RNAseq expression analysis of potato tubers differing in resistance to soft rot caused by bacteria *Dickeya solani*

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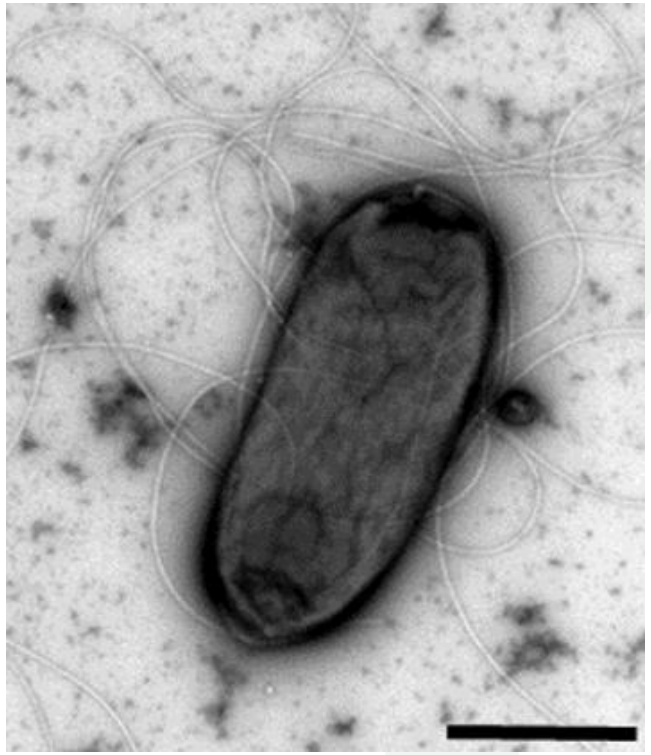
Introduction

Dickeya solani



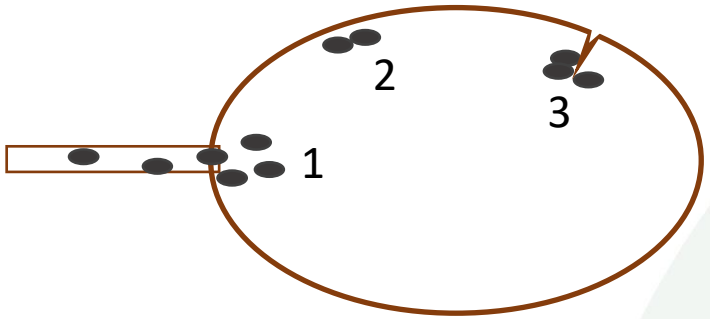
Lisicka et al. 2018.
Front. Plant Sci. 9:374

Soft rot

Introduction

Soft rot of potato tubers

Infection:



1. Stolons – cell wall disruption
2. Lenticels – cell wall disruption
3. Wounds

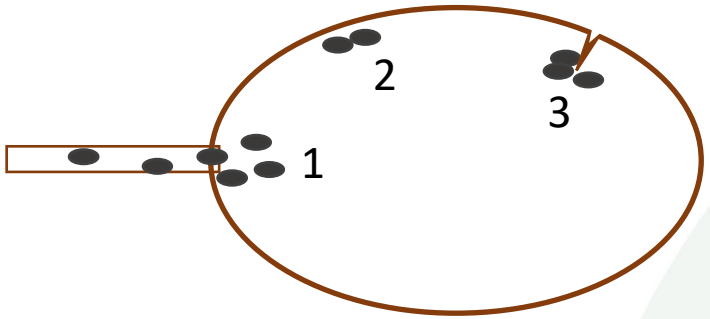
Type of stress:

- Abiotic - wounding
- Biotic - bacteria

Introduction

Soft rot of potato tubers

Infection:



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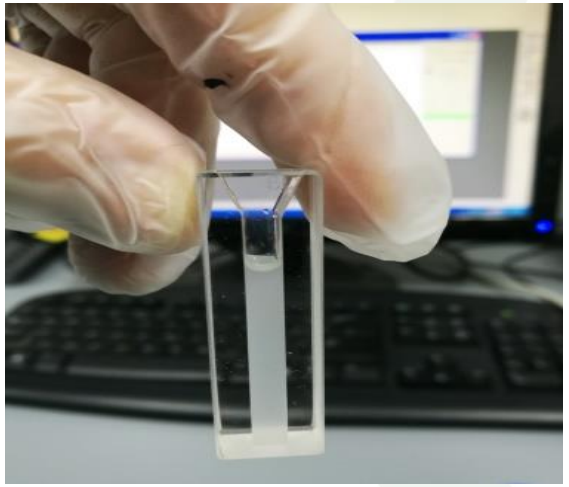


Lebecka, 2001

Introduction

Cultivar Irys

Lady Claire

Lady Rosetta

Highly susceptible ⟷ Medium resistant

Materials

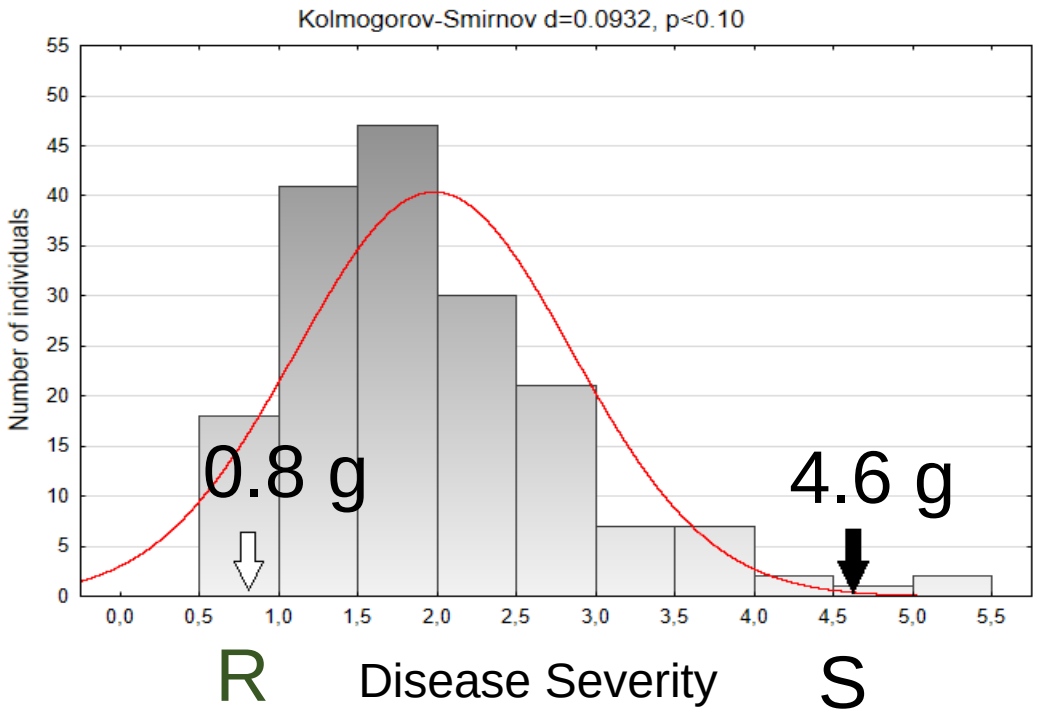
Diploid interspecific hybrids of *Solanum* spp.

Reaction of potato tubers to inoculation with bacteria *D. solani*

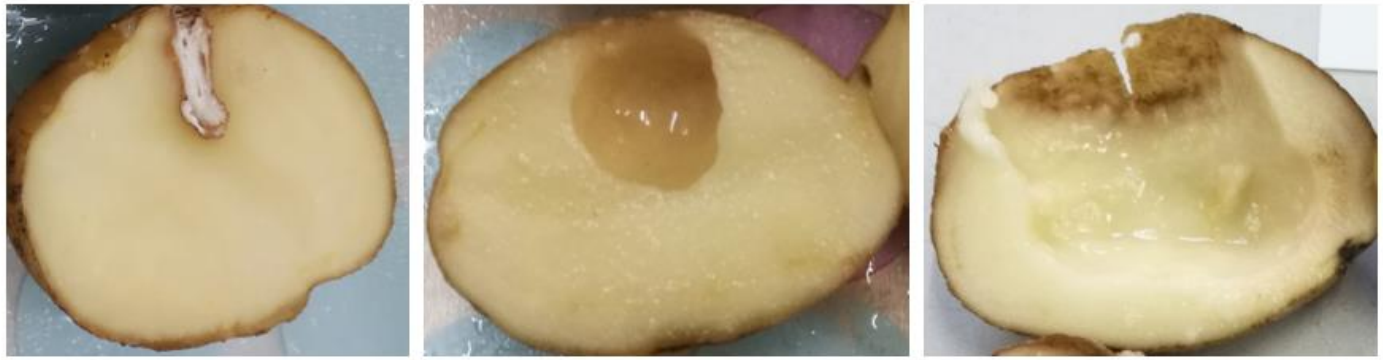
in the highly resistant parent (**R**) and the susceptible parent (**S**)

Materials

Frequency distribution of disease severity



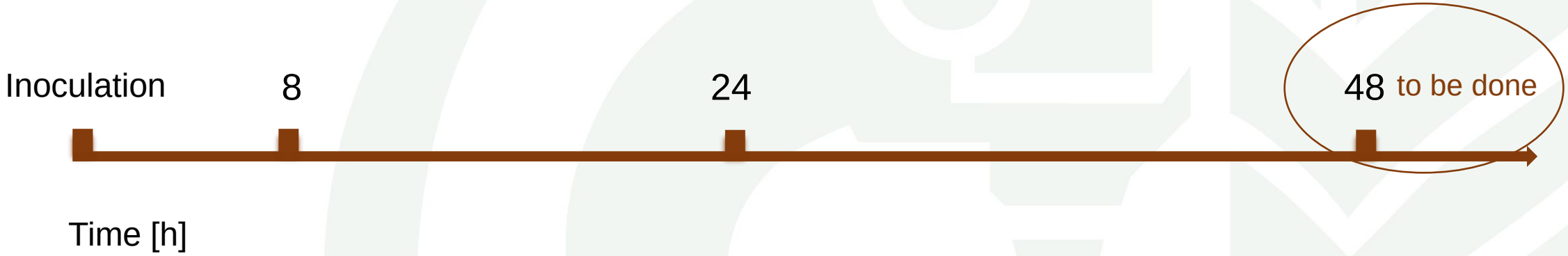
Phenotypic variance of disease severity in the mapping population



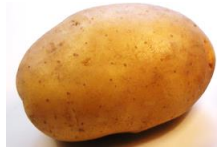
Three days after inoculation with bacteria *Dickeya solani*

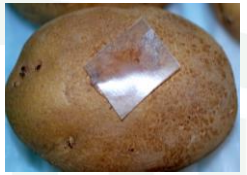
Objectives

- To reveal differences in gene expression in resistant clones in comparison with susceptible ones in three different phases of infection.



Methods





RNA sequencing

Not treated

Wounded + Water

Wounded + Bacteria

Resistant

NTR

WR

BR

Susceptible

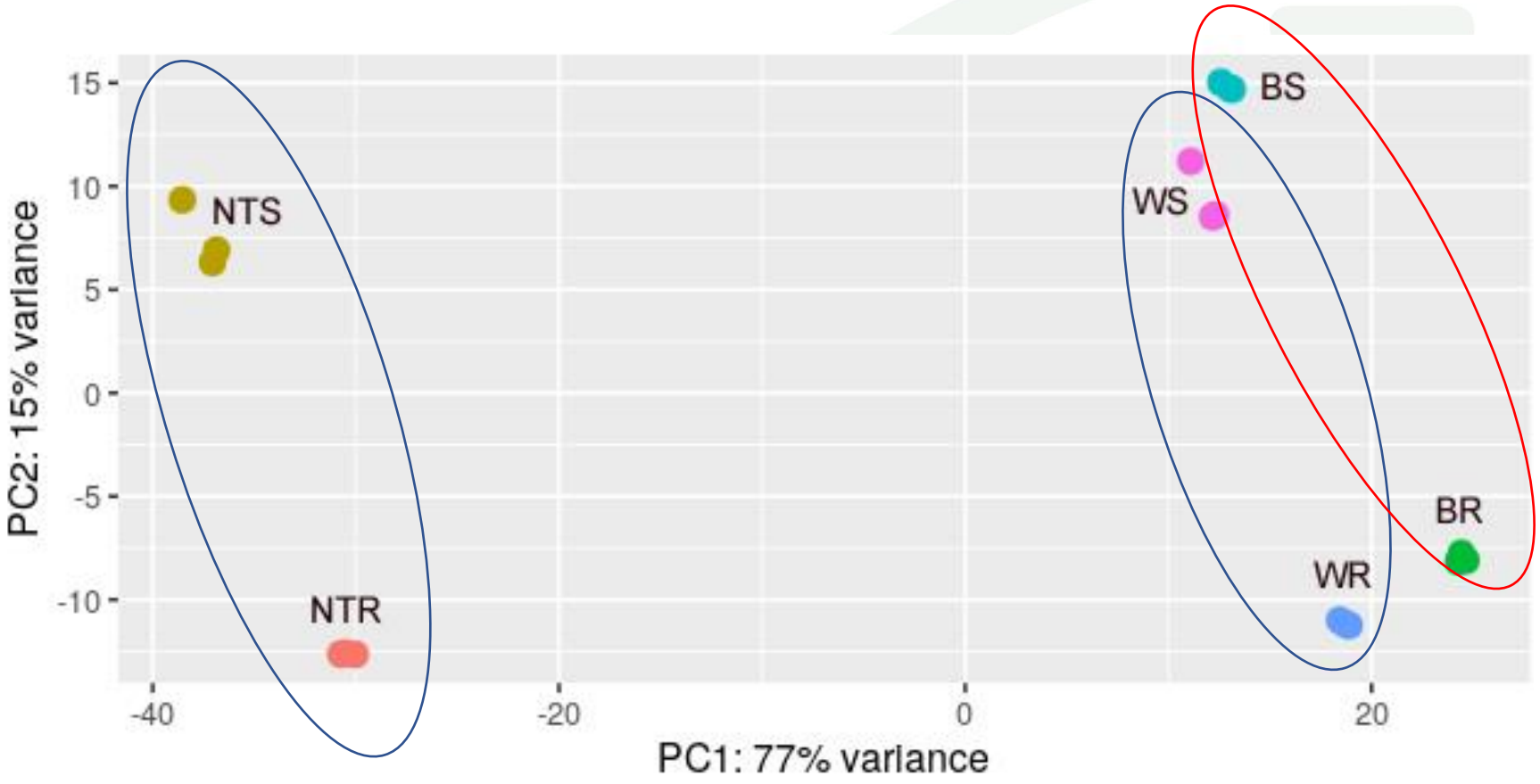
NTS

WS

BS

Results

Principal Component Analysis



B – bacteria

NT – not treated

W – water

R – resistant

S – susceptible

8 hours post inoculation

The most variation in gene expression is due to the treatment.

Results

Principal Component Analysis

B – bacteria

NT – not treated

W – water

R – resistant

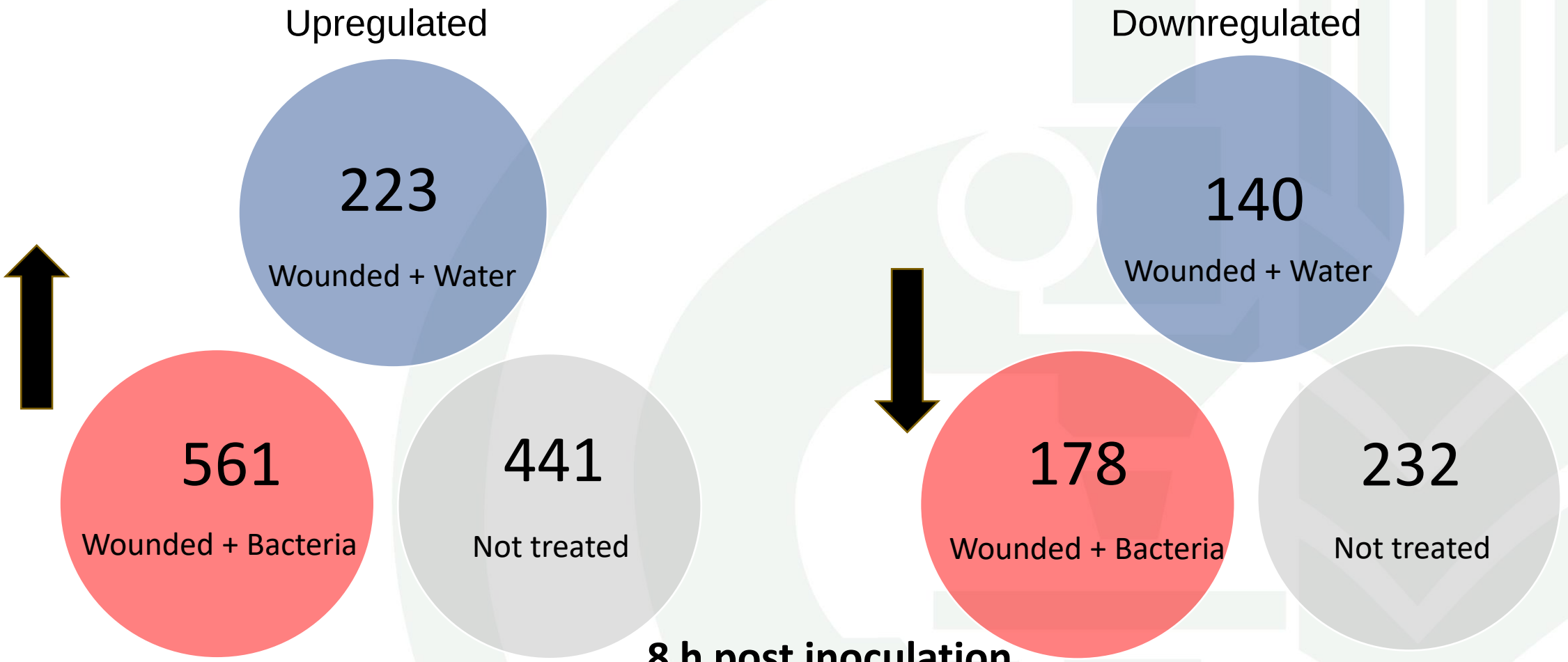
S – susceptible

8 hours post inoculation

The second principal component showed gene expression variation due to the resistance level.

Results

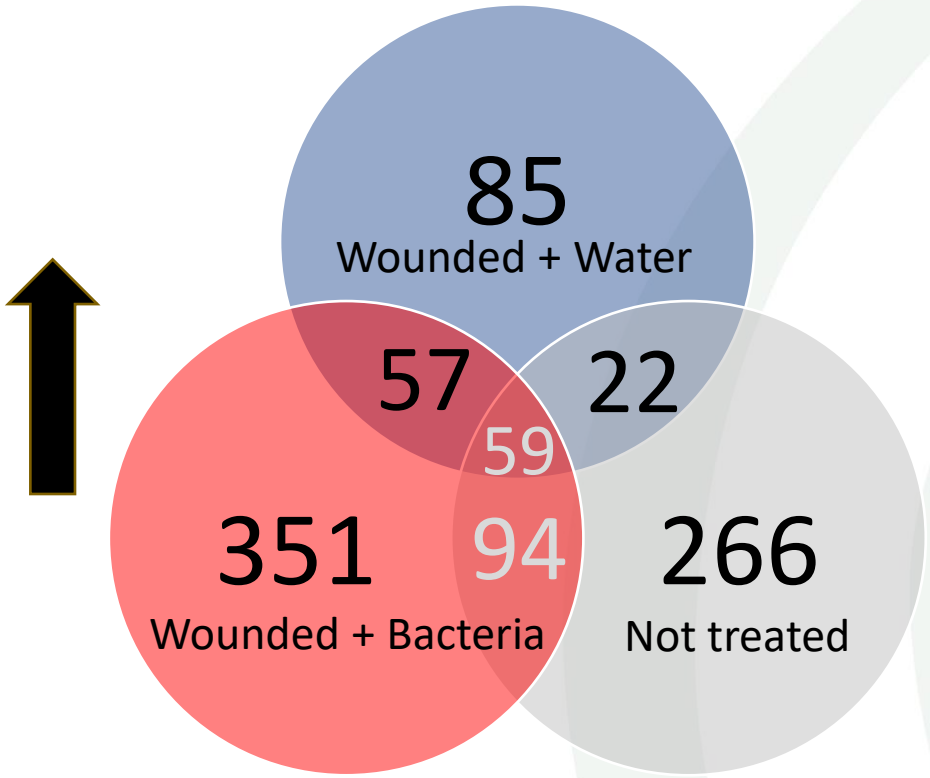
Number of differentialy expressed genes - Susceptible *vs* Resistant



Results

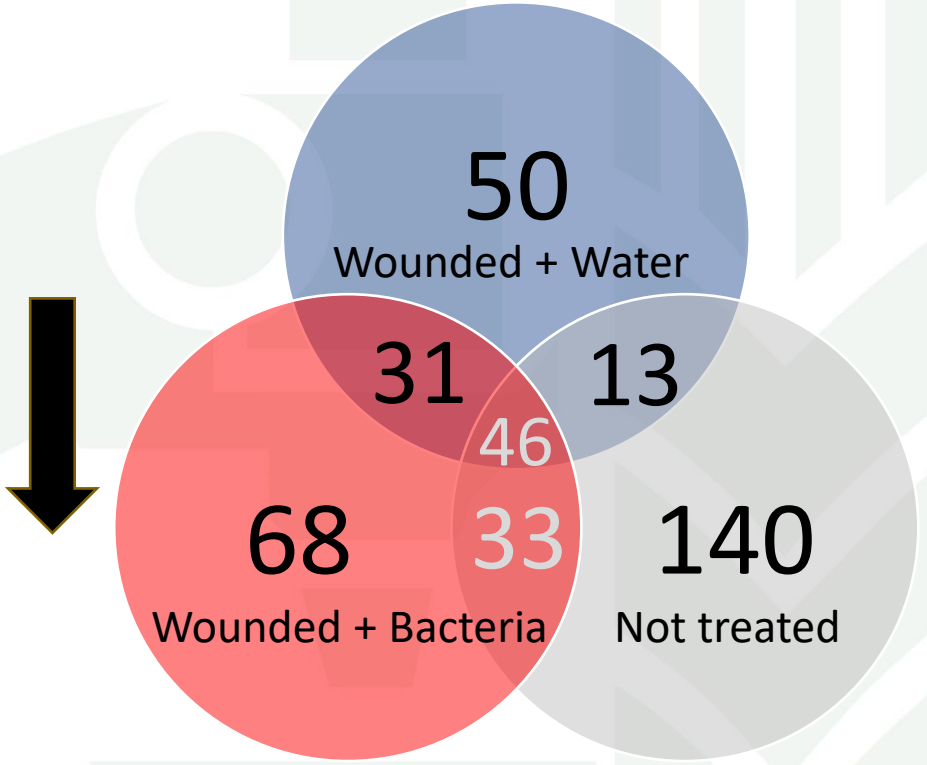
Number of differentialy expressed genes - Susceptible *vs* Resistant

Upregulated



FC $lg_2 \geq 2.0$; $p \leq 0.05$

Downregulated



FC $lg_2 \leq -2.0$; $p \leq 0.05$

8 h post inoculation

Results

Number of differentialy expressed genes - Susceptible *vs* Resistant

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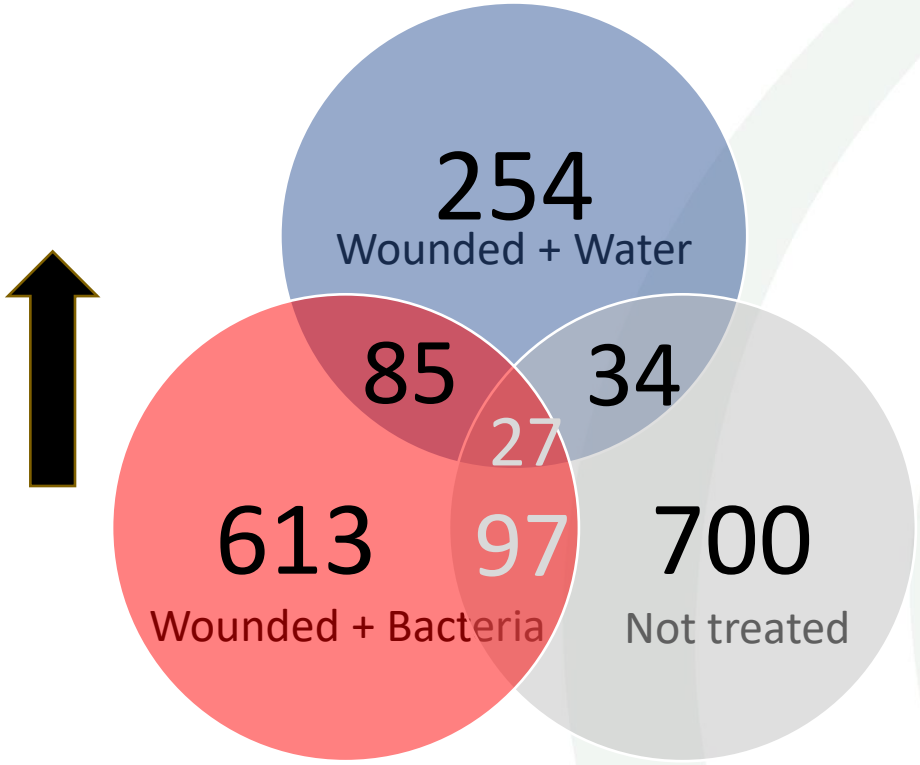

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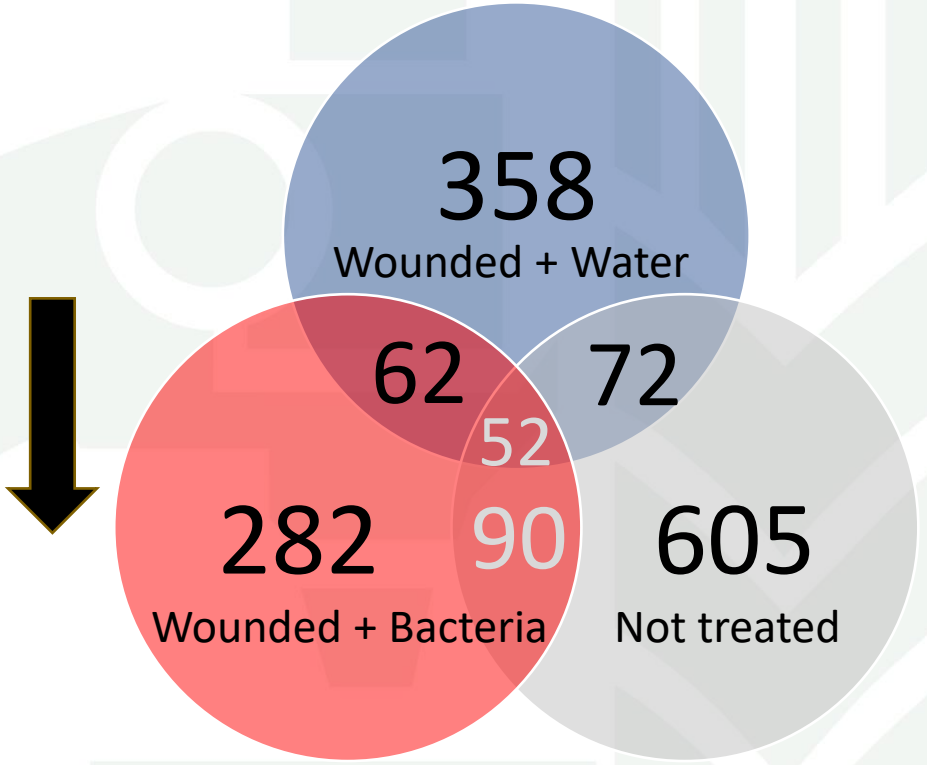


FC $lg_2 \leq -2.0$; $p \leq 0.05$

24 h post inoculation

Results

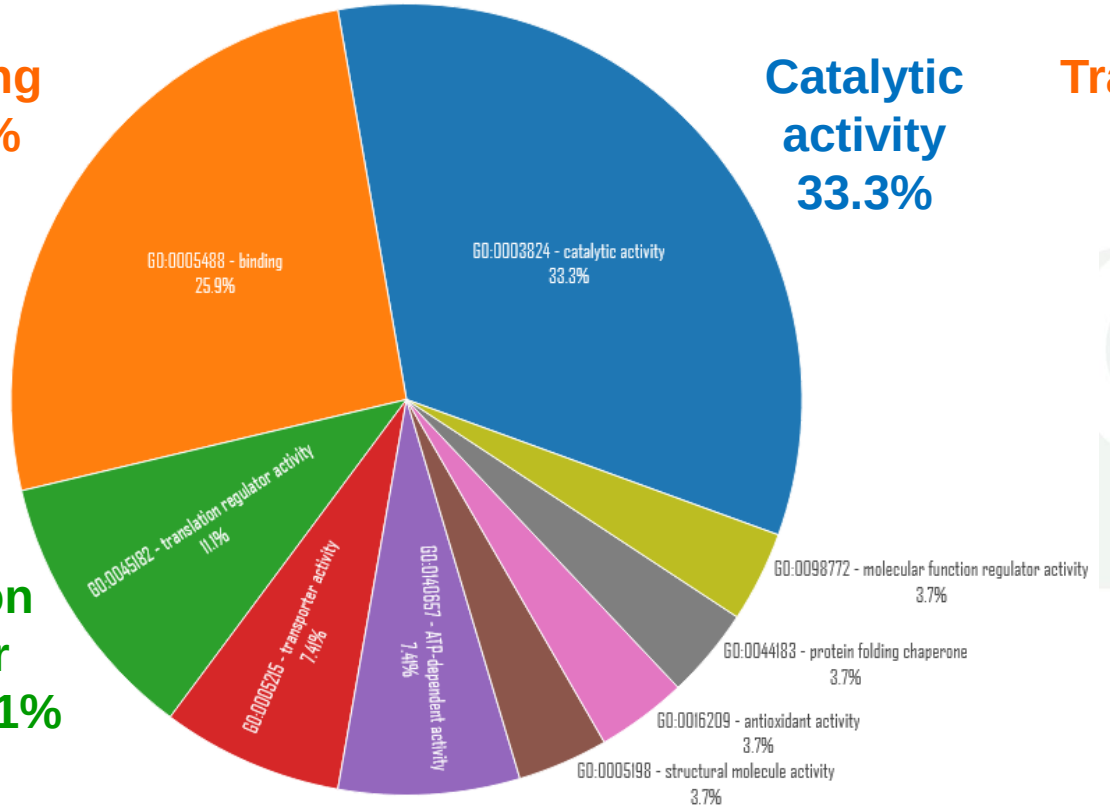
GO enrichment analysis, Molecular Functions in „**Wounded + Bacteria**”
Susceptible *vs* Resistant

8 hpi

Binding 25.9%

Catalytic activity 33.3%

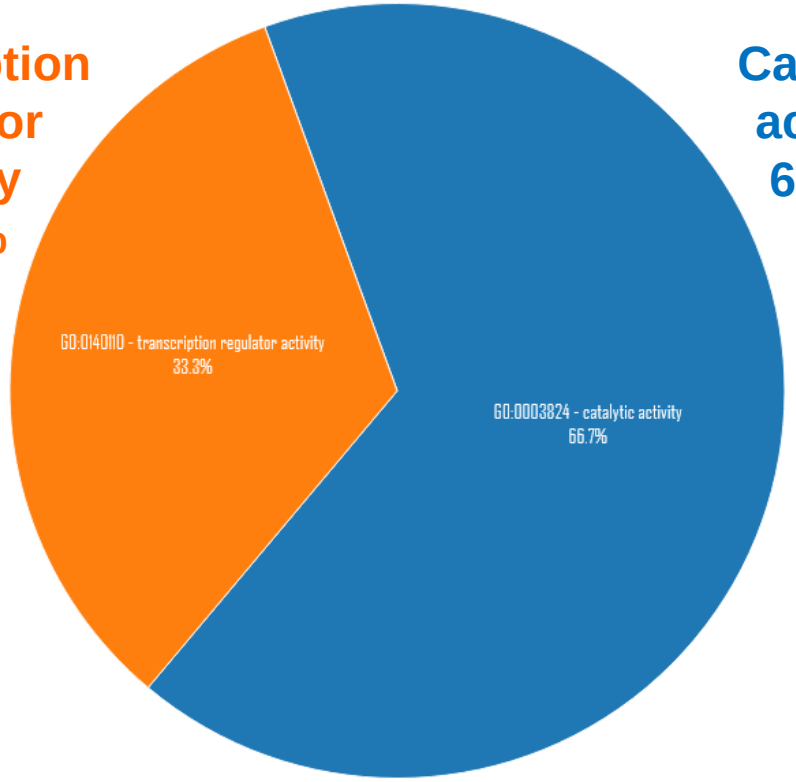
Translation regulator activity 11.1%



24 hpi

Transcription regulator activity 33.3%

Catalytic activity 66.7%

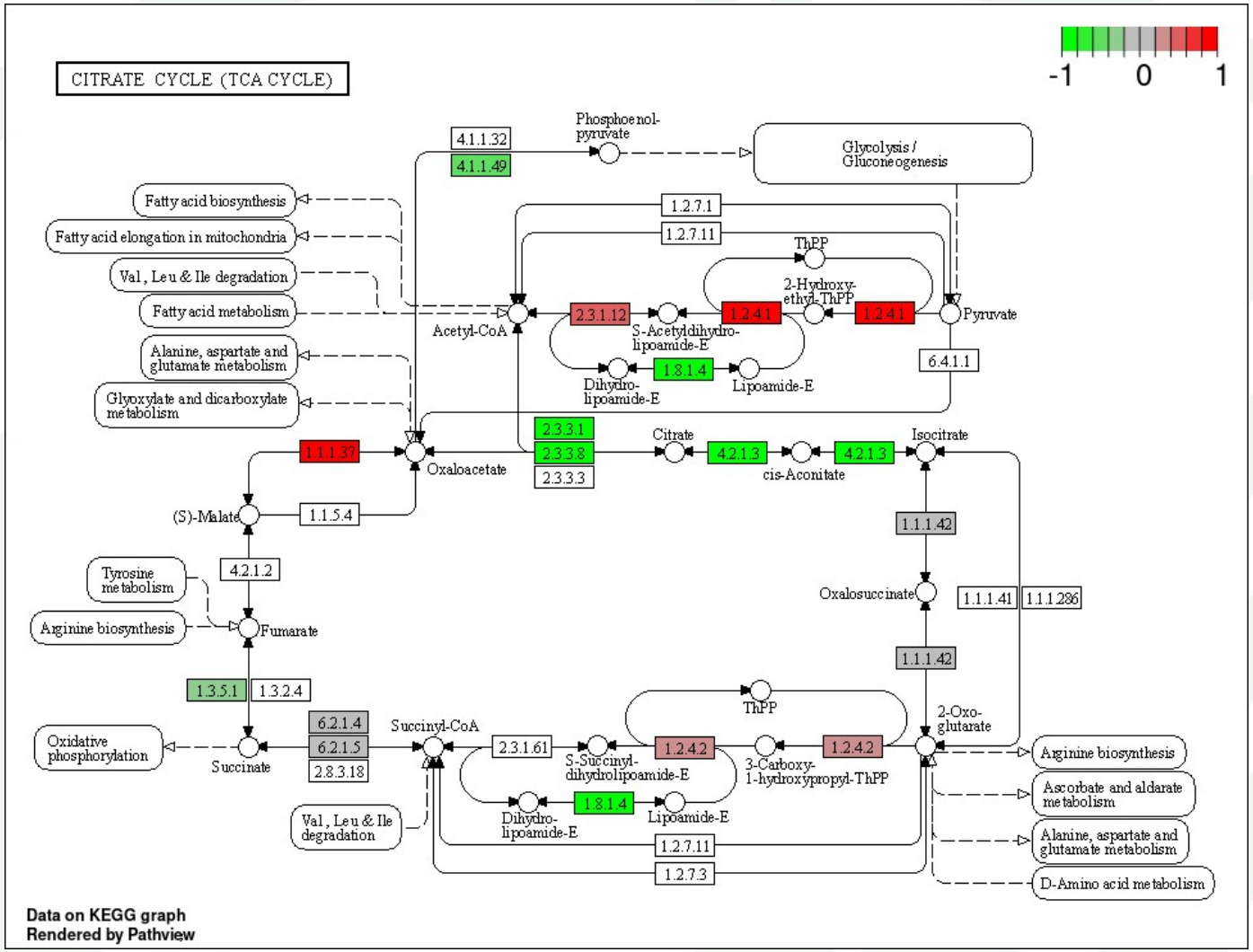


There are differences in over-represented GO terms, molecular functions, at the early phase of the infection (8 hpi) and later stage of infection (24 hpi).

Results

The Krebs Cycle is the significant metabolic pathway 24 hpi.

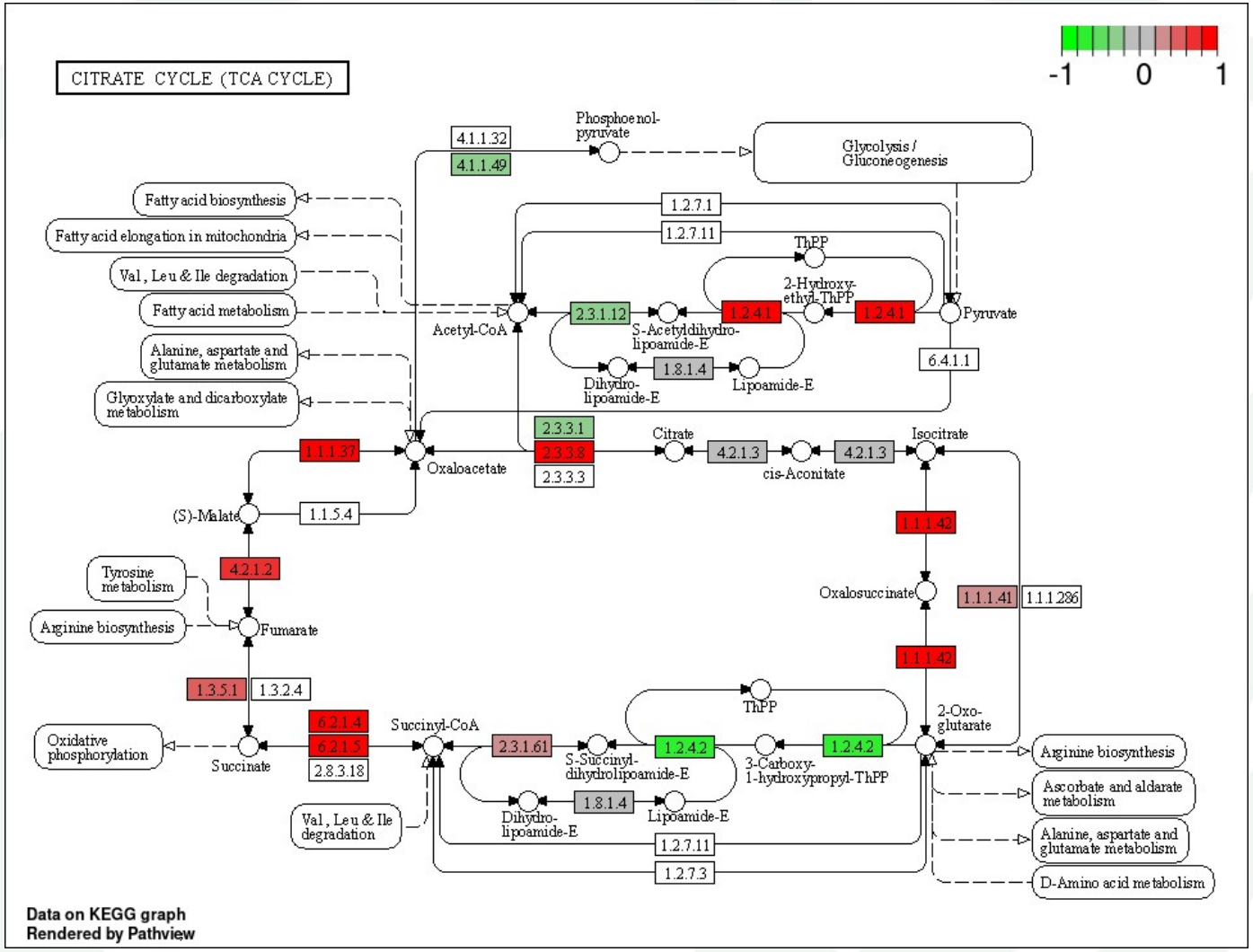
Not treated – Susceptible *vs* Resistant



Results

The Krebs Cycle is the significant metabolic pathway 24 hpi.

Wounded + Water – Susceptible *vs* Resistant



Results

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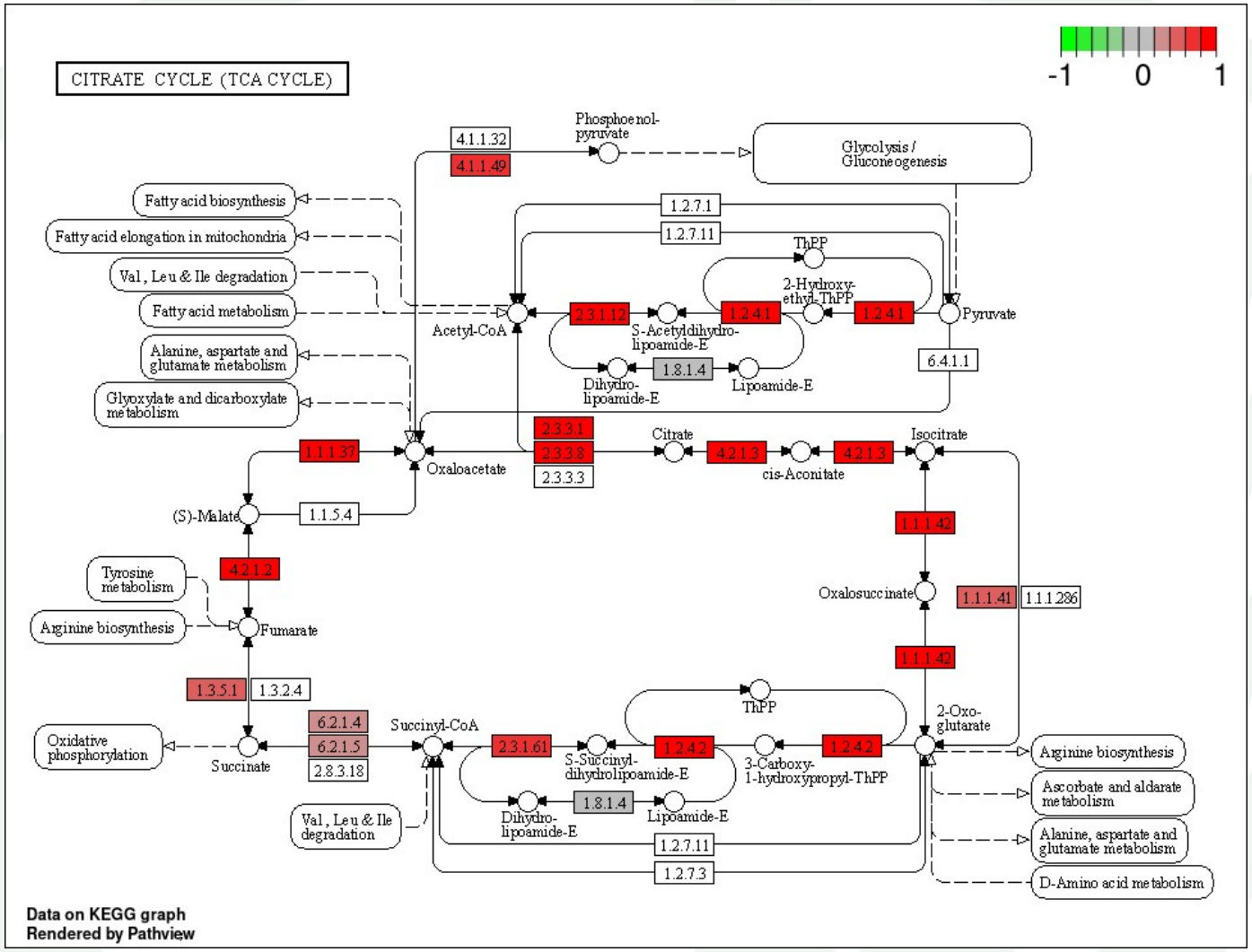
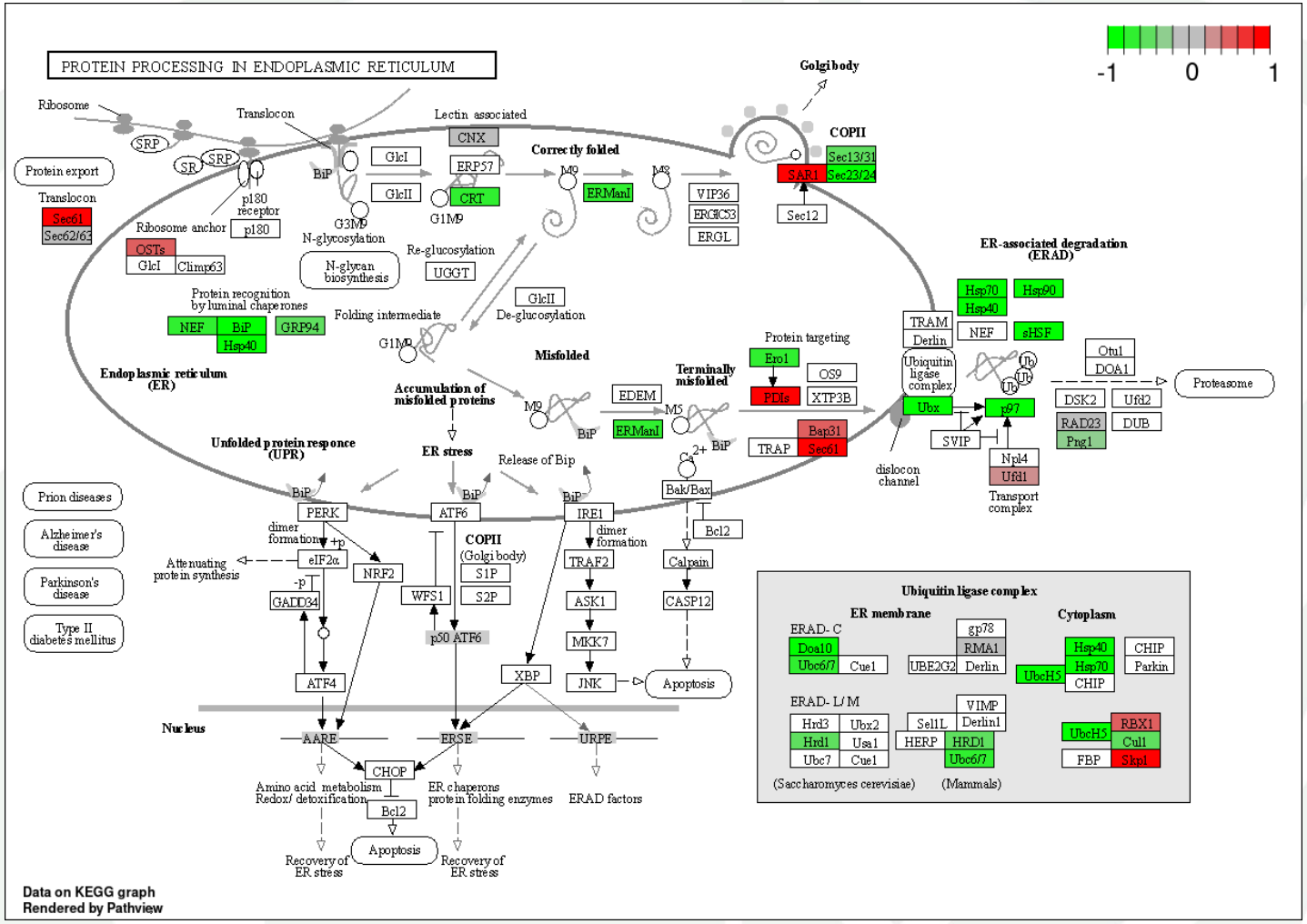
Wounded + Bacteria – Susceptible *vs* Resistant



Results

Protein processing in endoplasmic reticulum 24 hpi is the significant pathway in both wounded and wound-inoculated samples.

Wounded + Water – Susceptible *vs* Resistant



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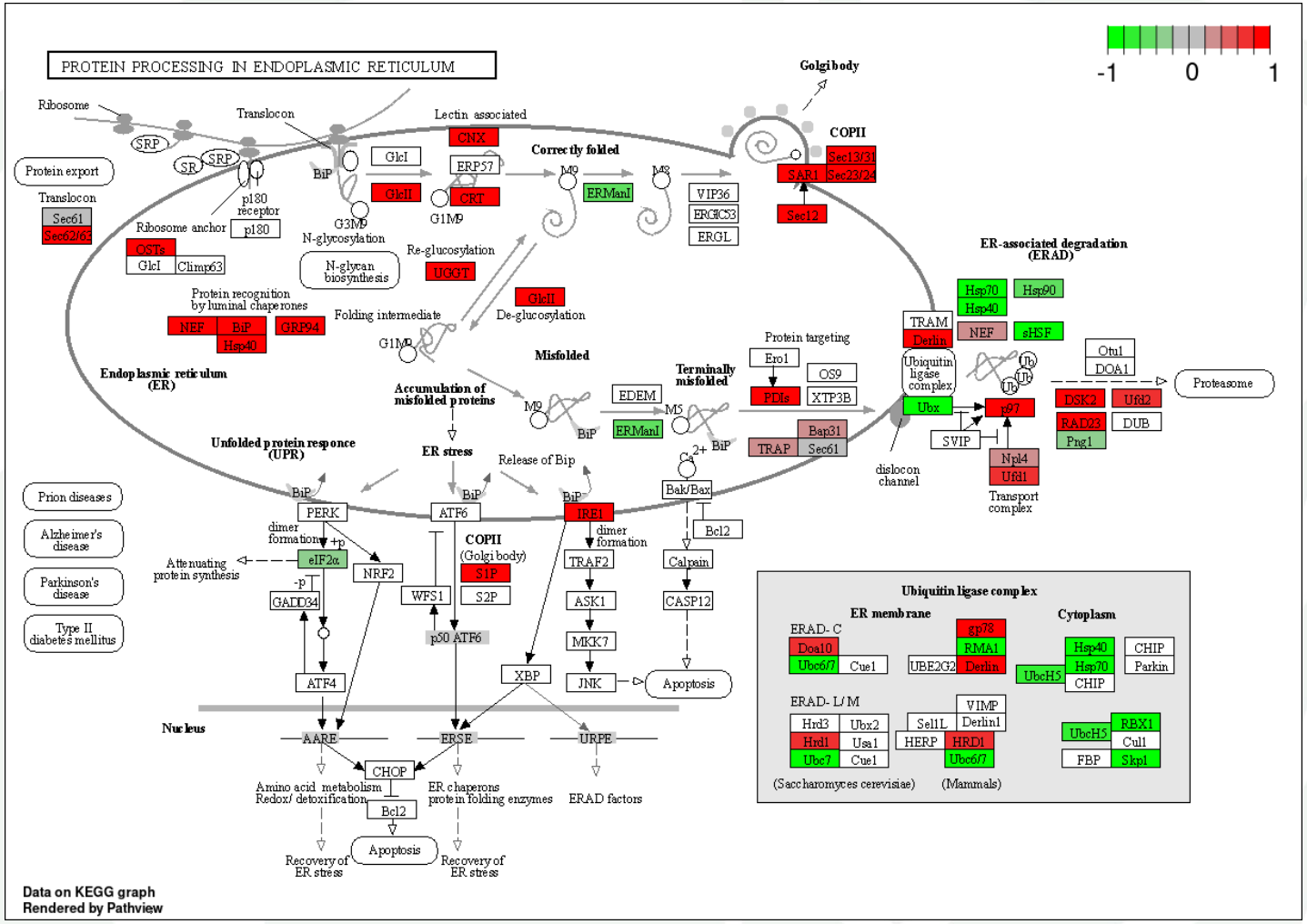
Wounded + Bacteria – Susceptible *vs* Resistant



Conclusions

- The first principal component separated not treated potato tubers from wounded and wound-inoculated tubers (77% and 68%, 8 and 24 hpi respectively). The second component separated samples due to the level of resistance to *Dickeya solani* (15% and 18%, 8 and 24 hpi respectively).
- The number of differentially expressed genes between resistant and susceptible bulks increased with time after inoculation with *Dickeya solani.*
- The gene ontology analysis showed that the resistance to soft rot bacteria was enriched in DEGs associated with the Krebs Cycle and protein processing in the endoplasmic reticulum (24 hpi).

Acknowledgments

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Thank you for your attention.

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