A Rhamnolipid precursor triggers Induced Systemic Resistance in Arabidopsis

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A Rhamnolipid precursor triggers Induced Systemic Resistance in Arabidopsis

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Introduction

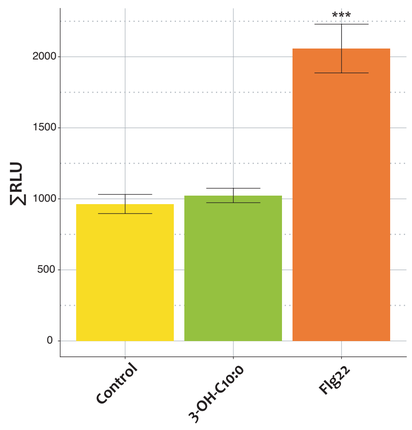
In their environment, plants are frequently challenged by pathogenic microorganisms. To deal with these pathogens, plants possess an arsenal of defence mechanisms, quickly activated following microorganism perception. This perception involves Microbe-Associated Molecular Patterns (MAMPs) that are recognized by plant cells through Pattern Recognition Receptors (PRRs) resulting in plant innate immunity (MTI, MAMP-Triggered Immunity). We previously showed in the laboratory that a natural rhamnolipids secretome (RLsec), produced by *Pseudomonas aeruginosa*, induce classical markers of plant immunity on *Arabidopsis thaliana* leaves and is highly effective on several plants to induce local resistance at the foliar level against phytopathogenic microorganisms[1, 2, 3]. Among the RLsec constituents, the 3-hydroxydecanoic acid (3-OH-C10:0) synthesis precursor of rhamnolipids (RLs) was identified.

The aim of this study is to determine if the 3-OH-C10:0 precursor of RLs is perceived by *A. thaliana* roots and if this perception triggers a systemic resistance against the necrotrophic fungus *Botrytis cinerea*.

3OH-C10:0 triggers immunity markers in roots

To investigate the 3-OH-C10:0 perception by roots, commonly used markers of plant MTI were followed.

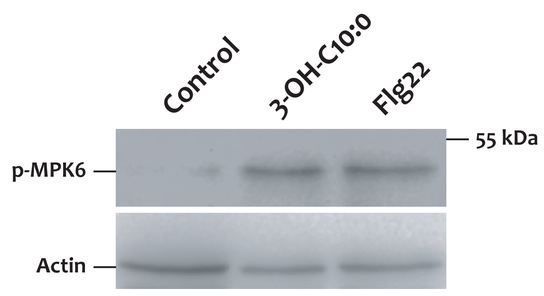
- ROS accumulation



ROS production in *A. thaliana* roots during 40 minutes after treatment with 10 µM 3-OH-C10:0 or 1 µM Flg22

Unlike Flg22, **no ROS production was detected** with 10 µM 3-OH-C10:0 treatment.

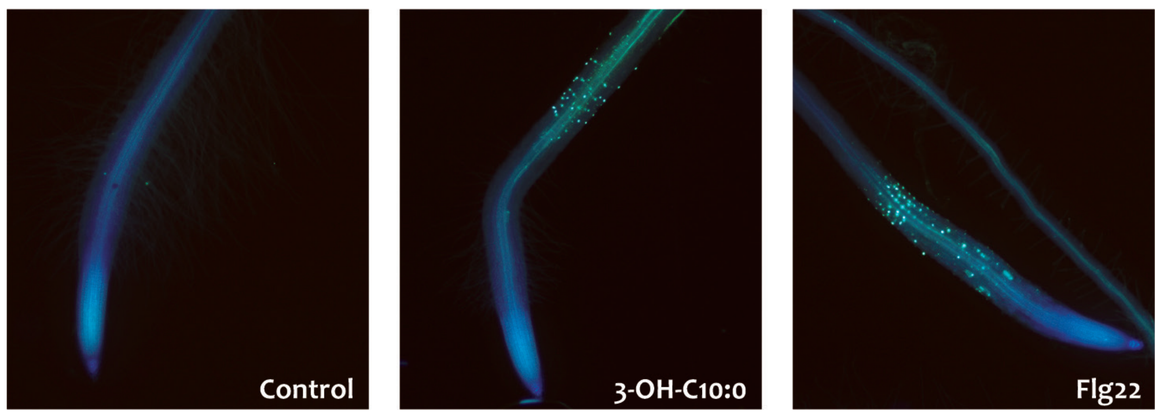
- MAPK activation



Detection of MAPK activation in roots 10 minutes after treatment with 10 µM 3-OH-C10:0 or 1 µM Flg22

3-OH-C10:0 treatment induced **MAPK6 activation** in *A. thaliana* roots in a similar manner than the Flg22 peptide.

- Callose deposition



Detection of callose deposition in roots, 24h after treatment with 10 µM 3-OH-C10:0 or 1 µM Flg22

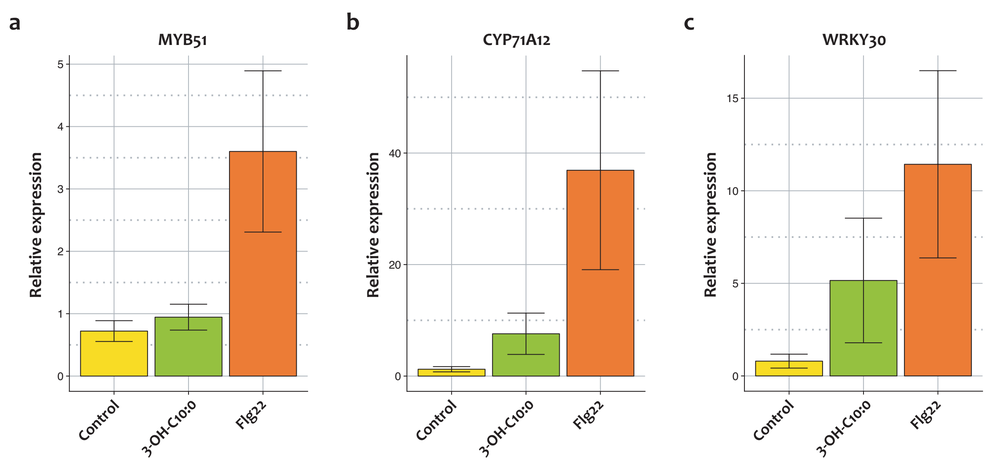
Similarly to Flg22, 3-OH-C10:0 treatment triggered **callose deposition** localized to the epidermal layer in the root elongation zone.

3-OH-C10:0 triggers transcriptional changes in roots

Expression pattern of the root MTI marker genes, *MYB51*[4], *CYP71A12*[4] and *WRKY30*[5] were followed by qRT-PCR in roots 3h after treatment with 10 µM 3-OH-C10:0 or 1 µM Flg22 as positive control.

- *MYB51* (a) gene expression was significantly induced at 3h after Flg22 treatment but no induction was observed following 3-OH-C10:0 treatment.

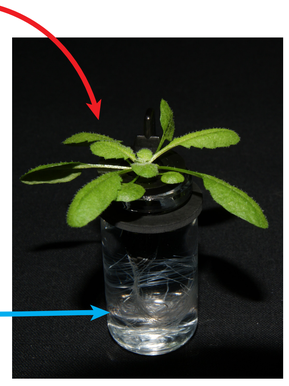
- *CYP71A12* (b) and *WRKY30* (c) genes were induced by both 3-OH-C10:0 and Flg22 at 3h post-treatment



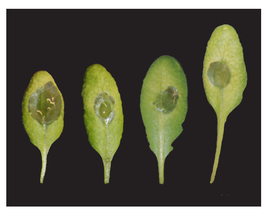
3-OH-C10:0 induces systemic resistance in *A. thaliana* against *B. cinerea*

2- Inoculation of leaves with a *Botrytis cinerea* conidial suspension (1.10^5 conidia.mL^{-1})

1- Treatment Roots elicitation with 10 µM 3-OH-C10:0 or 1 µM Flg22 48 hours before pathogen inoculation

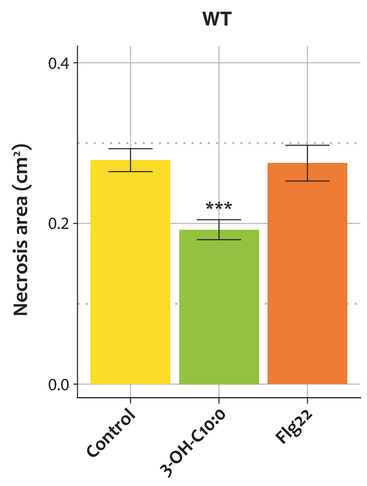


3- 72 hours after inoculation **Measurment of necrosis area**



- WT plants treated with 3-OH-C10:0 showed a significant reduction on disease severity.

Interestingly, Flg22 did not showed similar ability in triggering ISR against *B. cinerea.*



Conclusion

The 3-OH-C10:0 perception by roots lead to a systemic resistance against *B. cinerea* in *A. thaliana* leaves and induce MAPK activation, callose deposition and induction of MTI markers genes.

References

[1]Varnier *et al.* Plant Cell Environ. 32, 178-193 (2009)
[2]Sanchez *et al.* Plant Physiol. 160, 1630-1641 (2012)
[3]Monnier *et al.* Front. Plant Sci. 9, 1170 (2018)
[4]Millet *et al.* Plant Cell, 22, 973–990 (2010)
[5]Stringlis *et al.* Plant J., 93, 166–180 (2018)

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