Emergence and diversification of a highly invasive tree pathogen lineage

L. Stauber\textsuperscript{1,2}, S. Prospero\textsuperscript{1} & D. Croll\textsuperscript{2}

\textsuperscript{1} Swiss Federal Research Institute WSL, Phytopathology, Birmensdorf (Switzerland)
\textsuperscript{2} Laboratory of Evolutionary Genetics, Institute of Biology, University of Neuchâtel (Switzerland)
Chestnut blight – *Cryphonectria parasitica*
Pathogen vs saprophyte
Pathogen vs saprophyte

Emergence & diversification of a highly invasive pathogen lineage
Pathogen vs saprophyte

Emergence & diversification of a highly invasive pathogen lineage

Illumina WGS data (~300 isolates)
Genome size
Cell wall degrading enzymes
Cell wall degrading enzymes

CAZyme gene count

p < 0.001***
Cell wall degrading enzymes
Emergence & diversification of a highly invasive lineage
The chestnut blight invasion
Low diversity in south-eastern Europe
Low diversity in south-eastern Europe
Low diversity in south-eastern Europe

- vc type: EU-12
Low diversity in south-eastern Europe

- **vc type**: EU-12
- **Mating type**: MAT-1
Low diversity in south-eastern Europe

- **vc type**: EU-12
- **Mating type**: MAT-1
- **S12 lineage** = "clonal"
What we don’t know about S12...

Origin?

Origin: 1938

S12
What we don’t know about S12...

Origin?

Diversity in S12?
What we don’t know about S12...

Origin?
Diversity in S12?
Evidence for adaptive evolution?
Origin of S12

Stauber et al. bioRxiv 2020
S12 - genetic donors
S12 - genetic donors
Origin of S12

Likely origin of S12 in northern Italy
Diversity in a “clonal lineage”
Diversity in a “clonal lineage”
Diversity in a “clonal lineage”
Genetic drift & human trade

Stauber et al. bioRxiv 2020
Diversity in a “clonal lineage”

- Mutation accumulation (~85% singletons!)

Stauber et al. bioRxiv 2020
Recombination in a “clone”

- Mutation accumulation (~85% singletons!)
- Recombination (PHI: p=0.0035**)
Recombination in a “clone”

- Mutation accumulation (~85% singletons!)
- Recombination (PHI: p=0.0035**)
Purifying selection within lineage

- Mutation accumulation (~85% singletons!)
- Recombination (PHI: p=0.0035**)
- Few deleterious mutations

Stauber et al. bioRxiv 2020
Origin: European (Italian) bridgehead
Origin: European (Italian) bridgehead

Diversity: no geography, mutation accumulation
Origin: European (Italian) bridgehead

Diversity: no geography, mutation accumulation

Evolution:
• Purifying selection
• Clonality advantageous?
• Recombination possible!
Thanks to...

Simone Prospero (Swiss Federal Research Institute WSL)

Daniel Croll (University of Neuchâtel)

Laboratory of Evolutionary Genetics (University of Neuchâtel)

Phytopathology Group (WSL)

Ludwig Beenken (WSL)

Genetic Diversity Centre Zurich (GDC)

Swiss National Science Foundation (SNF)

Secil Akilli, Marin Ježić, Mihajlo Risteski and Kiril Sotirovski