

Selection for fungicide tolerance in *Phytophthora infestans*

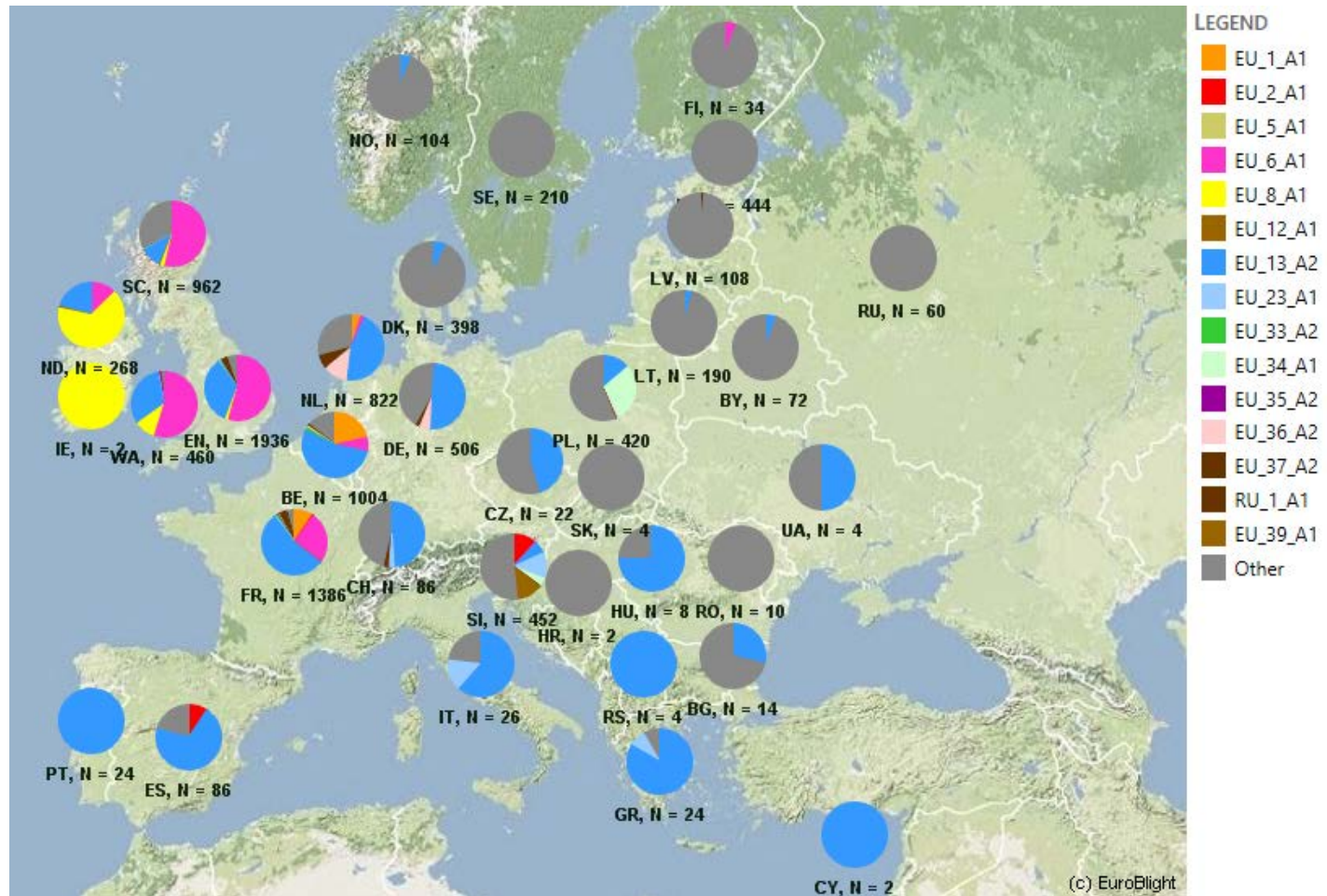
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P. infestans population structure

Euroblight 2002-2016



Pathogen traits that increase the risk of developing fungicide resistance

- Large population size
- Multiple disease cycles per season
- High production and efficient spread of spores
- Sexual recombination present in the disease cycle

PI displays all of the above in Sweden, but has only developed resistance against metalaxyl...

Field trial

- The effect of reduced fungicide dose on yield of starch potato (cv Kuras)
- - Revus Top, *difenconazole*, *mandipropamid* (4 sprays)
- - Infinito, *propamocarb*, *fluopicolide* (3 sprays)
- - Ranman Top, *cyazofamide* (5 sprays)
- Half and full recommended fungicide dose
- Final blight assessment:
 - half dose, 6.8%
 - full dose, 0.3%

Sampling

- FTA-papers for genotyping (population structure), 50 samples per treatment, half dose and full dose. Untreated in a adjacent field trial
- Isolation for phenotyping (aggressiveness, fungicide tolerance), 15 isolates per treatment



Full dose



Half dose

Aggressiveness

- 15 isolates per treatment (untreated, half dose, full dose)
- Inoculated on Bintje
- Incubated under constant conditions (15 °C, 16 h light, 80% RH)
- Latency period, lesion growth and sporulation was determined

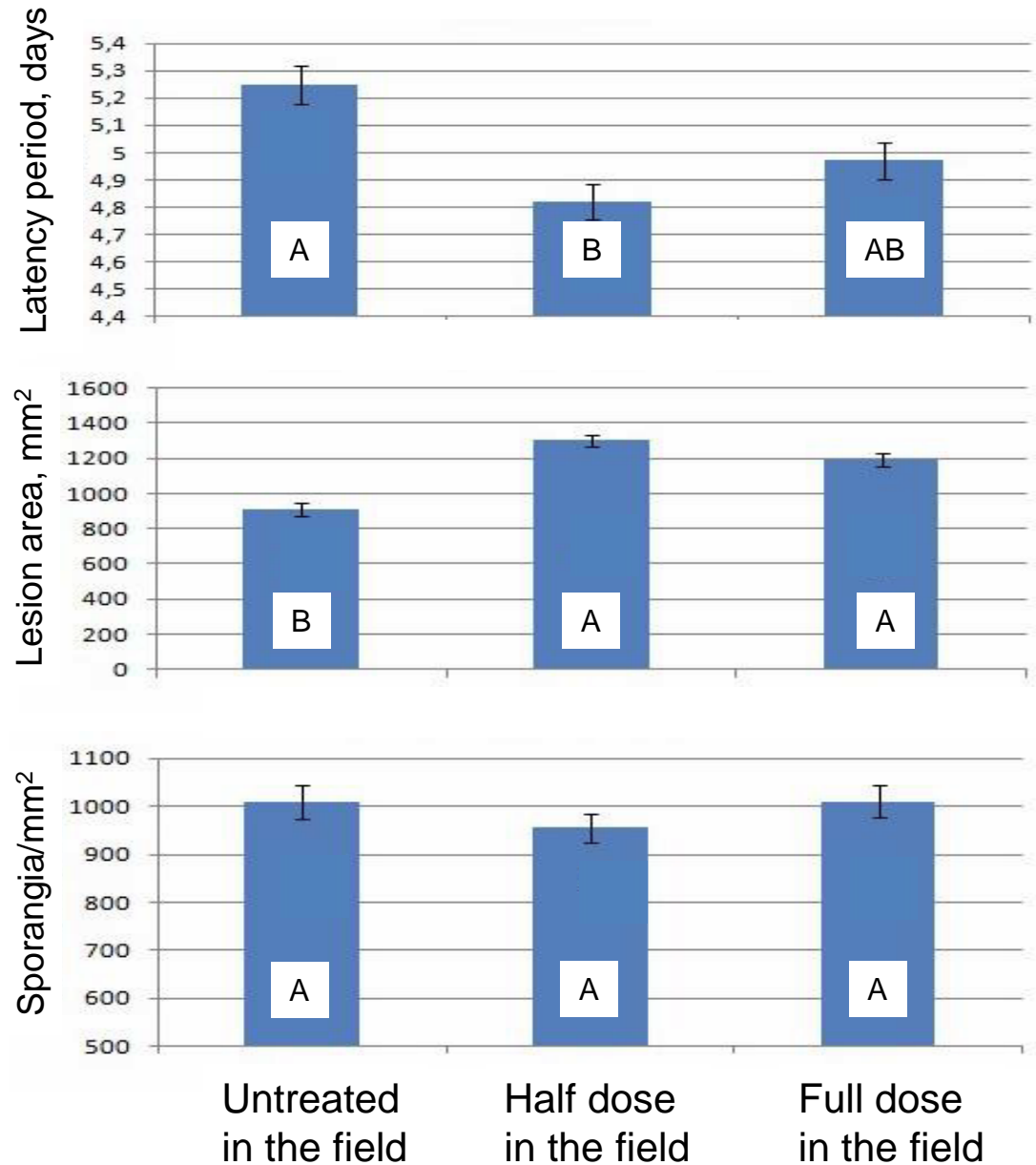


Photo: Gabriella Olsson

Results

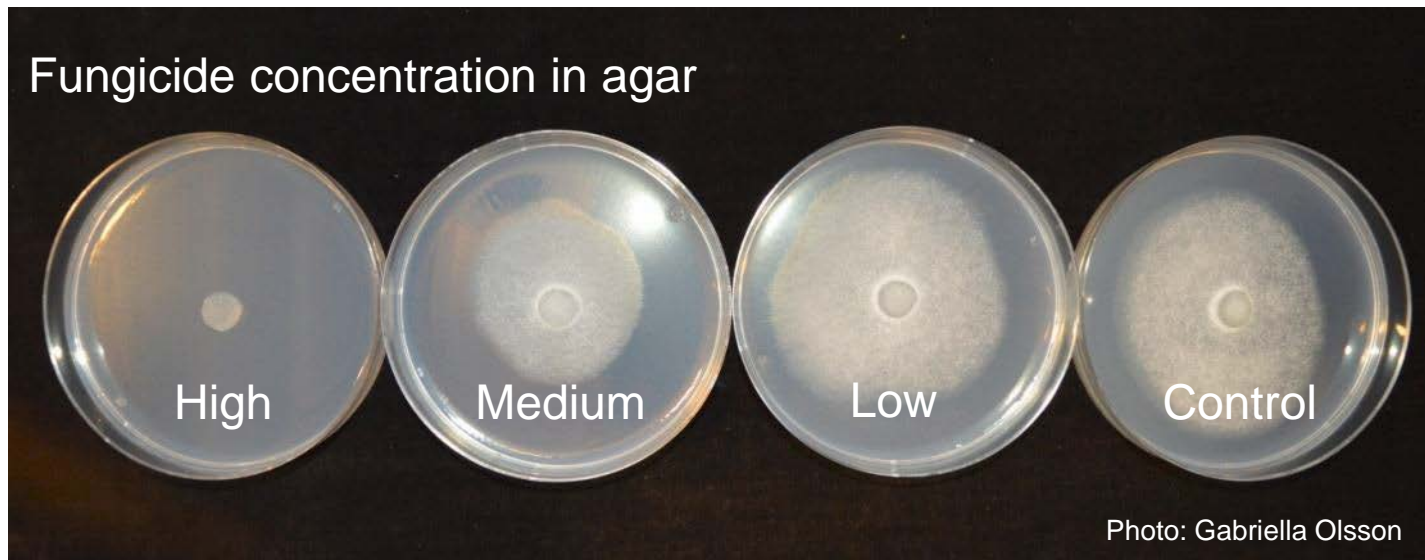
Aggressiveness

- Shorter latency period for samples from treated plots compared to samples from untreated plots
- Faster lesion growth in samples from treated plots compared to samples from untreated plots
- No difference in sporulation between samples from different treatments



Fungicide tolerance

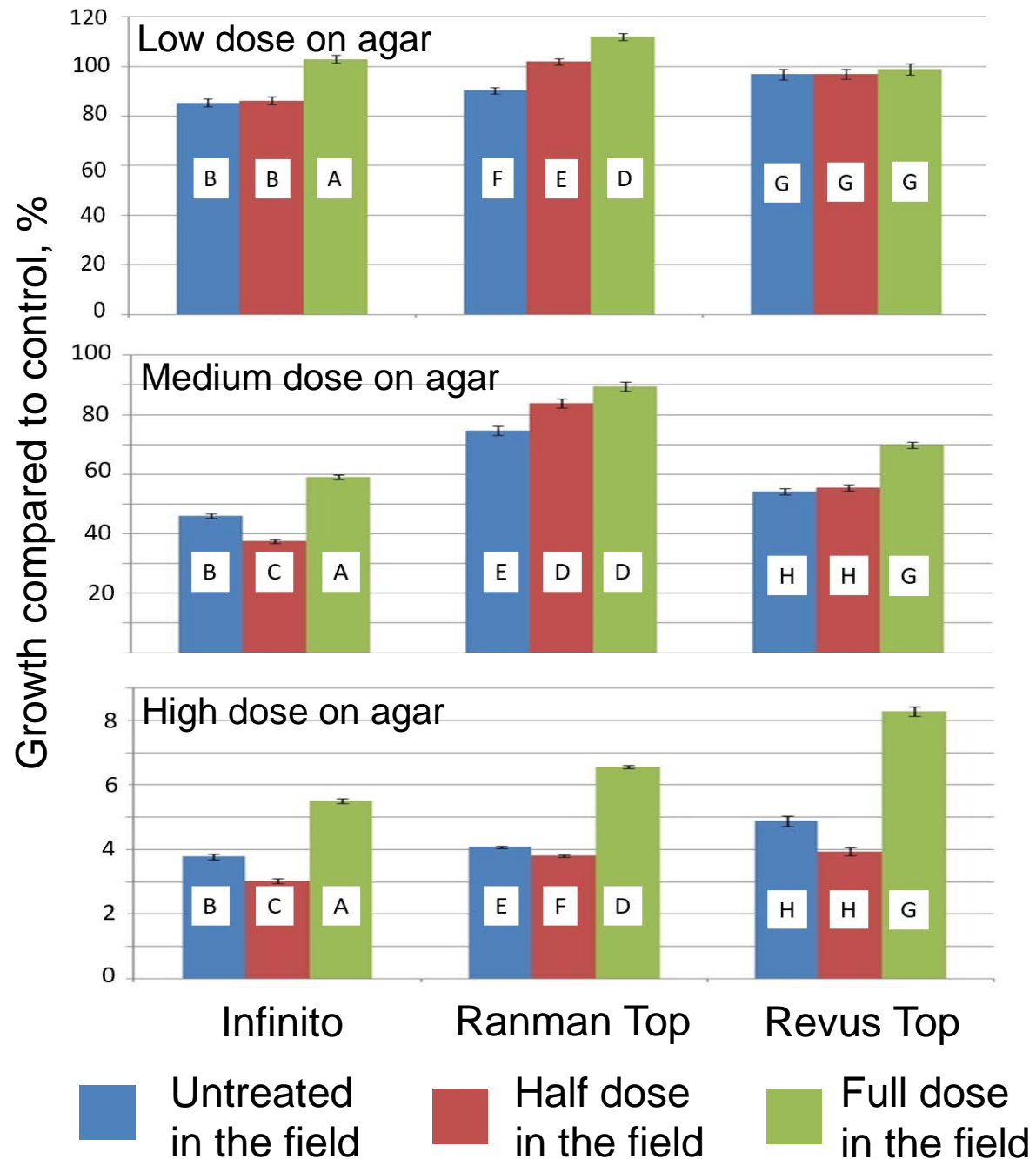
- In vitro test on agar with the three fungicides used in the field trial
- Three fungicide dose levels set to cover a dose - response range from close to no growth to full growth. The doses differed between the fungicides tested.
- 15 isolates each from the untreated, half dose and full dose plots were tested
- Nine experimental units (three field treatments x three dose levels in the lab)



Results

Fungicide tolerance

- Fungicide treatments during a single season increased the fungicide tolerance of PI to all three fungicides
- A clear dose effect on the development of fungicide tolerance



Genotyping

- Multiplexing with the 12 Euroblight SSR markers
- ~200 samples after clone correction within populations (untreated, half dose, full dose)

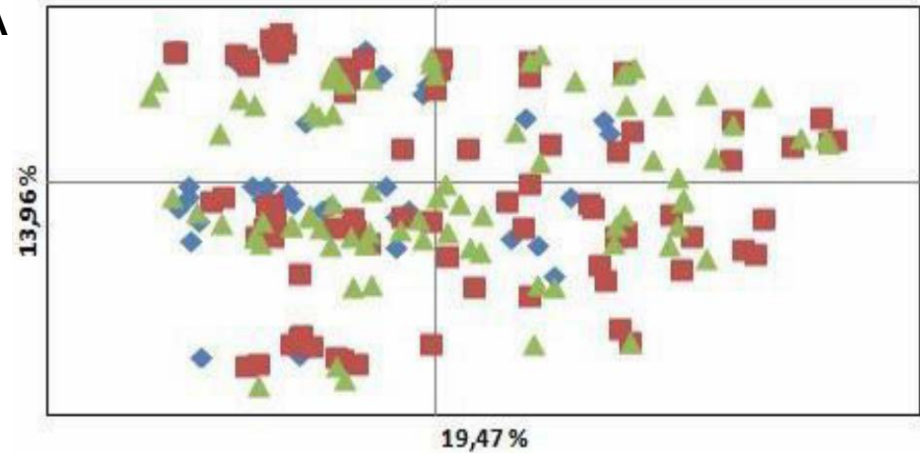


Results

Genotyping

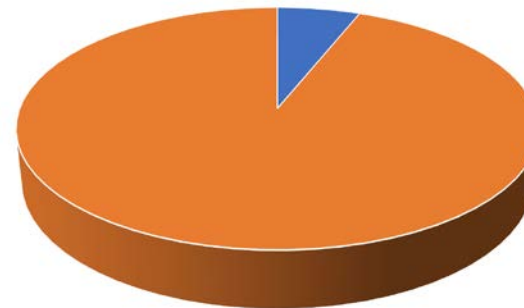
- No population differentiation from the different treatments, i.e. no apparent effect from genotype selection on population structure

PCA



- ◆ Samples from plots untreated plots in the field
- Samples from plots treated with full dose in the field
- ▲ Samples from plots treated with half dose in the field

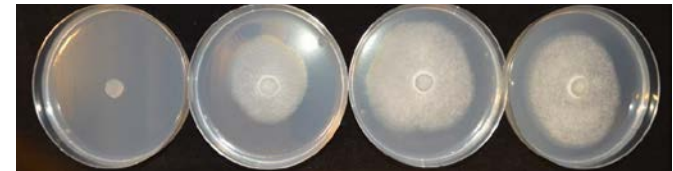
AMOVA



- Between populations
- Among populations

Conclusions

- Fungicide treatments **did** increase overall aggressiveness
- Fungicide treatments **did** increase fungicide tolerance
- These effects are caused by other factors than selection of specific SSR -genotypes
- Phenotypic population differentiation could be observed over short distances (< 100 m)



Full dose



Half dose