

# Understanding *Phytophthora lateralis*

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- Geographical occurrence of *Phytophthora lateralis*
- Biology and life cycle
- Disease symptoms
- Findings at Balloch Country Park
- Latest update on *P. lateralis* in Scotland
- Current and proposed research



- EPPO alert list pathogen
- Main host is Lawson cypress
- First appeared in Pacific North West of USA in 1920s - now major pathogen of Lawson cypress across native range
- Rapid spread along coastal Oregon, slower in drier inland areas, infects roots
- Can also cause disease on Pacific yew
- Recently isolated from old-growth *Chamaecyparis* forests in Taiwan

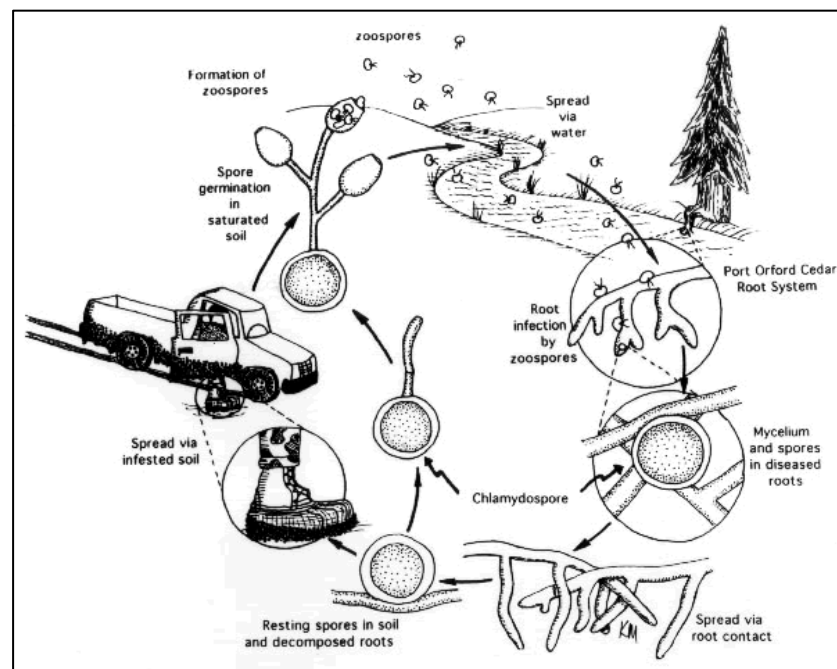
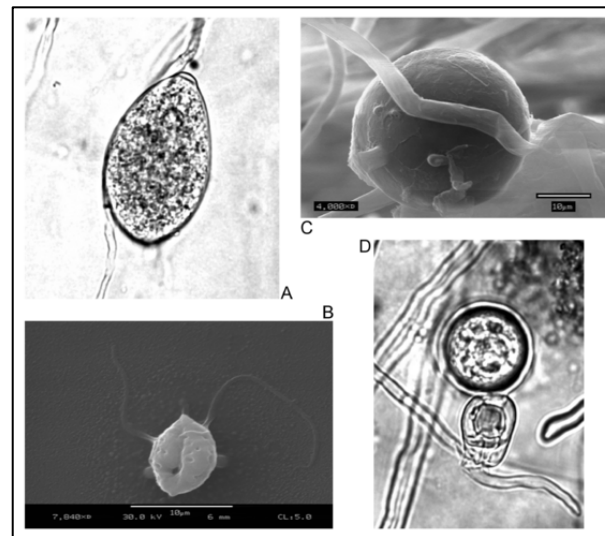




- *P. lateralis* never previously recorded in Britain
- Detected in France in 1998 and Netherlands 2004 - nurseries
- Between 2005-2008 a decline of hedgerow Lawson cypress in Brittany
- *P. lateralis* found to be causal agent
- Several sites affected in Brittany, covering an area of 400km<sup>2</sup>
- Aerial infections common in Brittany



- Oomycete pathogen with swimming zoospore stage - water dispersed
- Favours cool, wet weather conditions, lives in soil
- Can survive long term in soil as thick-walled resting spores (chlamydo spores)
- Infects host *via* roots, but French outbreaks show aerial infections
- Evidence that *P. lateralis* can be air-dispersed *via* sporangia, like *P. ramorum*



- Lesions spread up lower stem kill phloem and disrupt xylem, cause crown death
- Less than 2200 Ha of commercially grown Lawson cypress in Britain - but huge risk for amenity and garden Lawson cypress
- Potentially severe impact on ornamental plant trade in Britain





- Disease symptoms first noted in 2009, becoming more prevalent during 2010
- Dieback and mortality
- FR visited site in October 2010
- Mainly Lawson cypress and yew affected





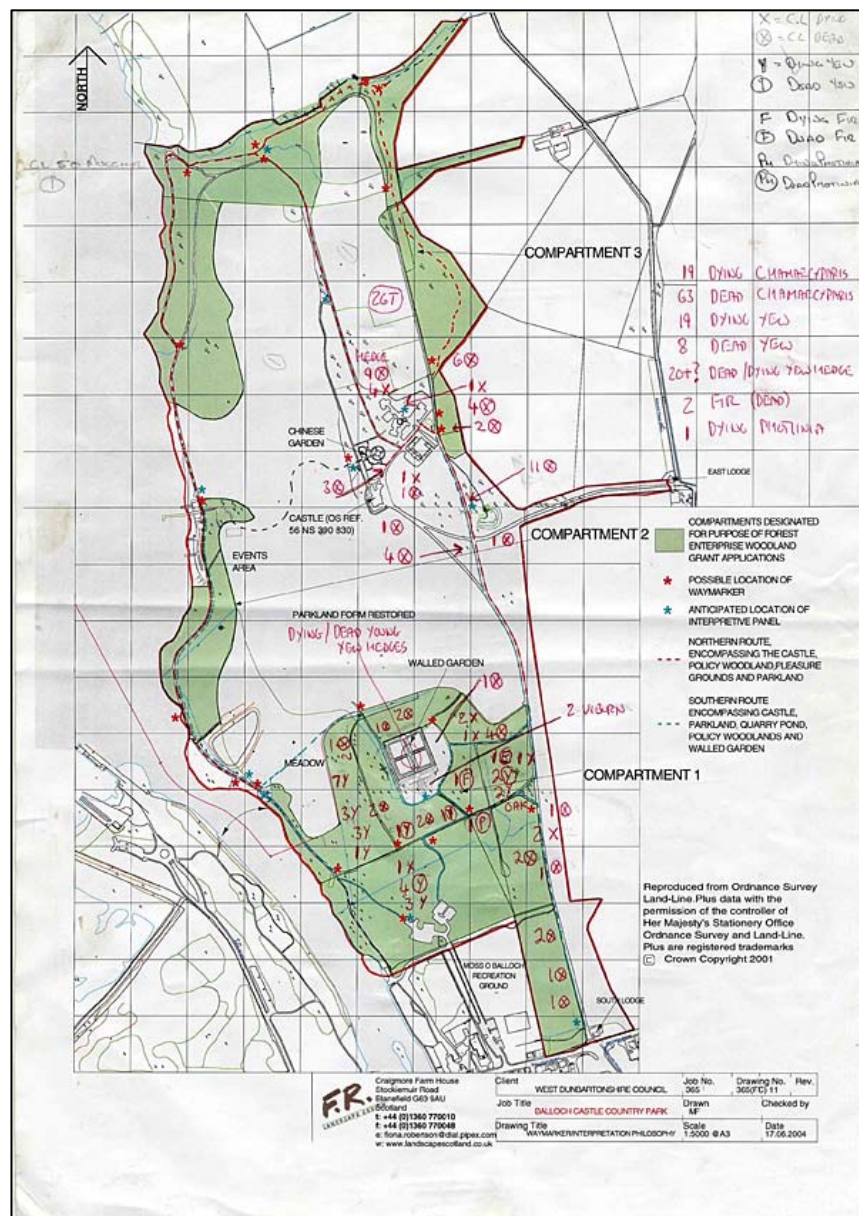








- A survey of the park in November 2010 revealed:
  - 63 dead Lawson cypress
  - 19 dying Lawson cypress
  - 8 dead yew trees
  - 19 dying yew trees
  - 20+ hedgerow yew dead
- Need for rapid diagnosis













- Take bark samples from lesion margins
- Soil samples too
- Bark samples initially tested for *Phytophthora* using LFD
- Molecular analysis directly on bark sample
- Isolation of pathogen and confirmation of identity



- *Phytophthora lateralis*\* confirmed on eleven Lawson cypress
- *Phytophthora ramorum* confirmed on one Lawson cypress\*\* and one Rhododendron
- *Phytophthora cinnamomi* confirmed on one yew and one Lawson cypress
- One Lawson cypress harboured *P. lateralis*, *P. cinnamomi* and *Phytophthora syringae*

\*first ever record in Britain

\*\*second record on Lawson cypress



- 23 Lawson cypress dead/dying
- More trees showing very early stage symptoms
- *P. lateralis* now confirmed as present on five Lawson cypress at Greenock cemetery
- Thought to be a second, unrelated introduction of the pathogen



- Trees in early stages of decline show basal lesions





- *Phytophthora lateralis*
- *Phytophthora austro-cedrae*
- *Phytophthora cambivora*





- Recent finding of *P. lateralis* on *Thuja occidentales* nursery stock in Scotland
- New host record
- Plants originated in France





- Test pathogenicity of *P. lateralis* on English yew and other species to determine risk
- Epidemiology of infections in Scotland
- Survey extent of spread of *P. lateralis*
- Molecular analyses of different *P. lateralis* strains
- Geographical origin and pathway of introduction of *P. lateralis*



- Balloch *P. lateralis* strains are genetically unique (Cox and ITS)
- Most similar to strains from USA compared with Taiwan, but still clear differences
- Balloch *probably* not associated with recent outbreak in Brittany
- Greenock ITS identical to Brittany ITS
- Need to acquire more isolates from recent European outbreaks

P2202_Balloch	CGATGTTTTACATTCATGGGCTATTCCTCATTAGGTATTA AATTAGATGCTTGTCC <b>AGG</b>
P2305_Balloch	CGATGTTTTACATTCATGGGCTATTCCTCATTAGGTATTA AATTAGATGCTTGTCC <b>AGG</b>
P2060_Oregon	CGATGTTTTACATTCATGGGCTATTCCTCATTAGGTATTA AATTAGATGCTTGTCC <b>TGG</b>
P2061_Oregon	CGATGTTTTACATTCATGGGCTATTCCTCATTAGGTATTA AATTAGATGCTTGTCC <b>TGG</b>
P2146_Taiwan	<b>TG</b> ATGTTTTACATTCATGGGCTATTC <b>CA</b> TCATTAGGTATTA AATTAGATGCTTGTCC <b>TGG</b>
P2148_Taiwan	<b>TG</b> ATGTTTTACATTCATGGGCTATTC <b>CA</b> TCATTAGGTATTA AATTAGATGCTTGTCC <b>TGG</b>



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