

This Guidance note gives examples of symptoms to look for and to avoid when observing larch that may be suspected to have *Phytophthora ramorum* infection.

If you suspect that you have located a stand of larch infected with *P. ramorum*, please report it without delay.

South West EnglandTel: 01626 890666, email: fc.sweng.cons@forestry.gsi.gov.uk**Wales**Tel: 0300 068 0300, email: bww.ts@forestry.gsi.gov.uk**Scotland & Other areas of England**www.forestry.gov.uk/fr/INFD-5UWEY6

Owners or managers of individual garden, parkland, street or amenity trees who think their trees might be infected should contact Forest Research's Disease Diagnostic Advisory Service – www.forestry.gov.uk/fr/INFD-5UWEY6

(Contact details correct as of 4th April 2011)

Background

The quarantine disease *Phytophthora ramorum* was first found in the UK in 2002, initially in the horticultural trade. Over a number of years it was discovered in the wider environment of parks & gardens, woodland and heathland. In the wider environment it was largely associated with *Rhododendron* species that act as a host from which spores are produced (although since 2009 it has also been found sporulating on *Vaccinium myrtillus* (bilberry) in heathland). When produced in sufficient quantity these spores could infect trees and other plants in the vicinity. Control efforts in woodlands had focussed primarily on removing *Rhododendron*. The Forestry Commission, Forest Research (FR) and the Food and Environment Research Agency (FERA) have been working together to survey, study and control the disease since its arrival.

Phytophthora ramorum: identifying symptomatic larch

Phytophthora ramorum in larch

During August 2009 at a site in east Cornwall laboratory testing confirmed *P. ramorum* present in Rhododendron in the understorey of mature Japanese larch (*Larix kaempferi*) as well as on the foliage of young thicket stage Japanese larch in an adjoining area. Further testing on private and Forestry Commission managed woods in north & west Devon and west Somerset confirmed the presence of *P. ramorum* in mature Japanese larch as well as species in its understorey, including Rhododendron, sweet chestnut, beech, birch, oak and Western hemlock. On some sites there was little or no rhododendron present.

These findings highlighted a significant change in the dynamics of the disease; previously tree infection had only been observed in the proximity of infected Rhododendron. Further significance of infection in larch was that it was unusual being a sporulating foliar host that also develops multiple stem lesions. Studies by FERA and FR discovered sporulation on infected larch was of a much greater level than other known hosts – over 1 million zoospores were found in one 250ml rainwater sample taken from under infected mature Japanese larch (Webber et al 2010) whilst laboratory tests identified up to 2600 sporangia (each containing 20-25 zoospores) growing on a single needle (Webber 2011).

By winter 2010 extensive surveying of larch stands across the UK confirmed the pathogen was located across many sites in south west England, areas of Wales (particularly in the south), several sites in Northern Ireland and isolated cases in Scotland and the Isle of Man. The Republic of Ireland confirmed that they also had a “small number” of cases (ROI Dept of Agriculture Fisheries & Food 2010). At the time of writing, there are no reports of findings of *P. ramorum* in larch elsewhere in Europe.

Identification

The following pages give examples of symptoms to be aware of when looking for larch infected with *P. ramorum*. How early an infected stand is identified depends on how vigilant the surveyor is, and how easy it is to see the canopy of the trees (where the pathogen enters the tree). *P. ramorum* is a quarantine pathogen - the sooner infected trees are identified, the quicker they can be felled to reduce the chance of further sporulation and therefore risk of spread to other larch stands or nearby susceptible hosts.

Page 11 illustrates symptomatic *Rhododendron ponticum* which may also indicate that a site is infected with the pathogen. Finally the last two pages illustrate other factors that prior to closer inspection may potentially be confused with *P. ramorum* infection of larch.

Phytophthora ramorum: identifying symptomatic larch



Symptoms when externally viewing stands of larch

- Dead and partially flushed trees present in groups, patches or distributed throughout stand.
- Crown and branch dieback likely to be present with distinctive yellowing or ginger colour when branches are girdled.

Phytophthora ramorum: identifying symptomatic larch



Symptoms within stands of mature larch

- Dead and partially flushed trees present in groups, patches or distributed throughout stand.
- Crown and branch dieback likely to be present with distinctive yellowing or ginger colour when branches are girdled.

Phytophthora ramorum: identifying symptomatic larch



- Individual or many branches with partial or complete dieback in crown.
- Epicormic growth protruding through dead branches (sometimes extending down stem below dead crown).
- Profuse resin bleeds on main stem (at crown level) and branches (may only be visible with binoculars).

Phytophthora ramorum: identifying symptomatic larch



Symptoms on felled mature larch

•**NB If you suspect *P. ramorum* do not fell samples until advised by an FC inspector.**

•Profuse resin bleeds on main stem and branches. Branches / stems often encrusted with dried whitish-coloured resin.

•Lesions partially and completely girdling branches. Some retained brown, discoloured & partially flushed needles between lesion and branch tip.

Phytophthora ramorum: identifying symptomatic larch



Symptoms within stands of thicket-stage larch

- Dead and partially flushed trees present in groups, patches or distributed throughout stand.
- Crown and branch dieback likely to be present with retained dead needles and resinous lesions.

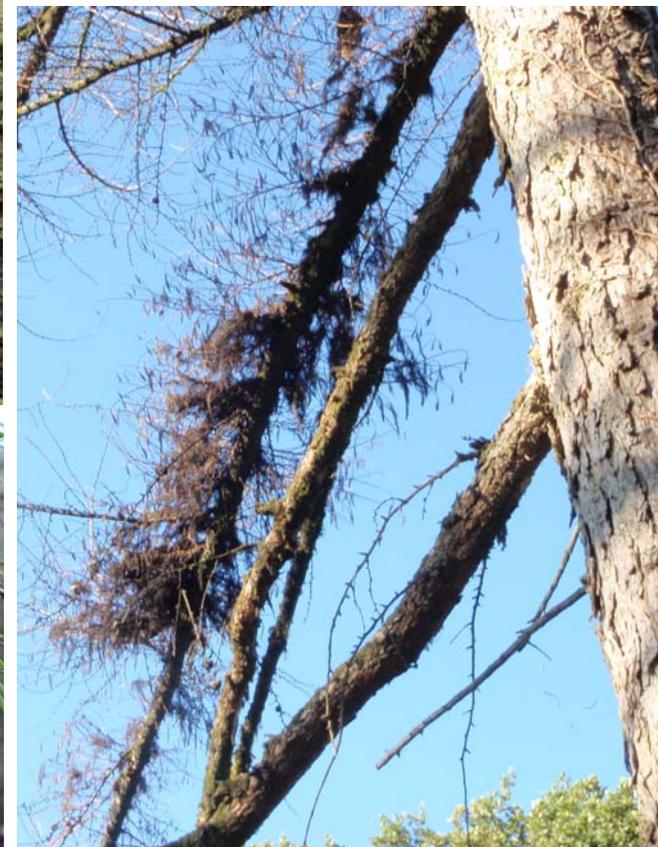
Phytophthora ramorum: identifying symptomatic larch



Symptoms within stands of young larch

- Dead and partially flushed trees present in groups, patches or distributed throughout stand.
- Crown and branch dieback likely to be present with retained brown needles and multiple resinous lesions.

Phytophthora ramorum: identifying symptomatic larch



Foliage symptomatic of sporulating material

- These symptoms are most likely to be seen immediately prior to autumn – September & October.
- Wilt and dieback of fresh growth. Distinct grey or blackened needles (often only retained towards tips of shoots).

Phytophthora ramorum: identifying symptomatic larch



Symptoms to be aware of in winter

- Retained needles indicating sudden death of branch(es) or crown.
- Resinous bleeds may be apparent, especially on stems.

Phytophthora ramorum: identifying symptomatic larch



P. ramorum* Symptoms in *Rhododendron ponticum

- Wilt and dieback of fresh growth.
- Shoot dieback extending down from growing tip often giving a “crook” effect.
- Dieback extending from the stem of leaf down the midrib and also on the leaf tip - i.e. wherever water collects.
- Watery appearance to dieback. On the underside of the leaf infection tend to follow the cell structure and does not have a clearly defined edge.

Phytophthora ramorum: identifying symptomatic larch

There are common biotic and abiotic factors affecting larch including frost damage (top right) and larch canker (bottom centre & right). It is worth reading publications such as Diseases & Disorders of Forest Trees *Gregory & Redfern (1998)* etc. to familiarise yourself before surveying.



Shoot dieback. Twigs with partial and/or failed bud flush can be indicative of *P. ramorum* infection. The inner bark on such twigs is typically necrotic (ie brown and discoloured) not fresh and slightly green. If twigs lack fully flushed buds but the end of the shoot has green needles and the bark is green and healthy, then *P. ramorum* is **not** the cause and frost damage is a much more likely culprit.



Partial shoot dieback with resin patch symptomatic of *Phytophthora ramorum*.

Browning of older growth with green shoots symptomatic of frost damage.



Resin patches symptomatic of *Phytophthora ramorum*.



Sooty coloured resin patches symptomatic of larch canker.



Small fruiting bodies of larch canker.

Phytophthora ramorum: identifying symptomatic larch

There are common biotic and abiotic factors affecting larch including deer and squirrel bark stripping (top left and centre), *Phacidium coniferarum* (top right), honey fungus (bottom left) and aphid damage (bottom centre and right). It is worth reading publications such as *Diagnosis of Ill Health in Trees Strouts & Winter (2001)* etc to familiarise yourself before surveying.



Phytophthora ramorum: identifying symptomatic larch

References

Anon (2010). Press release "Disease found in Japanese larch trees in Ireland"
www.agriculture.gov.ie/press/pressreleases/2010/august/title.45756.en.html

Webber JF (2011). Powerpoint presentation: Update on research findings – *Phytophthora ramorum*.

Webber JF, Turner J & Jennings P (2010). Report on research undertaken between October 2009 to March 2010 on *Phytophthora ramorum* incited dieback of larch (*Larix kaempferi*).

For the latest information on larch dieback caused by *Phytophthora ramorum* please see www.forestry.gov.uk/pramorum