

# Preliminary Results of Foliage Susceptibility to *Phytophthora kernoviae* sp.nov. : A new pathogen of forest trees in the UK



S. Denman; C.M. Brasier; A. Brown; S.A. Kirk; E. Orton; J.F. Webber  
Forest Research, Alice Holt Lodge, Farnham, Surrey, GU10 4LH, UK



*Phytophthora kernoviae* sp. nov. is a newly discovered pathogen occurring in the UK, that attacks foliage, particularly of exotic shrub species, and bark of certain indigenous and exotic trees. Foliage infections cause leaf blight and necrosis of leaves and shoots, whereas infected trees develop blackened trunk cankers with associated bleeding, bark necrosis and ultimately severely infected trees die. Similarities in disease symptoms between *P. ramorum* and *P. kernoviae* exist. *Phytophthora kernoviae* was first discovered on a beech tree with a canker covering a large part of the stem, and later on a rhododendron bush adjacent to the tree, in Cornwall, south-west England.

*Phytophthora kernoviae* is homothallic, and produces caducous sporangia, which are adapted for aerial dissemination. To date sporangia have not been found on bark of infected hosts and this suggests that foliage may be a source of sporangial inoculum as has been demonstrated for *Phytophthora ramorum* with bay laurel (*Umbellularia californica*) (Davidson *et al.* 2002), tanoaks (*Lithocarpus densiflora*) and redwood needles (*Sequoia sempervirens*) (Garbelotto 2004). Consequently it is important to establish the foliage host range of *P. kernoviae* to determine the epidemiology of the disease and develop a disease management strategy. We report here on preliminary results of foliage susceptibility tested using a detached leaf dip assay, and list current foliar hosts discovered during field surveys in the UK.

## Materials and Methods

### Detached Leaf Dip Assay

- Leaves were dipped into a  $10^6$  zoospores/ml suspension for 30 seconds (Fig. 1a).
- Leaves were placed on racks in plastic boxes (Fig 1b), which were then covered with cling film and incubated at 20°C for 8 days with a 12h light/dark cycle.
- Visual assessment of the percentage necrotic leaf area and re-isolation from the dead-live junction of the lesion were carried out.

### Field Survey

- Field surveys were carried out in natural woodlands and gardens in Cornwall, south-west England.
- Symptomatic foliage was collected and isolations made on synthetic mucor agar (Brasier and Kirk 2002).
- Isolates were transferred to carrot agar and incubated at 20°C for 6 d in the dark.
- Cultures were examined using a microscope. The ITS1 and ITS2 regions of representative isolates were sequenced.

## Results

### Detached leaf dip assay

- Magnolia was most susceptible with 40% leaf area covered by a continuous lesion (Figs. 2 and 3).
- Rhododendron, tulip tree, wild cherry and lilac were also highly susceptible but necrosis was often patchy.
- Smaller speckled lesions formed on bay laurel, laurel and birch.
- No lesions occurred on ash, beech, elm, hazel, holly, lime or sweet chestnut.



Figure 2. Necrotic leaf area of inoculated plants after 8 days. Black line shows the limit of dipped region

Biological Name	Common Name
<i>Acer pseudoplatanus</i>	sycamore
<i>Aesculus hippocastanum</i>	horse chestnut
<i>Betula pendula</i>	birch
<i>Carpinus betulus</i>	hornbeam
<i>Castanea sativa</i>	sweet chestnut
<i>Corylus avellana</i>	hazel
<i>Fagus sylvatica</i>	beech
<i>Fraxinus excelsior</i>	ash
<i>Gevuina avellana</i>	Chilean hazelnut
<i>Ilex aquifolium</i>	holly
<i>Liriodendron tulipifera</i>	tulip tree
<i>Magnolia</i> sp.	magnolia
<i>Populus tremula</i>	aspen
<i>Prunus avium</i>	wild cherry
<i>Prunus laurifolia</i>	laurel
<i>Quercus cerris</i>	Turkey oak
<i>Quercus ilex</i>	holm oak
<i>Quercus petraea</i>	sessile oak
<i>Quercus robur</i>	common oak
<i>Quercus rubra</i>	red oak
<i>Rhododendron catawbiense</i>	rhododendron
<i>Syringa vulgaris</i>	lilac
<i>Tilia cordata</i>	small leaved lime
<i>Ulmus procera</i>	English elm
<i>Umbellularia californica</i>	bay laurel

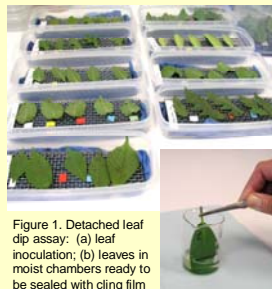


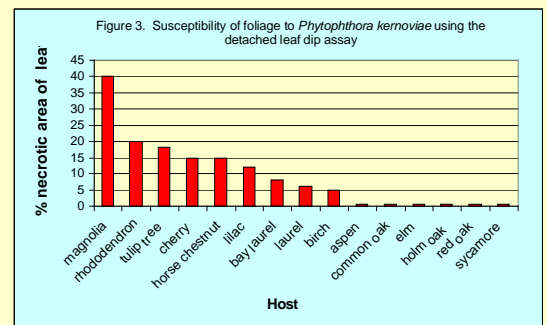
Figure 1. Detached leaf dip assay: (a) leaf inoculation; (b) leaves in moist chambers ready to be sealed with cling film



Figure(s) 4. *Gevuina avellana* with leaf blight caused by *Phytophthora kernoviae* in Cornwall



Figure(s) 5. Rhododendron infected with *Phytophthora kernoviae* in Cornwall



### Field survey

*Phytophthora kernoviae* was isolated from these hosts sampled in the survey:

*Gevuina avellana* (Chilean hazelnut) (*Proteaceae*) (Fig. 4).

*Liriodendron tulipifera* (Tulip tree) (*Magnoliaceae*).

*Michelia doltsopa* (*Michelia*) (*Magnoliaceae*).

Rhododendron (*Ericaceae*) (Fig. 5).

It has also been reported from magnolias (*Magnoliaceae*) growing in the same area (PHSI and CSL, pers. comm.).

Table 1. List of plant species inoculated in the detached leaf assay

## Discussion

This is the first report of naturally infected hosts susceptible to *Phytophthora kernoviae*. Most foliage hosts discovered so far belong to the plant family *Magnoliaceae*. Preliminary results of the leaf dip tests demonstrate that *Phytophthora kernoviae* may have a more limited host range than *Phytophthora ramorum* and that *Magnoliaceae* in particular are highly susceptible. This could suggest an origin of the pathogen in China where many *Magnoliaceae* are native.

Successful infection and disease development using zoospore inoculum on non-wounded foliage indicates that this is the probable mode of foliage infection in nature. During this study abundant sporangia developed on both surfaces of magnolia leaves, and to a lesser extent on the lower surface of rhododendron leaves. The ease and abundance with which they developed strengthens the idea that they play an important role in disease initiation. Further studies on infection of intact foliage on host plants need to be carried out. Although the bark of beech trees was highly susceptible, foliage was not.

## References

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