

This guidance note gives examples of symptoms to look for and to avoid when observing larch trees which might be suspected of having *Phytophthora ramorum* infection.

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

- **In England**, please email tree.health@forestry.gsi.gov.uk or telephone 0300 067 4321.
- **In Scotland or Wales**, please use [Tree Alert](#).
- **In Northern Ireland**, please use [TreeCheck](#).

Owners or managers of individual garden, parkland, street or amenity trees who think their trees might be infected should contact Forest Research's Tree Health Diagnostic & Advisory Service (www.forestry.gov.uk/fr/ddas) by email to ddas.ah@forestry.gsi.gov.uk.

(Contact details correct as of September 2017)

Background

The quarantine pathogen *Phytophthora ramorum* was first found in the UK in 2002, initially in the horticultural trade. Over following years it was also discovered in parks, gardens, woodland and heathland. In the wider environment it was largely associated with rhododendron species, which act as a host from which spores are produced, although since 2009 it has also been found sporulating on bilberry (*Vaccinium myrtillus*) in heathland. When produced in sufficient quantity these spores could infect trees and other plants in the vicinity. Control efforts in woodland initially focused on removing rhododendron. The Forestry Commission, Forest Research, Natural Resources Wales, the Scottish Government, the Animal and Plant Health Agency (APHA) and the Northern Ireland Department of Agriculture, Environment and Rural Affairs 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 laboratory testing confirmed *P. ramorum* present in rhododendron in the under-storey of mature Japanese larch (*Larix kaempferi*) at a site in east Cornwall, 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 northern and western Devon and western Somerset confirmed the presence of *P. ramorum* in mature Japanese larch as well as species in its under-storey, 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 which also develops multiple stem lesions. Studies by FERA and Forest Research discovered that sporulation on infected larch was of a much greater level than on other known hosts. (Webber et al 2010)

By winter 2010 extensive surveying of larch stands across the UK confirmed that the pathogen was present 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. Surveillance in 2011 revealed further sites of infection in proximity to previously identified clusters. In addition, outbreaks in north-western areas of the UK were identified. These larch outbreaks in almost all cases had an association with previously existing infection in *Rhododendron ponticum*. The Republic of Ireland confirmed that it also had 11 cases. (ROI Dept of Agriculture Fisheries & Food 2011)

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 might also indicate that a site is infected with the pathogen. The last two pages illustrate other factors which, before closer inspection, might 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 (might 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 a Forestry Commission 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 and partially flushed needles between lesion and branch tip.

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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.

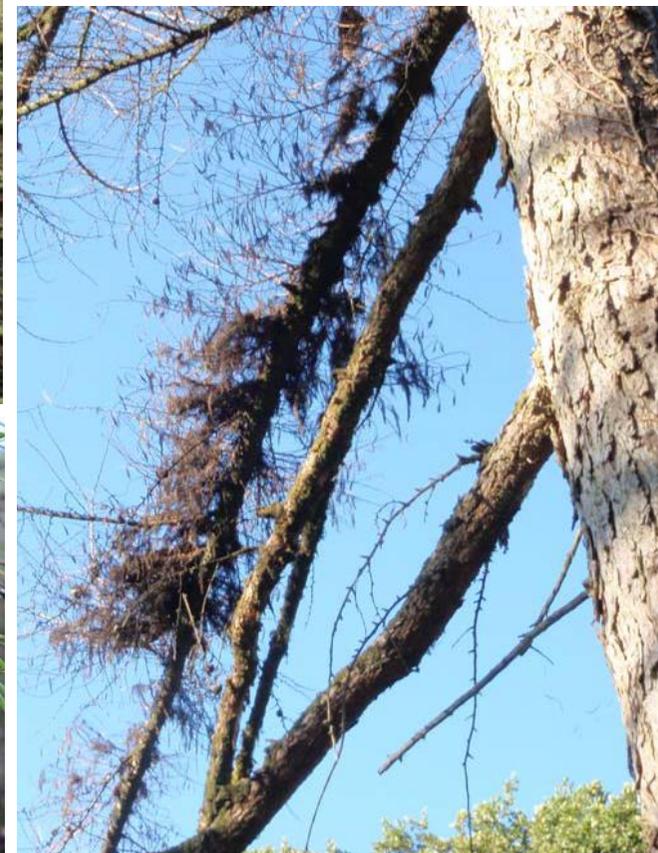
Phytophthora ramorum: identifying symptomatic larch



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.

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Foliage symptomatic of sporulating material

- **These symptoms are most likely to be seen at the onset of autumn, in September and 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 might 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 mid-rib and also on the leaf tip, i.e. wherever water collects.
- Watery appearance to dieback. On the underside of the leaf, infection tends 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. before surveying.



Shoot dieback. Twigs with partial and/or failed bud flush can indicate *P. ramorum* infection. The inner bark on such twigs is typically necrotic (i.e. 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

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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 (2011). Questions and Answers - *Phytophthora ramorum* on Japanese larch in Ireland

<http://www.agriculture.gov.ie/forests-service/forest-health-and-seeds/phytophthora-ramorum-symptomson-japanese-larch/>

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/pramorun