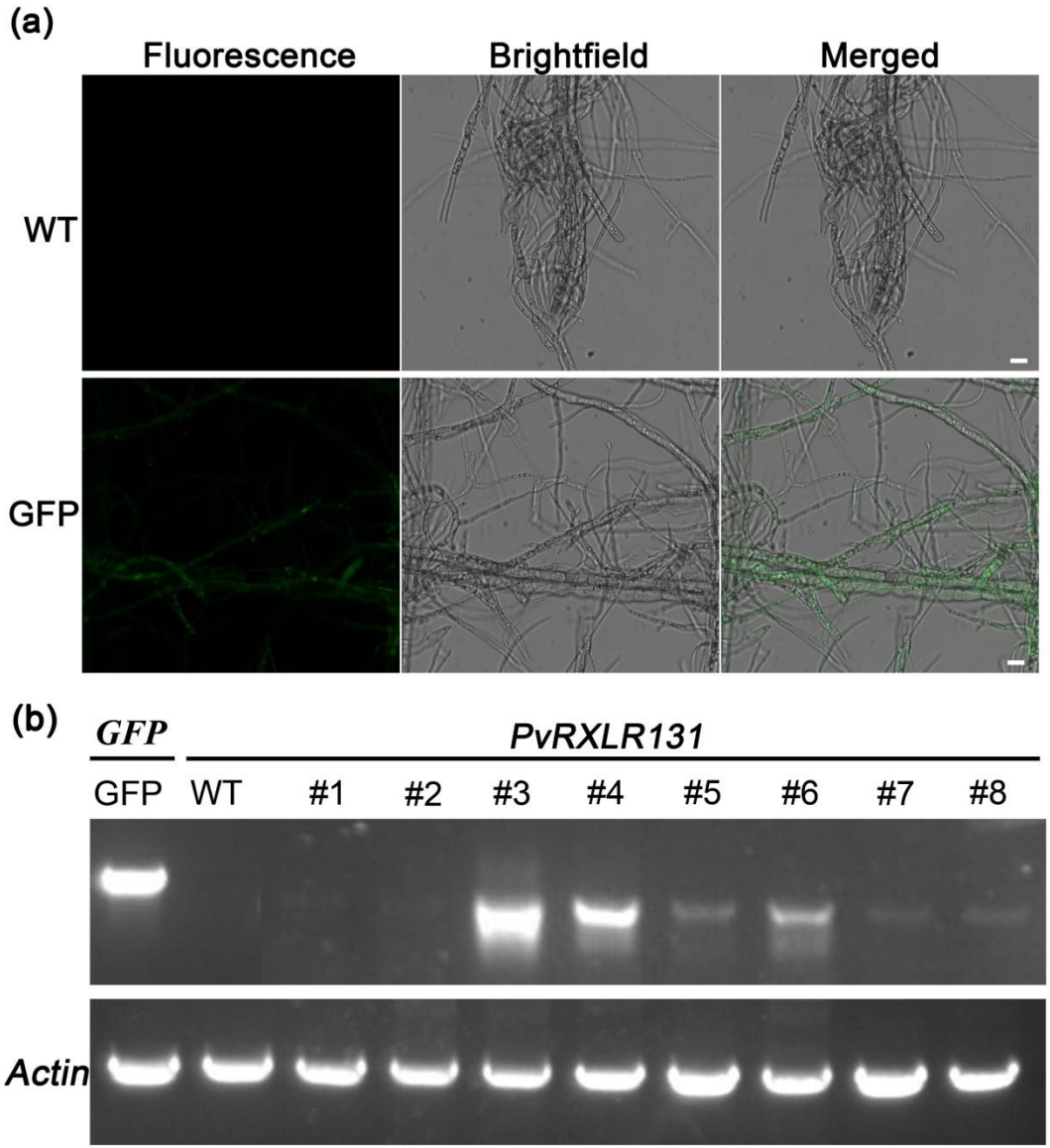


PCR detection of *PvRXLR131* gene

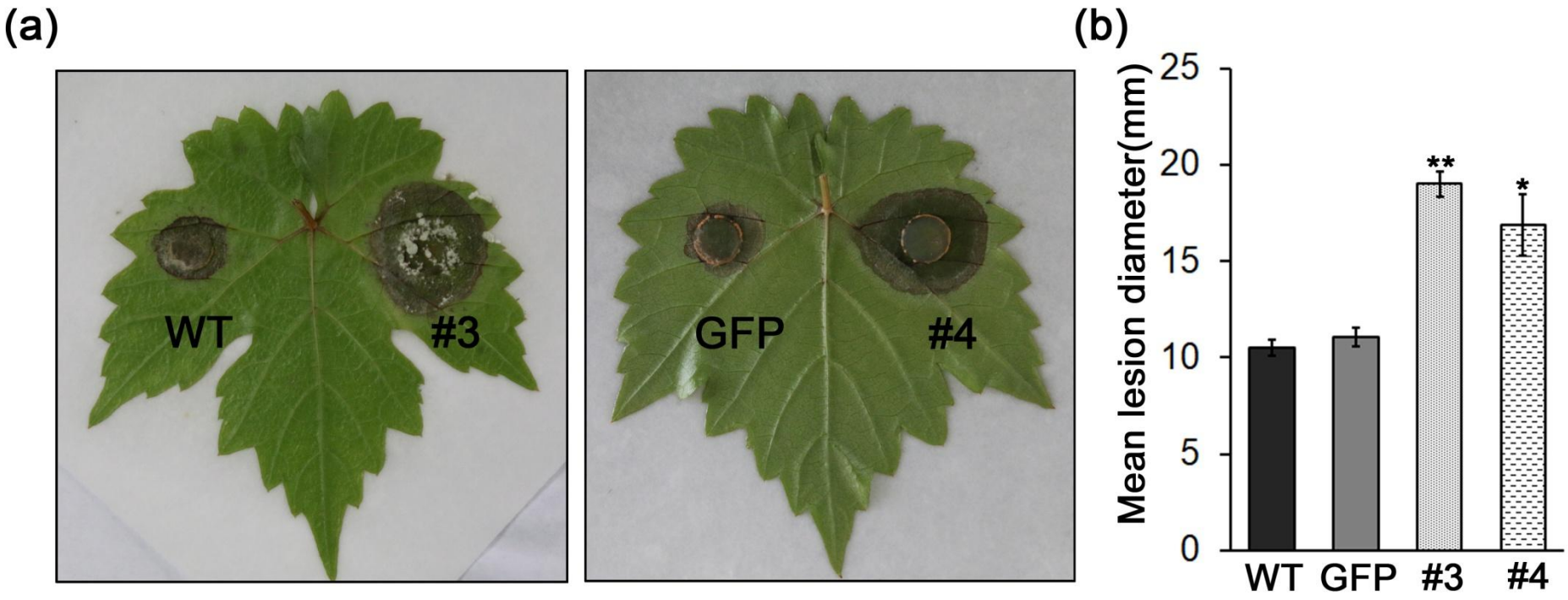


Sequence alignment of PvRXLR131 and its homologs in oomycetes

PvRXLR131 is required for pathogen virulence

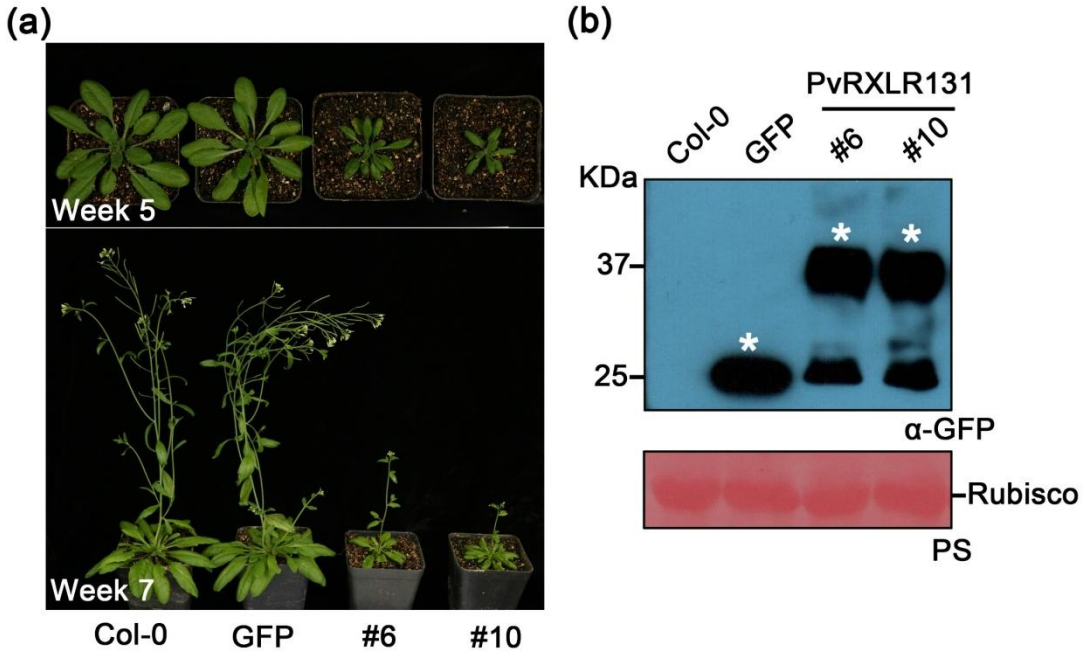


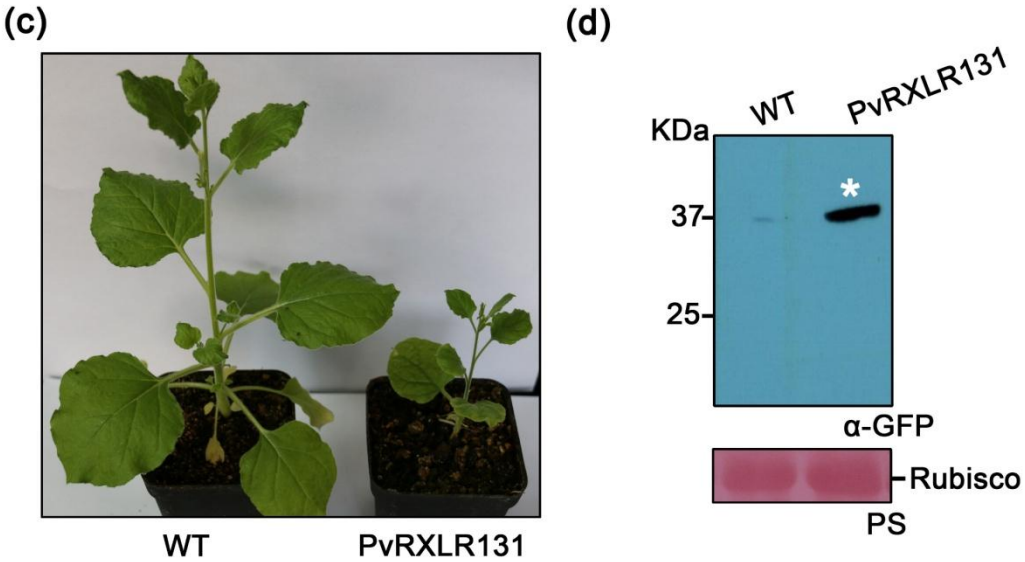
Characterization of *Colletotrichum gloeosporioides* transformants by fluorescence microscopy and RT-PCR



PvRXLR131 enhances *Colletotrichum gloeosporioides* pathogenicity

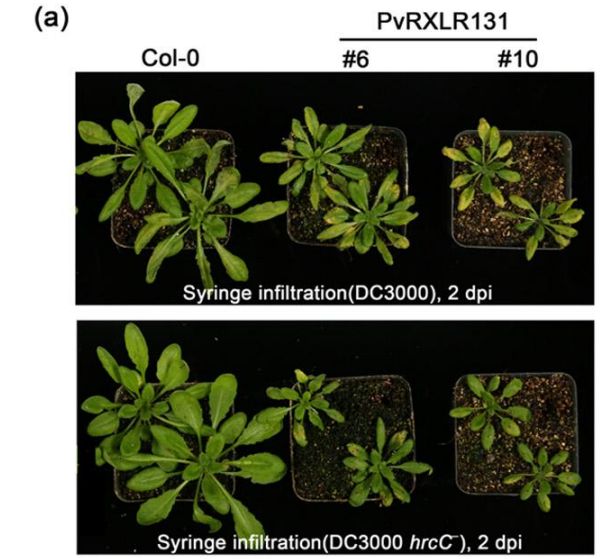
PvRXLR131-transgenic plants exhibit dwarf phenotype

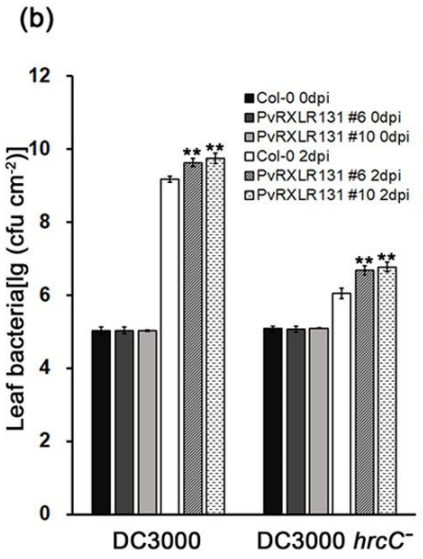


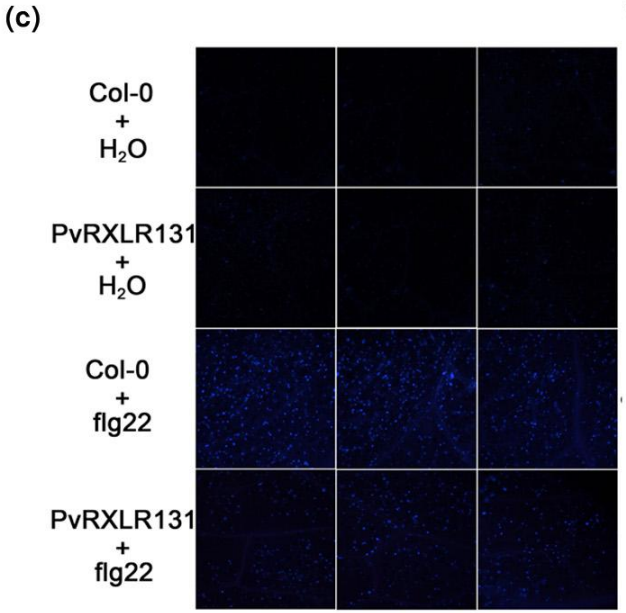


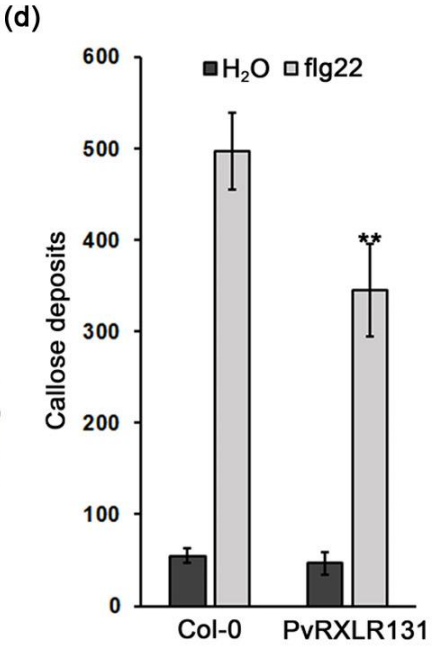
PvRXLR131-transgenic plants display dwarf phenotype

PvRXLR131 suppresses plant innate immunity

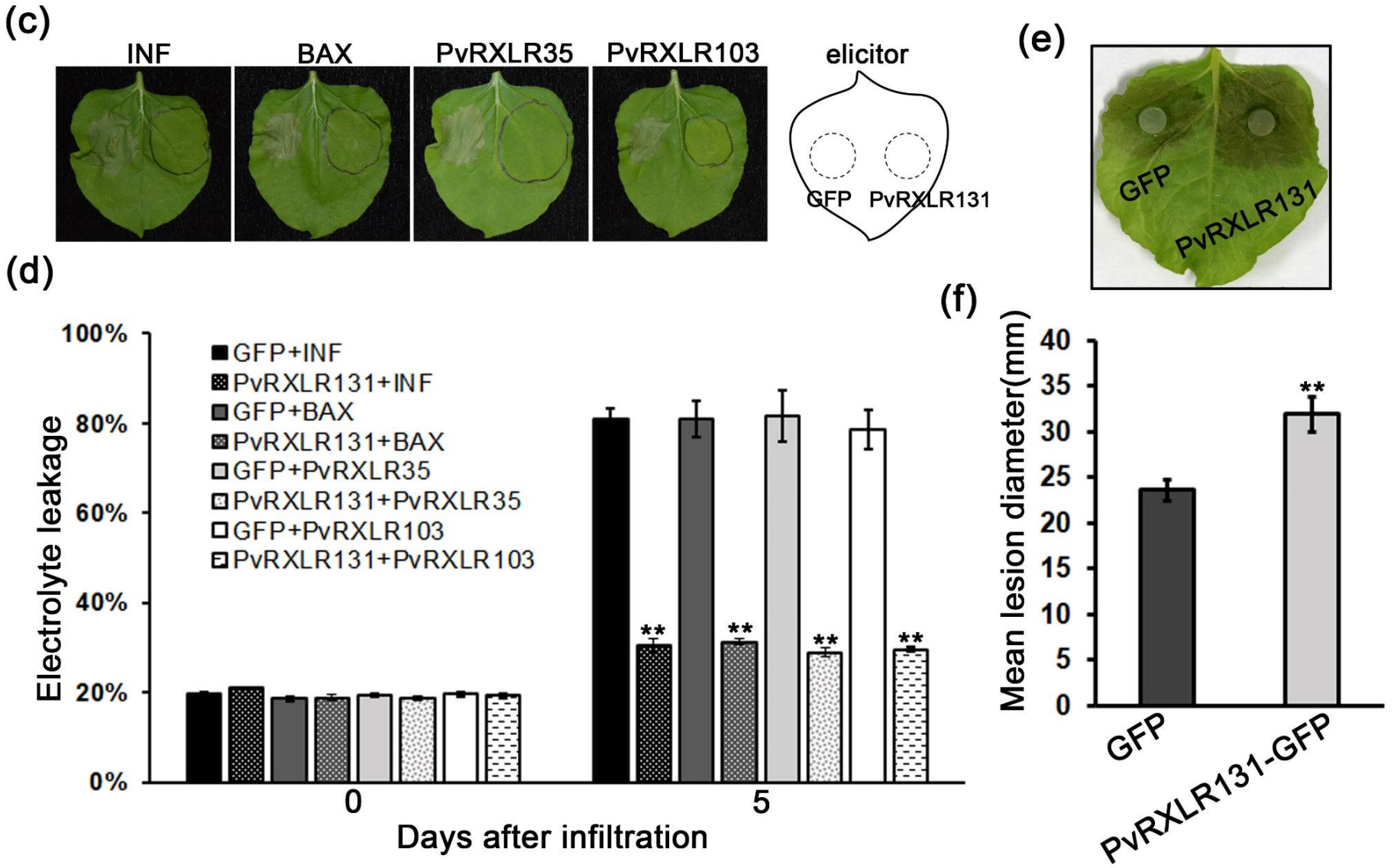






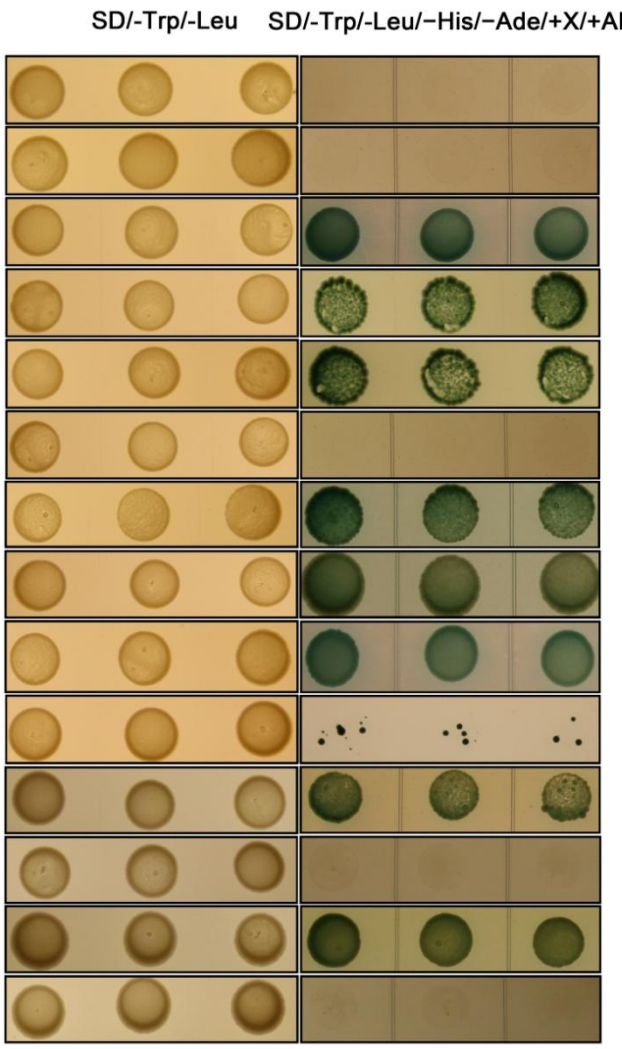


PvRXLR131 attenuated the resistance of *Arabidopsis* to *Pseudomonas syringae*

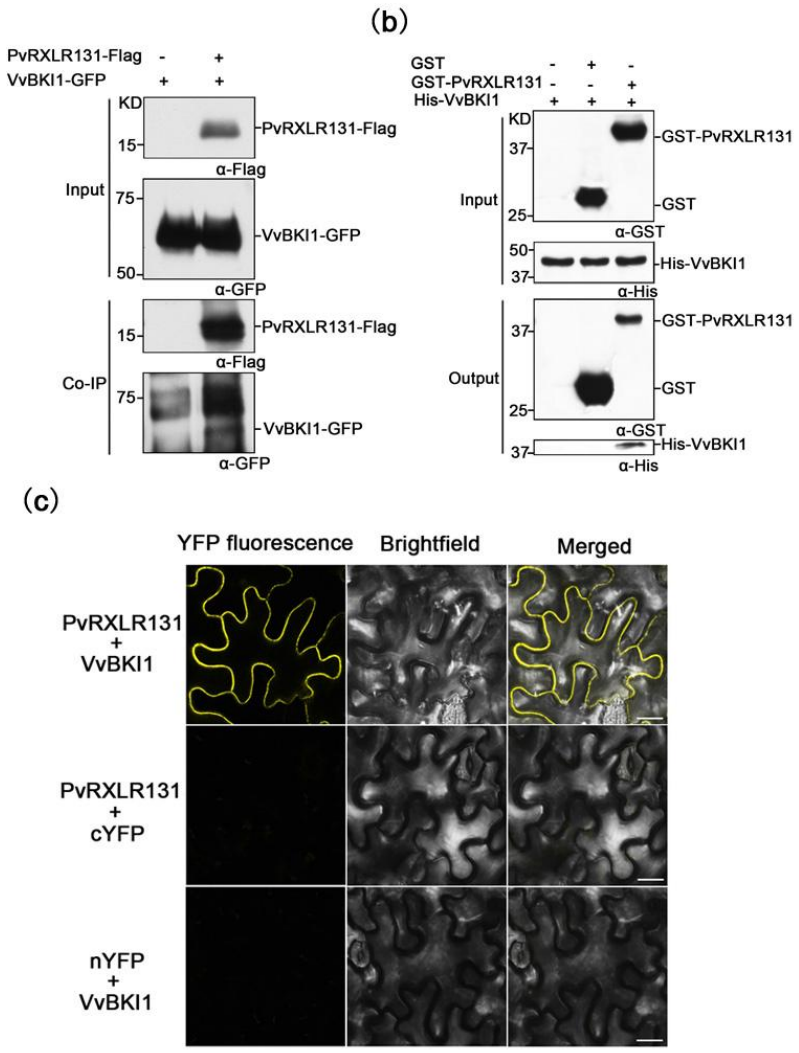


PvRXLR131 suppressed innate immunity of *N. benthamiana*

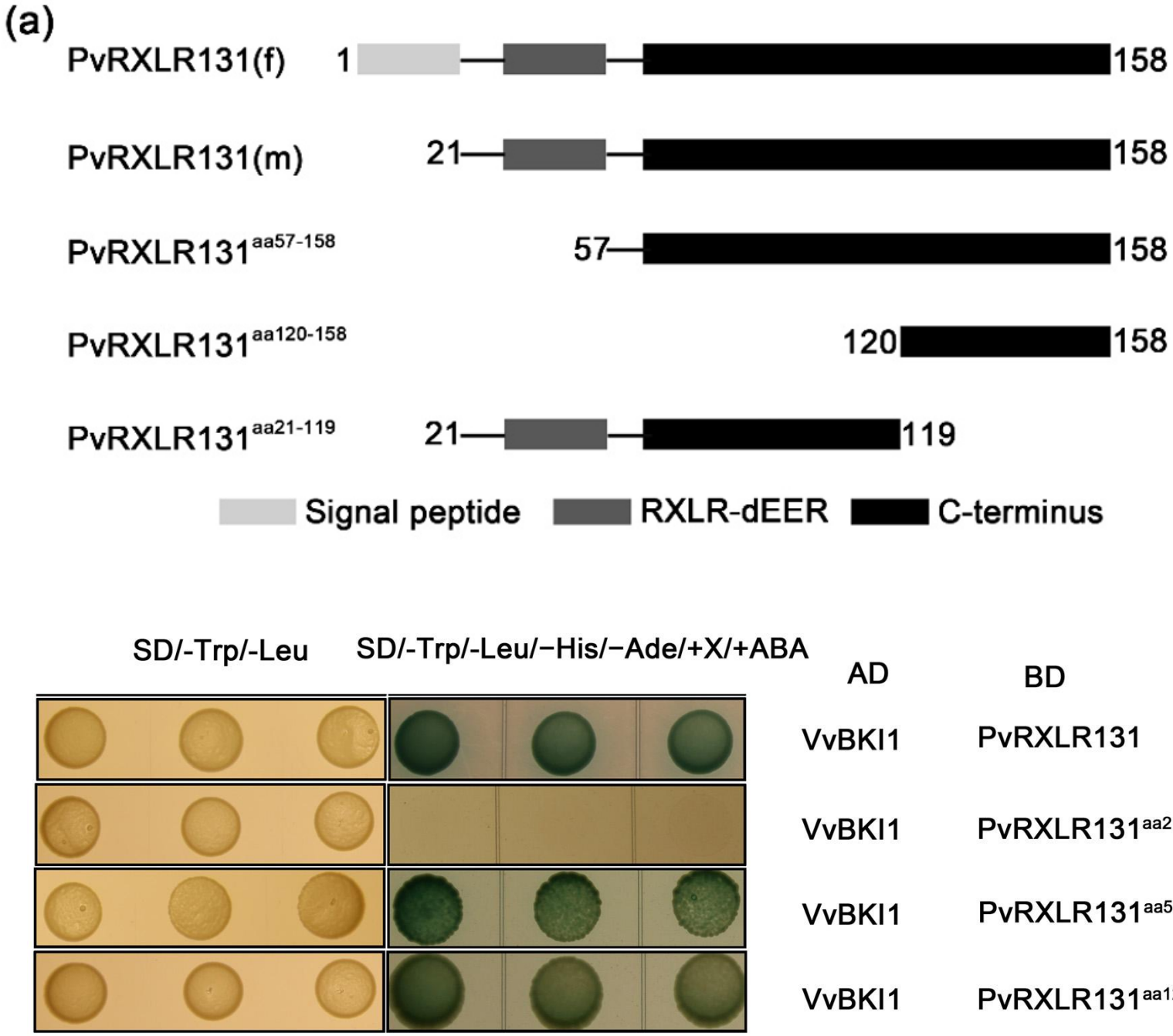
PvRXLR131 interacts with plant BKI1



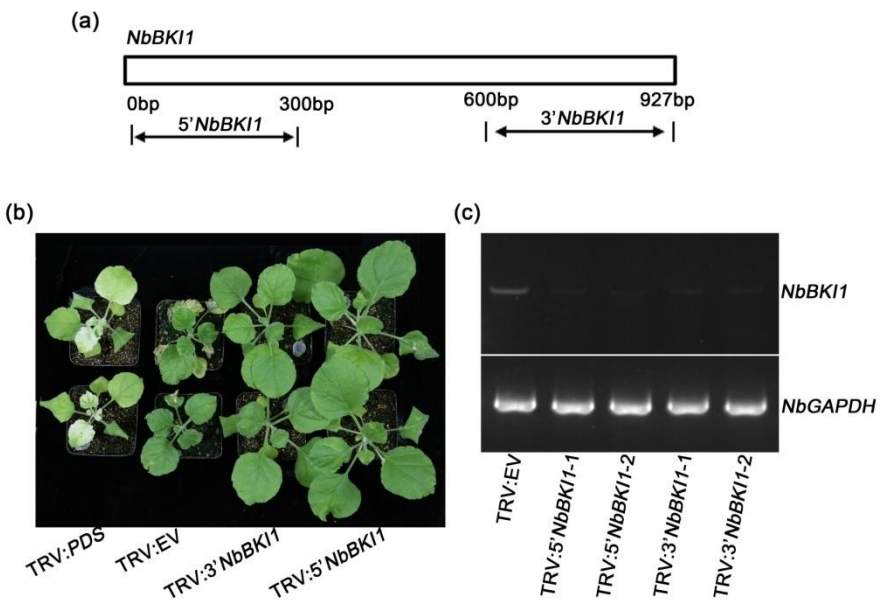
AD	BD	
VvBKI1	pGBKT7	
pGADT7	PvRXLR131	
VvBKI1	PvRXLR131	A
AtBKI1	PvRXLR131	
NbBKI1	PvRXLR131	
VvBKI1	PvRXLR131$^{aa21-119}$	
VvBKI1	PvRXLR131$^{aa57-158}$	
VvBKI1	PvRXLR131$^{aa120-158}$	
VvBKI1^{Y211F}	PvRXLR131	
VvBKI1^{Y211D}	PvRXLR131	
AtBKI1^{Y211F}	PvRXLR131	C
AtBKI1^{Y211D}	PvRXLR131	
NbBKI1^{Y199F}	PvRXLR131	
NbBKI1^{Y199D}	PvRXLR131	

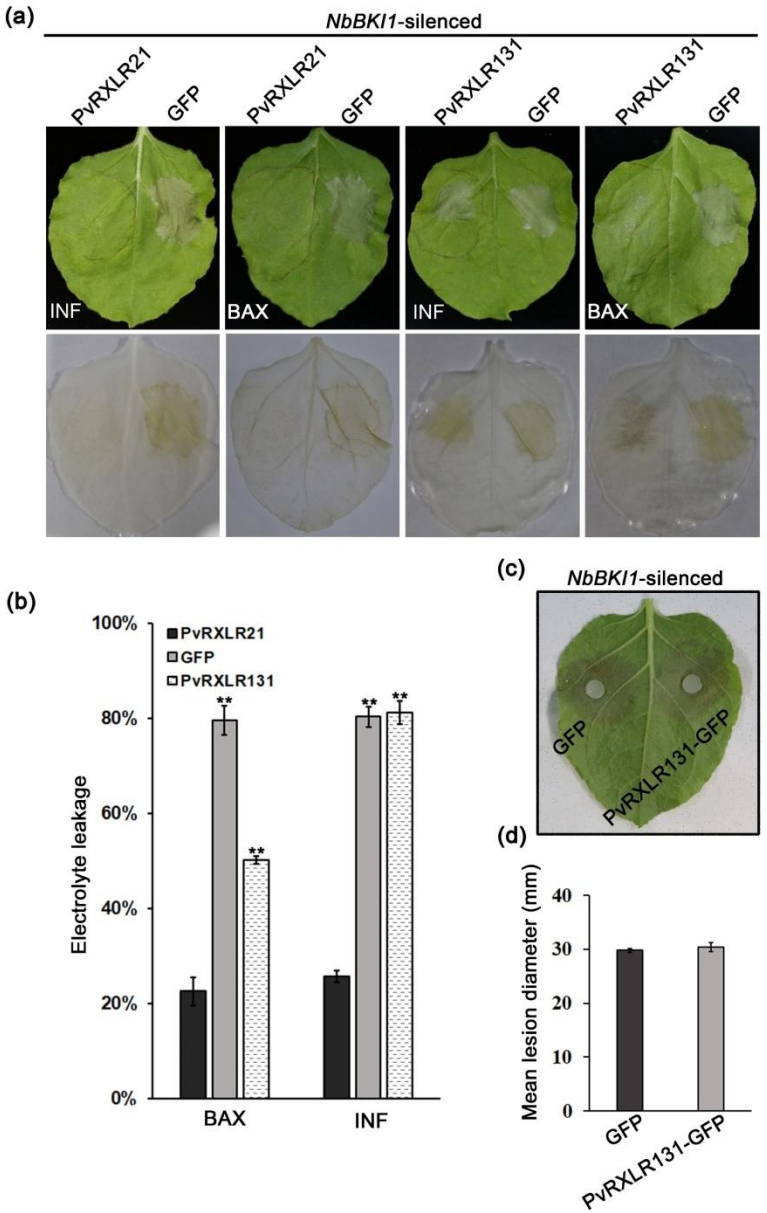


Confirmation of the interaction between PvRXLR131 and VvBKI1


(a)
PvRXLR131(f)
1
158
PvRXLR131(m)
21
158
PvRXLR131aa57-158
57
158
PvRXLR131aa120-158
120
158
PvRXLR131aa21-119
21
119
Signal peptide
RXLR-dEER
C-terminus
SD/-Trp/-Leu
SD/-Trp/-Leu/−His/−Ade/+X/+ABA
AD
BD
VvBKI1
PvRXLR131
VvBKI1
PvRXLR131aa21-119
VvBKI1
PvRXLR131aa57-158
VvBKI1
PvRXLR131aa120-158

Virulence function of PvRXLR131 required BKI1





PvRXLR131 fails to suppress elicitor-triggered cell death and promote *Phytophthora capsici* growth in *NbBKI1*-silenced *Nicotiana benthamiana*

Summary

Grapevine downy mildew pathogen *Plasmopara viticola* secretes PvRXLR131 to target plant BKI1, the receptor inhibitor of brassinosteroid (BR) and ERECTA (ER) signaling pathways, to suppress plant immunity and promote infection.

Acknowledgements

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