

# PHYTOPHTHORA RAMORUM AND KERNOVIAE IN SCOTLAND: A STATUS REPORT, SUMMER 2010.

*Phytophthora ramorum* and *P. kernoviae* are fungus-like plant pathogens which attack a wide range of trees and shrubs, and have the potential to cause significant damage in gardens, woodlands and heathland. This paper sets out the history of these diseases in Scotland, the current situation and the actions being taken to control them.

## 1. Background

### 1.1 History

1.1.1 *P. ramorum* was identified in 2000 as the pathogen responsible for the sudden death of oak trees in California and Oregon, and for dieback of rhododendron nursery stock in The Netherlands and Germany, both of which had been observed since the early 1990s. It was found in GB in 2002 and is now present within the nursery trade throughout much of Europe and third countries, and in the wider environment in many western European countries. Emergency measures are in place in EU legislation to prevent its spread.

1.1.2 *P. kernoviae* was first discovered in 2003, in a woodland in Cornwall, during inspections for *P. ramorum*. It has also been identified in New Zealand, but there has been very little spread outwith GB, and it is rarely found in nursery stock. There is no specific EU legislation dealing with *P. kernoviae*, but in GB the same measures have been taken against it as are required for *P. ramorum*.

1.1.3 In England and Wales, there have been extensive outbreaks of both *P. ramorum* and *P. kernoviae*. There is a focus in the south-west of England, particularly for *P. kernoviae* where a statutory disease management zone was prescribed in 2004. *P. ramorum*, however, has been found widely across England and Wales, reaching to Newcastle and East Anglia, with over 250 outbreaks in gardens, woodland and heathland, and over 500 in nurseries and garden centres.

1.1.4 Although a number of trees (less than 100) had been affected, there had been no serious outbreaks in commercial forestry until September 2009, when stands of Japanese larch were found to be heavily infected with *P. ramorum* on several sites in south west England. Further surveys have confirmed more than 50 Japanese larch sites infected, in England and Wales, with many more still under investigation. There have been no findings on Japanese larch in Scotland.

### 1.2 Biology

1.2.1 Both pathogens cause leaf blights and dieback on a wide range of shrub hosts and some trees, and bleeding bark cankers on certain tree hosts. They spread by producing spores which can be dispersed to other plants by water (rain-splash, irrigation, wind-blown rain or fog) or in soil or plant debris moved on footwear or vehicles. Movement of infected plants is a significant source of long-distance

spread. Both pathogens can also persist for several years in soil and plant debris, infecting re-growth or replacement plants.

1.2.2 There are no chemical treatments which can reliably kill *P. ramorum* or *P. kernoviae*, although some fungicides can reduce symptoms and sporulation. For this reason the use of fungicides is prohibited in nurseries where infection is found, to ensure that symptoms are not masked and infected plants can be identified. Eradication requires removal and secure disposal or burning of all infected plants, monitoring of regrowth and replacement with non-susceptible species.

1.2.3 The amount of spores produced varies between host plants. In most cases, spores are not produced on bark cankers, only on leaves. *Rhododendron ponticum* is one of the most significant sporulators in GB and has been a major source of spread, which has been generally limited to a few metres. However, Japanese larch has recently been found to produce at least five times as many spores of *P. ramorum* as *R. ponticum*, and evidence suggests it may be aurally dispersed up to 50 km, or more, raising concerns about future spread.

## 2. Outbreaks in Scotland

### 2.1 Horticultural trade

2.1.1 *P. ramorum* was first found in nursery stock in Scotland in 2002. Outbreaks in nurseries, garden centres and newly landscaped sites are usually restricted to particular consignments and can be eradicated within a few months, by destruction of infected plants and quarantine of susceptible species. The following table shows the number of outbreaks in each year.

Year	2002	2003	2004	2005	2006	2007	2008	2009	Total
Outbreaks of <i>Pr</i> in trade	18	6	6	3	0	6	7	0	46

Some premises have experienced repeated outbreaks, particularly those which specialise in susceptible species. 28 premises have been affected to date.

2.1.2 There have been no findings of *P. kernoviae* in nursery stock in Scotland.

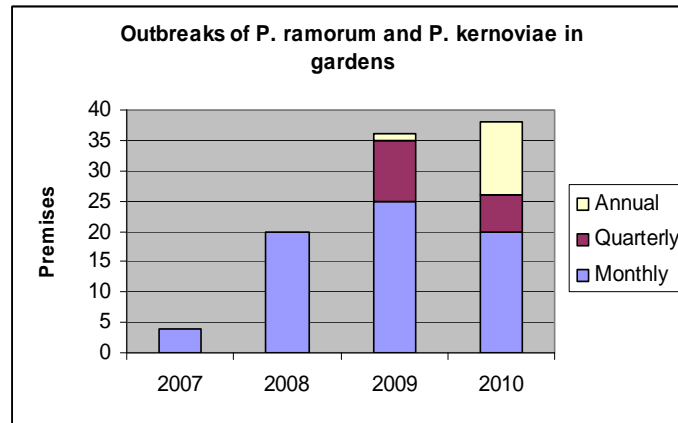
2.1.3 Nurseries which experience an outbreak are likely to suffer a significant financial impact from the destruction of infected stock and quarantine of other plants which may miss their market. However, in most cases it is reasonably straightforward to arrange for destruction, and for disinfection of the growing area. Managing pests and diseases is a regular activity for traders, and standard plant hygiene measures should prevent spread to other lots.

### 2.2 Gardens and wider environment

2.2.1 Many ornamental shrubs in heritage and botanic gardens are susceptible to *P. ramorum* and *P. kernoviae*. The first finding of *P. ramorum* in an established garden in Scotland was in September 2007, followed by *P. kernoviae* in another garden in January 2008. There are now 18 distinct outbreak sites, covering 38

premises ranging from large country house grounds and woodland to individual domestic gardens. 22 premises are infected with *P. ramorum*, 13 with *P. kernoviae* and 3 with both.

2.2.2 New outbreaks are visited monthly to identify any further infection. After three monthly inspections clear of new positives, the frequency is reduced to quarterly inspections, and after three clear quarterly inspections it falls to one inspection annually. After three annual inspections without new infection being found, the outbreak will be considered eradicated. The following chart shows the balance of new outbreaks and those moving towards eradication, to May 2010.



2.2.3 While removal of infected ornamental plants is often physically straightforward, it can have severe impacts on valuable collections of specimens or historic garden and landscape designs. There are also economic effects from reduced visitor numbers if the garden is significantly changed, and from the need to re-plan and re-plant. Non-symptomatic plants around the infected plant are also normally required to be destroyed to prevent spread, however in a carefully managed garden, vigilance for symptoms and good practice in plant hygiene may be permitted as an alternative.

2.2.4 *R. ponticum* is also involved in many garden and wider environment outbreaks. In some cases it was deliberately planted, before its invasive nature was realised, but in many cases it has spread out of control, including along roadsides and as understorey in woodland. Removal of rhododendron to control *P. ramorum* or *P. kernoviae* is normally beneficial to the habitat, enabling native species to re-colonise the area. It is, however, physically difficult and expensive; rhododendron often grows densely on steep and inaccessible terrain, and is persistent, requiring regrowth to be treated for at least 3 years after removal. Grants may be available to support rhododendron removal for environmental improvement, but these normally cover only a proportion of the costs. There may also be other consequences to consider, for example where *R. ponticum* is planted to protect less hardy plants from wind or sea-spray, or where it plays a role in stabilising soil on hillsides.

## Forestry

**2.2.5 To date no trees in Scotland have shown *P. ramorum* or *P. kernoviae* infection.**

2.2.6 Where outbreaks have been found in commercial forestry in England and Wales, such as those in Japanese larch, affected trees and susceptible species around them are required to be felled. The foliage must be destroyed and the timber transported to mills using suitable biosecurity measures to prevent any spread of disease.

2.2.7 Although these infections generally do not affect the quality or end use of the timber, they may still have significant financial impacts because trees need to be felled before their planned time and in some cases well before they are fully mature, when they have no commercial value. This also has implications for access and the costs of felling and extraction, and there are additional costs for biosecure transport and disposal of infected foliage and processing residues. A further issue is that *P. ramorum* and *P. kernoviae* have such a wide host range that options for replanting may be limited in some climates and soil types.

## Heathland species

2.2.8 In October 2008, *P. kernoviae* was identified on an area of *Vaccinium myrtillus* (blaeberry) in Merkland Wood near Brodick on the Isle of Arran. This small area of blaeberry has been eradicated to control further spread of the pathogen. To date no outbreaks have been found in heathland areas in Scotland.

2.2.9 Many tree and heathland species are susceptible to these pathogens. While small, isolated outbreaks can be dealt with by removing the infected plants, this may not be appropriate if the infection was more widespread in a native habitat. It is also extremely difficult to thoroughly remove plants such as heather, which has been shown to be susceptible in laboratory trials, and blaeberry. Research is under way to investigate measures to control infection in these environments, and what effect existing heathland management approaches, including muirburn, may have.

## **3. Control measures**

### **3.1 EU requirements**

3.1.1 The current measures required by EU legislation aim to eradicate *P. ramorum* from commercial plant production, and to at least contain outbreaks in the wider environment. The legislation requires that:

- Host plants may only be imported into or moved within the EU if they are free of the pathogen;
- Nurseries growing host plants must be inspected at least twice a year;
- If any infected material is found at a nursery or garden centre, it must be treated by:
  - Destruction of the infected plants and all susceptible plants within 2m;

- Holding all susceptible plants within 10m for 3 months of growth with at least two inspections in that time;
- Inspection of all other susceptible plants on the premises for signs of disease.
- Member States must undertake and report annually surveys of cultivated and uncultivated plants for evidence of the disease;
- If the pathogen is found at sites other than nurseries, measures must be taken at least to contain it.

3.1.2 There is, as yet, no specific EU legislation relating to *P. kernoviae*, but as with any new disease problem, we are required to notify findings and prevent its spread to other Member States.

### 3.2 Initial Controls in GB

3.2.1 From the first findings of *P. ramorum* in England, plant health authorities in GB have agreed to take stronger action than the EU minimum on outbreaks at sites other than nurseries, aiming at eradication wherever possible, and to take the same measures against *P. kernoviae* as against *P. ramorum*. This was managed through a GB Programme Board which included the Scottish Government, Defra and Forestry Commission. The Scottish Government continues to maintain contacts with Fera (Defra's plant health agency) to exchange information about current outbreaks, control measures and research.

The following controls were implemented in Scotland:

#### 3.2.2 Nurseries and garden centres:

- Initially, nurseries growing highly susceptible plants, such as Rhododendron, Viburnum and Camellia, were inspected 4 times each year. This was reduced to twice a year following the absence of findings in 2006, but was subsequently increased again to at least 3 times per year.
- Where an infection is found at a nursery, it is treated according to the EU requirements and the area where infected plants were grown or stored must be cleaned and disinfected.
- All nurseries registered with the Scottish Government for plant passporting are inspected at least once every year, when all host plants for *P. ramorum* and *P. kernoviae* are checked for any signs of infection.
- Garden centres are routinely monitored, and those handling host plants are particularly targeted.

### 3.2.3 Established gardens:

- A survey of between 20 and 60 established gardens has been carried out each year since 2003. There is a particular focus on gardens open to the public and those known to have collections of susceptible plants, and the survey is weighted towards the west of the country which climate modelling shows to be the area at the highest risk. However, a sample of gardens in central and eastern areas have also been surveyed. Gardens are also included in the survey figures if they are inspected as a result of owners or staff raising concerns.
- Where an infection is found in an established garden, the following measures are taken:
  - all infected plants must be destroyed;
  - other host plants within 2m must also be destroyed. For specimens with significant heritage or scientific value, close monitoring for any signs of disease may be agreed instead of immediate destruction;
  - restrictions are placed on any plant material being moved from the site. Plant sales may be allowed to continue provided there is strict separation between the nursery and sales area and the rest of the garden;
  - conditions are imposed to limit the risk of spread, including removal of plant debris from paths, restrictions on access if appropriate, and disinfection of tools, footwear and equipment;
  - inspectors revisit the site monthly, monitoring the garden for any new infection and checking that requirements are complied with. If three inspections pass without new infection being found, the frequency is reduced to quarterly and then annual.
- A survey of 3km radius around the garden is carried out as soon as possible after the initial finding, to check for any wider infection. The Forestry Commission assists in this survey if there is any woodland in the 3km area. The survey is not repeated, but inspectors will informally monitor other premises if the infected area is close to the boundary of the garden. Additional infection sites have been found in 5 of the 18 existing outbreaks.

### 3.2.4 Woodlands:

- In 2004, the Forestry Commission surveyed 512 woodland sites in Scotland for *P. ramorum* and *P. kernoviae*. No positives were found, and no symptoms have been reported in woodlands since. Following the first finding in Scotland of *P. ramorum* outside the nursery sector, in 2007, a programme began to re-survey those woodlands which were identified as susceptible. Over 200 of these have been re-surveyed to date.
- Were infection to be found in woodland or forestry in Scotland, the Forestry Commission would oversee measures similar to those set out above for gardens, taking account of the particular circumstances of the outbreak. Work

is generally confined to the removal and destruction of infected *Rhododendron* and to date no trees have been found infected.

### 3.2.5 Wider prophylactic clearance:

- In December/January 2010, Forestry Commission Scotland undertook a desk-based assessment of the cost implications of prophylactic clearance of all potential sporulating host plants within a 100m radius of each known *P. ramorum* and *P. kernoviae* infection in Scotland. This suggested a total, direct cost of some £500,000. The epidemiological impact of such work cannot readily be quantified.
- At their meeting in April, the Phytophthora Steering Group (see 3.5) agreed that in most cases, heightened control and surveillance activity would enable any new infections to be dealt with quickly and effectively. Two outbreaks were identified where the scale of infection, coupled with the extent of dense *Rhododendron ponticum*, is such that prophylactic clearance of potential sporulating host plants would be a sensible precaution. Forestry Commission Scotland is now taking these forward as potential SRDP-funded projects.

### 3.3 Consultation

In 2008 the Scottish Government, in parallel with Defra and the Forestry Commission, consulted stakeholders on the future management of risks from *P. ramorum* and *P. kernoviae*, asking whether controls should be increased, reduced or maintained at the same level. The majority of respondents were in favour of increasing controls.

### 3.4 Research

The Scottish Government is funding a 3-year study, which started in 2009, into the epidemiology of *P. ramorum* and *P. kernoviae* in managed gardens and heathland in Scotland. This is examining the behaviour of the pathogens in Scottish habitats and climate conditions, and investigating outbreaks on heathland in England to improve our understanding of their impacts on heathland species. This will help to develop management strategies for gardens and any heathland outbreaks, should they occur in Scotland. We are also taking into account the results of research being carried out in England and around the world.

### 3.5 Future programme of controls

From 2010 onwards, the following increased actions will be taken to survey for the presence of *P. ramorum* and *P. kernoviae* in Scotland. This will be overseen by a Phytophthora Steering Group with membership drawn from Rural and Environment Directorate (policy), Rural Payments and Inspections Directorate (including SASA) and the Forestry Commission.

### 3.5.1 Nurseries and garden centres

All nurseries registered to issue plant passports for susceptible species will be inspected three times each year. Those considered to present a higher risk, due to previous infections or proximity to other outbreaks, will be inspected four times a year. All other nurseries and garden centres will be inspected at least once a year.

### 3.5.2 Established gardens and public green space

Inspectors will aim to survey 100 sites other than nurseries. In addition to established gardens this survey will be widened to include other public green spaces such as parks and the grounds of public buildings.

### 3.5.3 Woodlands

The Forestry Commission will survey approximately 130 woodlands in 2010. Work will also be carried out to identify where Japanese larch is present in Scottish forestry, and to check for any infection in these areas.

### 3.5.4 Heathland

A survey of up to 100 heathland sites will be carried out by SEARS partners (Scotland's Environment and Rural Services – [www.sears.scotland.gov.uk](http://www.sears.scotland.gov.uk)) to check whether these diseases are present in the wider environment where they have potential to damage important native habitats.

### 3.5.5 Treatment

Where infection is found, the same approach will continue as before, with the aim of eradicating all outbreaks. Progress to date suggests that the current measures are effective, although vigilance is required over several years and some outbreaks are more persistent than others.