Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

Unravelling the defence arsenal of the wild *Solanum dulcamara* to *Phytophthora infestans*

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EAPR Pathology 2016

Dundee August 7th-11th

Phytophthora infestans

Phytophthora infestans is the causal agent of potato late blight

Its success in promoting disease → secretion of effectors

- suppress immunity
- promote disease

www.apsnet.org

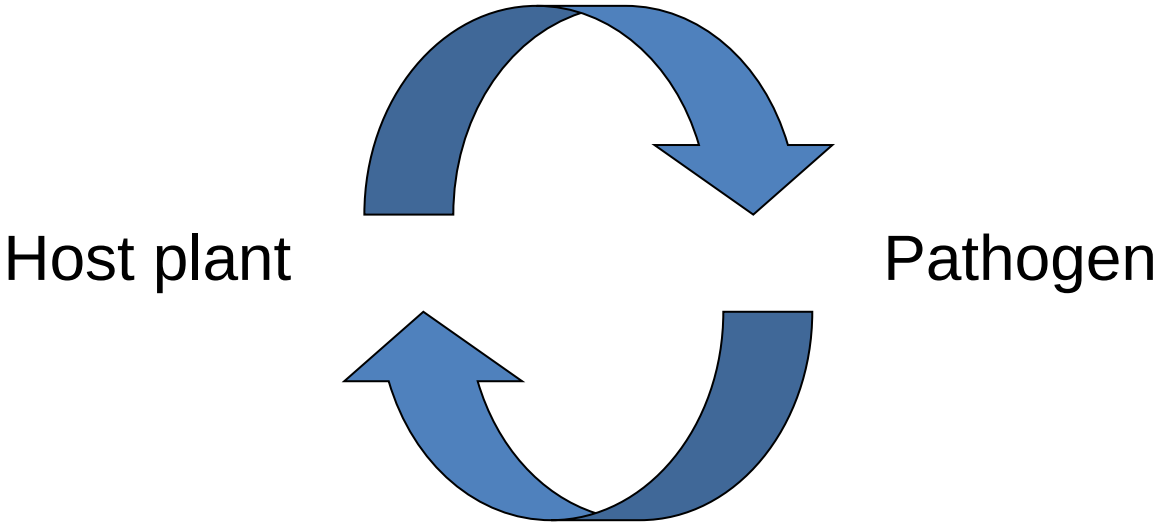
How to control *P. infestans*:

- Fungicides →

  Half of all fungicides used in Sweden are sprayed on potato which is grown on only a few % of the cultivated land

- Breeding for new sources of resistance

However, *P. infestans* can rapidly evolve
→ defence does not work any more.



Overall aim:

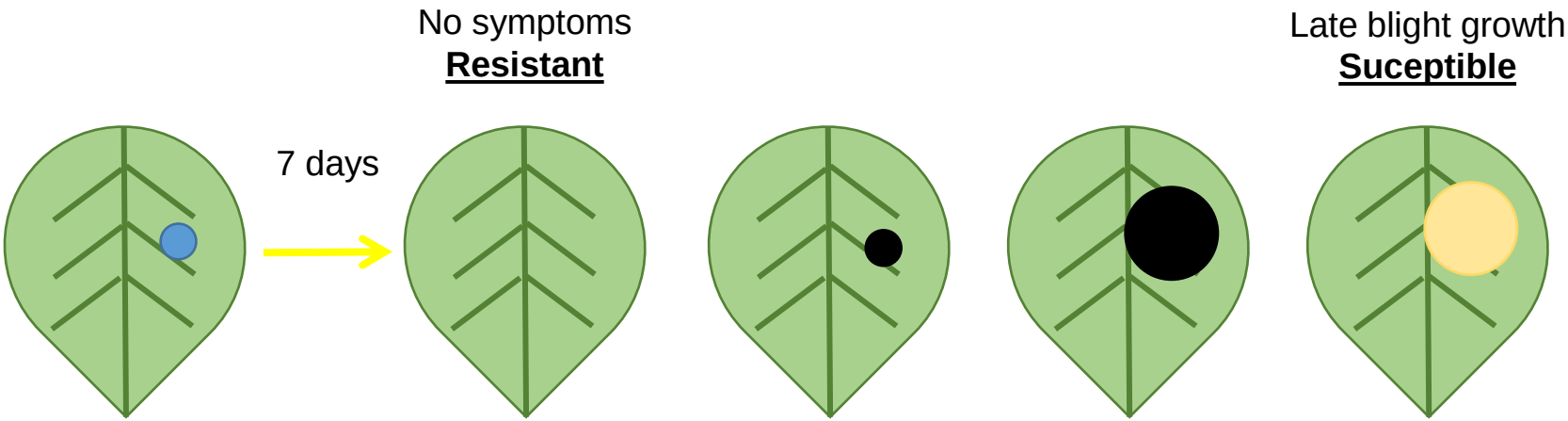
To find new ways to combat potato late blight that are more durable over time.

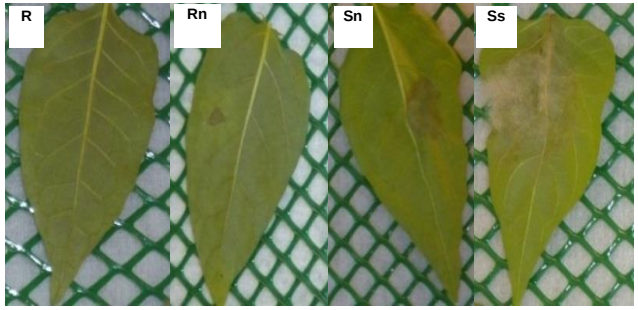
Solanum dulcamara

Bittersweet nightshade

- Wild relative of potato
- Perennial
- Common in Skåne (South Sweden)
- It is a host for *P. infestans*
  (Vetukuri, Masini *et al*., in prep.)

Defence responses of *S. dulcamara* to *P. infestans*





Abreha, Lankinen *et al*., (unpublished)

Different *S. dulcamara* genotypes collected around Skåne show high degree of variability in response to *P. infestans* (DLA)

Objectives

1) What are the phenotypic differences among the *S. dulcamara* genotypes?

- accumulation of reactive oxygen species (ROS)
- pathogen biomass
- callose deposition

2) Is *S. dulcamara* tolerant to *P. infestans*?

What is plant tolerance to disease?

Tolerance: ability of a plant to reduce the damage caused by a pathogen on its fitness

or

A plant gets infected, but doesn't die.
And maintains **yield**

Why studying tolerance is important?

Tolerance saves the host from the pathogen's harm

→ no selective pressure on the pathogen

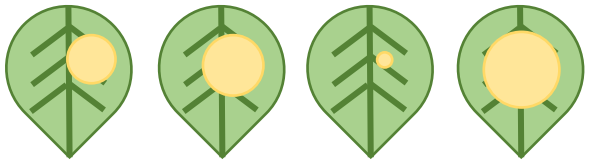
→ lower/no evolution of the pathogen

→ **more durable resistance**

How can you tell if a plant is tolerant?

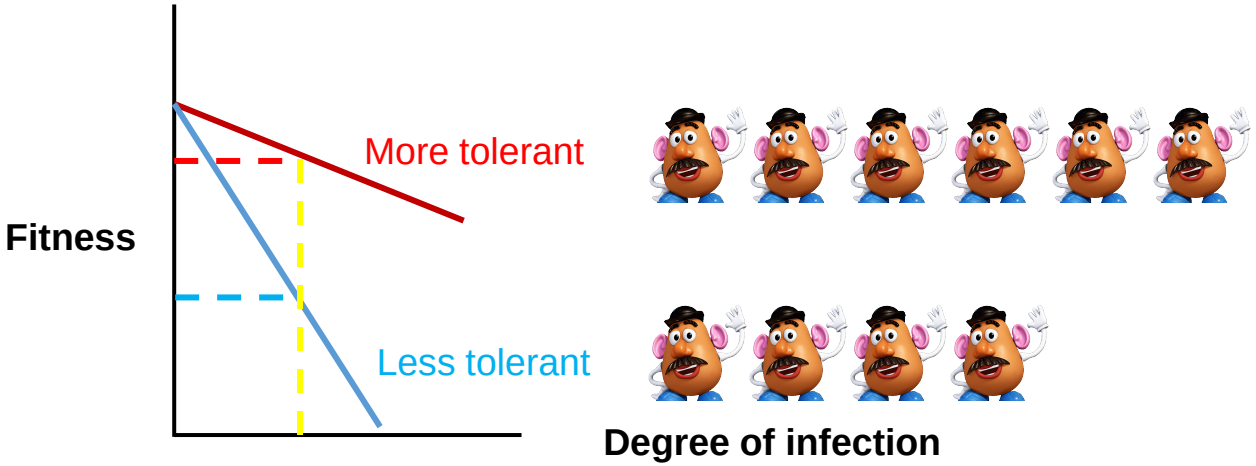
By studying the relationship between:

Degree of Infection



vs

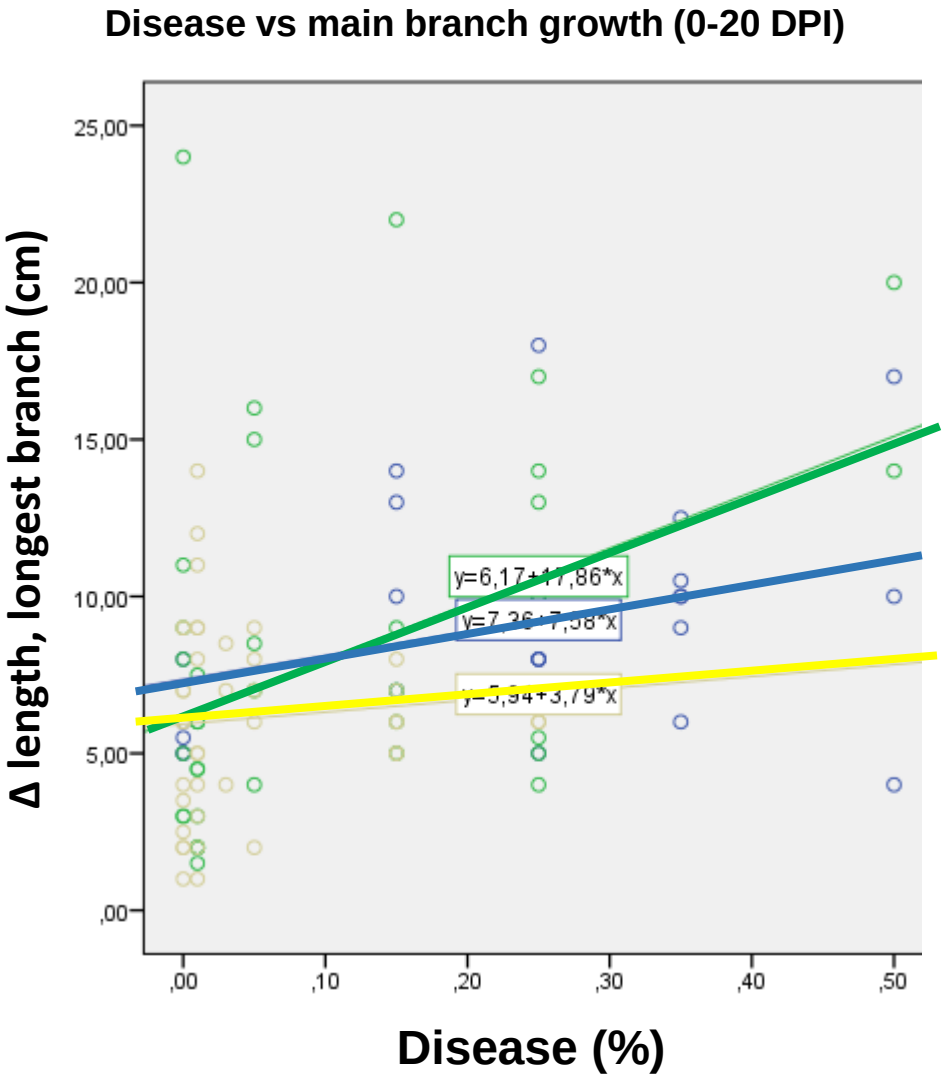
Plant fitness (yield)



Studying plant tolerance to *P. infestans* in *S. dulcamara*

- Three different *S. dulcamara* genotypes (selected from previous DLA)
- *P. infestans* isolate 88069 - 15000 and 30000 sporangia/ml
- Mock vs *P. infestans* spray-infected plants
- Disease quantification at 20 DPI using a disease scale (%, adapted from quantification of *P. infestans* in the field)
- Fitness measurements (0 and 20 DPI):
  - Number of branches
  - Branch length
  - Number of leaves

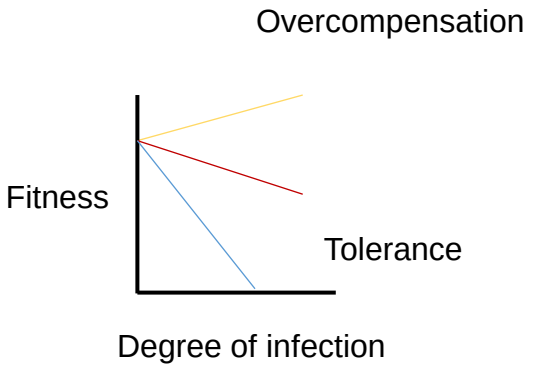
S. dulcamara overcompensate in response to *P. infestans*



G21 (Sn on DLA)

G20 (Sn on DLA)

L2 (Rn on DLA)



<u>Overcompensation</u>: increase in fitness following damage

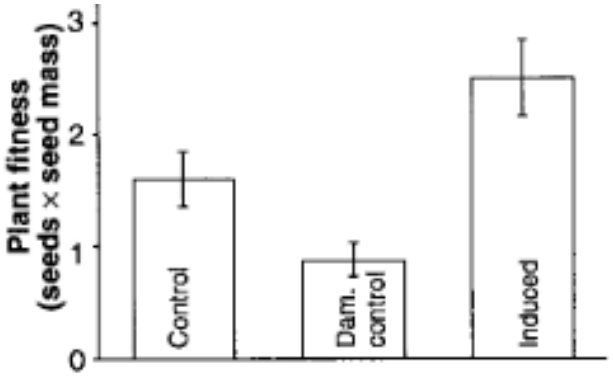
What do we know about overcompensation?

Mostly studied in plant – pest (and herbivores) interactions

Involves:

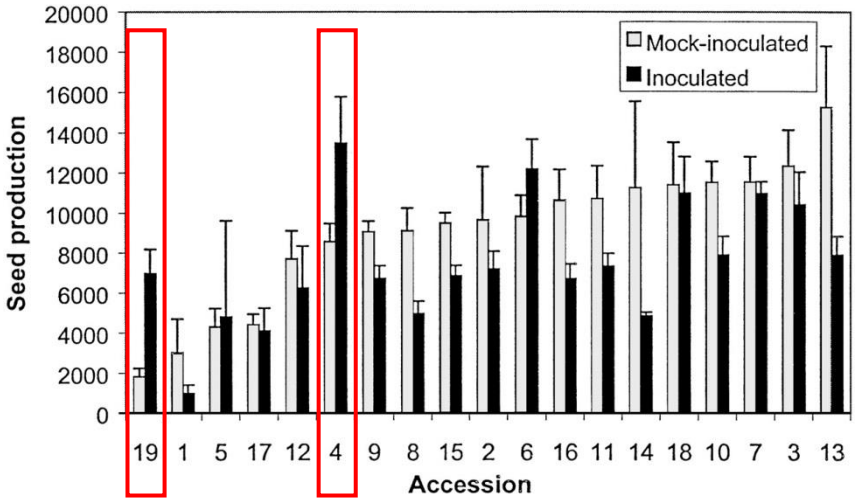
- bud and meristem dormancy release
- carbon reallocation
- up-regulation of primary metabolism

Wild radish – *Pieris rapae*



Agrawal, Science 1998

Arabidopsis – *Pseudomonas syringae*



Kover and Schaal, PNAS 2002

Still lacking → genetic basis for overcompensation

Summary and outlook

S. dulcamara* overcompensates in response to *P. infestans

- More *S. dulcamara* genotypes on test
- Study of tolerance/overcompensation **in the field** to quantify yield
- Transcriptomics and metabolomics to gain insights into the mechanism for tolerance/overcompensation

Acknowledgements

SLU Alnarp – Resistance biology

Åsa Lankinen
Erik Andreasson
Laura Grenville-Briggs

Kibrom Abreha
Erik Alexandersson
Mia Mogren
Pia Ohlsson
Ramesh Vetukuri

Maja Brus
Svante Resjö
Marit Lenman
Malin Dörre
Erland Liljeroth

Lund University

Lars Råberg

Carl Tryggers Stipendiestiftelse

PLANT LINK

Crafoordska stiftelsen
GRUNDAD AV HOLGER CRAFOORD 1980

Stiftelsen
Lars Hiertas Minne

Ingeborg Sörenssons fond

S. dulcamara overcompensates in response to *P. infestans*

Mock

P. infestans
30000
sporangia/ml