



Phytophthora infestans tracking on a European scale

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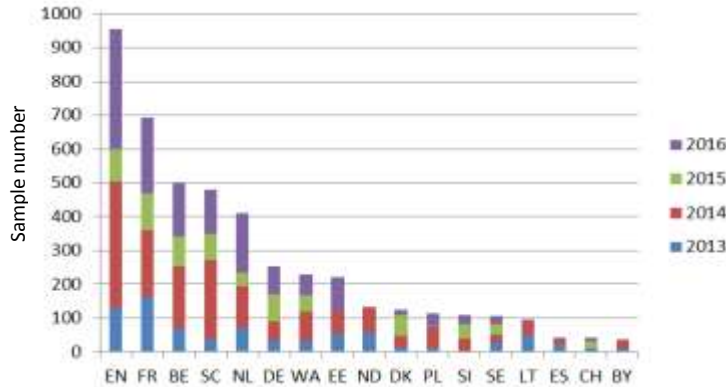
Euroblight aims/themes

- **Tracking (global) population dynamics of potato blight pathogens:**
Change = Trouble
- **Stewardship of host resistance genes and active ingredients** - develop and adopt innovative and sustainable control strategies on regional scales
- **Education, advocacy and communication** - taking into account different scales and stakeholders



Sample statistics

- 2013-2016 - 5250 samples from 34 countries genotyped
- Northwestern Europe most frequently sampled

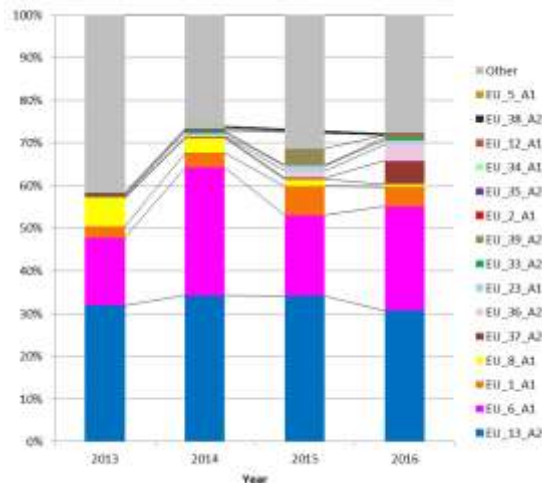


- EN – England
- FR – France
- SC – Scotland
- BE – Belgium
- NL – the Netherlands
- DE – Germany
- WA – Wales
- ND – Northern Ireland
- SE – Sweden
- PL – Poland
- DK – Denmark
- ES – Spain
- SI – Slovenia
- BY – Belarus
- CH – Switzerland
- EE – Estonia
- LT – Latvia



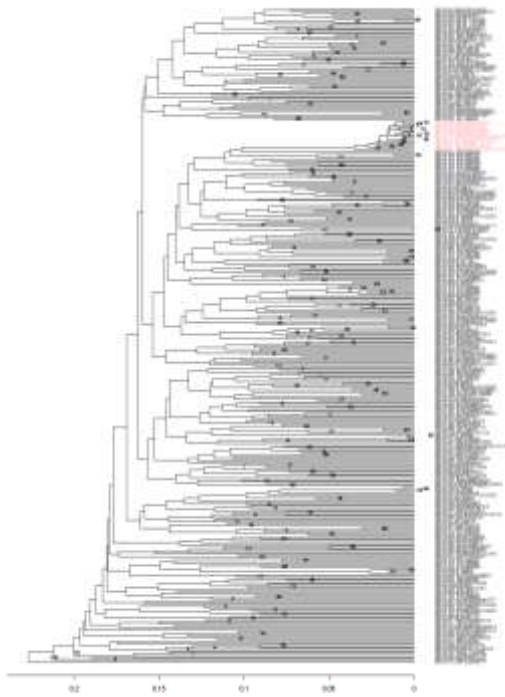
Countries with >30 samples shown

EU *P. infestans* genotype change

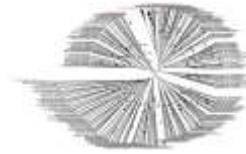


- Around 70% of EU population clonal
- EU_13_A2 & EU_6_A1 dominant
- EU_33_A2 'green 33' very low frequency
- **EU_36_A2 & EU_37_A2 novel clones increased in 2016**
- 20-30% of population each year genetically diverse 'Other' group probably from oospores. The *P. infestans* "gene pool"



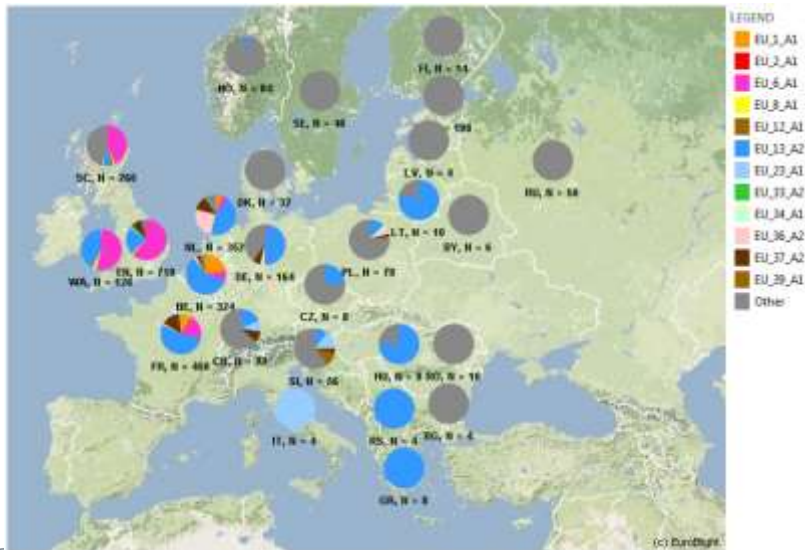


2016 – ‘Others’

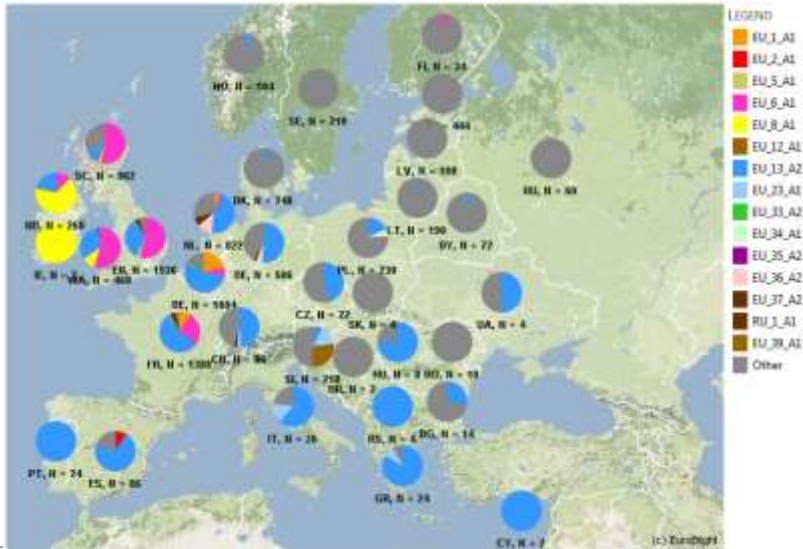


- Considerable genetic diversity in the sexual ‘Other’ population
- Minor genetic variation within asexual clones.

2016 data

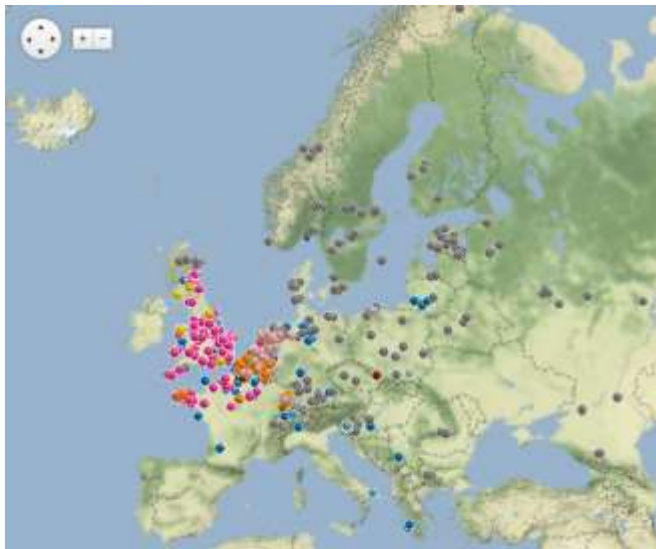


2013-2016 summary



• 5251 samples from 34 countries

2016 samples



• 1595 samples from 26 countries

2016 samples – EU_13_A2



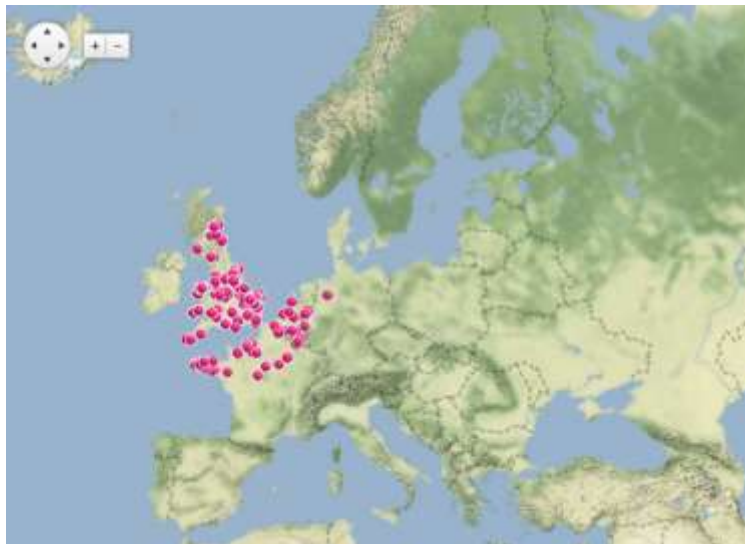
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Live map at

<http://euroblight.net/pathogen-characteristics-and-host-resistance/sampling-sites-and-genotype-maps/>

2016 samples – EU_6_A1



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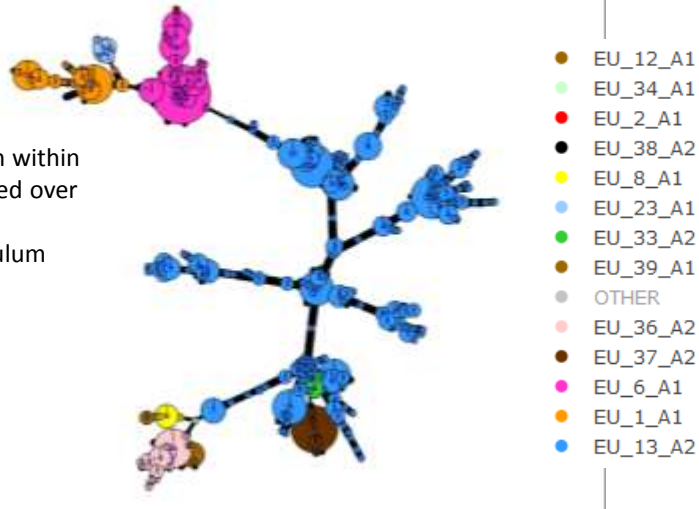


Live map at

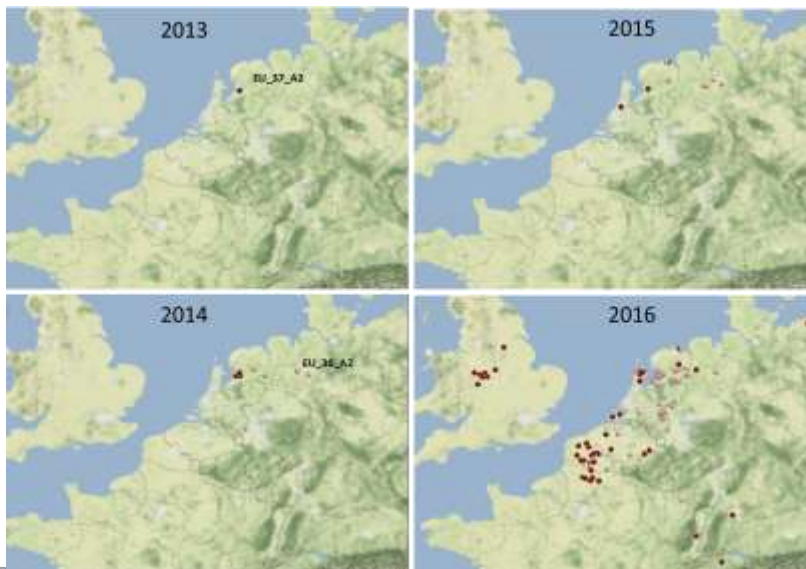
<http://euroblight.net/pathogen-characteristics-and-host-resistance/sampling-sites-and-genotype-maps/>

Genetic diversity 2016 – MSN clones only

- Minor variation within clones generated over time
- Can track inoculum spread



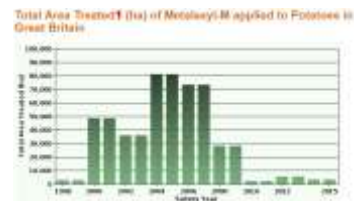
EU_36_A2 & EU_37_A2 timeline



Live maps at <http://euroblight.net/pathogen-characteristics-and-host-resistance/sampling-sites-and-genotype-maps/>

Population change and blight management

- **13 different fungicide groups on market for blight management**
- **Careful use required to reduce selection pressure**
- **EU_13_A2** emerged 2004, resistant to metalaxyl. Usage has fallen dramatically in Europe but it is still a good product where resistance is not dominant
- **33_A2** insensitivity to fluazinam
- **37_A2** insensitivity to fluazinam



Live maps at

<http://euroblight.net/pathogen-characteristics-and-host-resistance/sampling-sites-and-genotype-maps/>

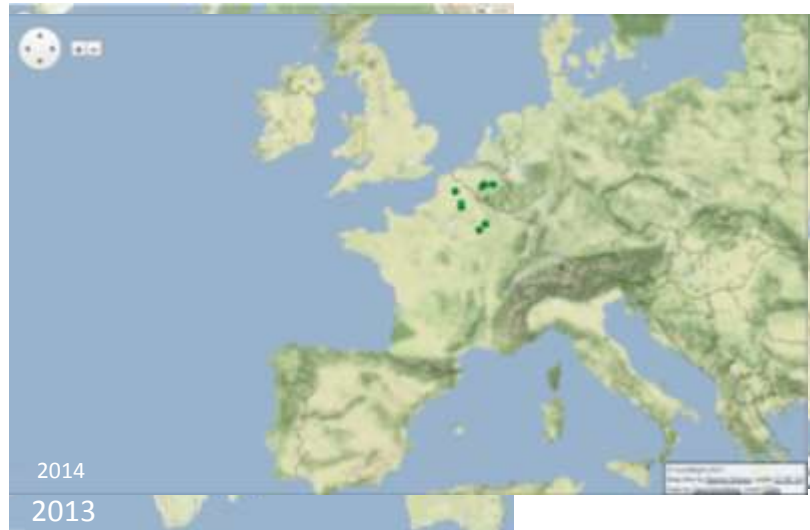
Green33 in the Netherlands 2008 - 2012



- Green33
 - NL2010: 20%
 - NL2011: 22%
 - NL2012: 6%



Green33 in recent years



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Press release on EU-37-A2

Reduced sensitivity to fungicides detected in the rapidly increasing *Phytophthora infestans* strain EU-37 (Dark Green 33)

Phytophthora infestans (potato late blight) is a major potato pathogen in Europe. It is highly virulent and can cause significant damage to potato crops. A new strain of the pathogen, EU-37 (Dark Green 33), was first detected in France in 2014 and has since spread to other countries. This strain is highly resistant to fungicides, which is a major concern for potato growers. The EuroBlight network is currently monitoring the spread of this strain across Europe.

Key findings:

- EU-37 is highly resistant to fungicides.
- EU-37 is highly virulent and can cause significant damage to potato crops.
- EU-37 has spread from France to other countries in Europe.

Conclusions:

The EuroBlight network is currently monitoring the spread of EU-37 across Europe. It is important for potato growers to be aware of this strain and to take appropriate measures to protect their crops. The network will continue to provide updates on the latest findings and recommendations.

Strategic implications:

The discovery of EU-37 highlights the need for improved fungicide resistance management strategies. It is important to use a combination of different fungicides and to rotate them regularly to reduce the risk of resistance. Additionally, it is important to monitor the spread of this strain and to report any new detections to the EuroBlight network.

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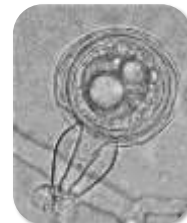
Clones – key questions

- **Origin – where and how?**
 - Several first reported in NL and DE
 - Presumed recombinant – commonly triploid
(36_A2 triploid, 37_A2 diploid) - (see Li et al., 2017 MPMI)
- **Drivers of spread?**
 - Adaptation: Mutation – Selection: host, fungicide, survival, aggressiveness
 - Chance – bottleneck, right place at right time



Conclusions

- New insights on pathogen diversity
- **Dominance of a few clones** across large areas of European crops shows that EU growers/industry **share management challenges**
- Surveys needed to inform fungicide use strategies to minimise the risks of product failure – **13_A2, EU_37_A2 and EU_33_A2**
- Much **primary inoculum is locally generated** and spread. Better management of inoculum sources would aid management
- A highly diverse gene pool of novel types is present as a result of **sexual oospore formation and derived infections**
- **High genetic diversity increases the risk** of blight management problems - evolving virulence against novel host resistance genes and reduced sensitivity to specific fungicide active ingredients
- Phenotypic traits of existing and novel genotypes being examined in ERA-NET project (IPMBlight2.0)
- Live data mapped on www.euroblight.net



Europe sponsors/contributors/collaborators

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