

Root associations of *Phytophthora ramorum* and *Phytophthora kernoviae* in UK woodlands

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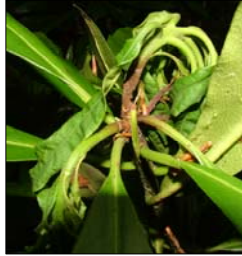
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BACKGROUND

Phytophthora kernoviae and *Phytophthora ramorum*, two pathogens recently introduced to the UK, incite foliar lesions, shoot necrosis, and death of *Rhododendron ponticum*, an invasive weed pervading UK woodlands. In infested woodlands, *R. ponticum* serves as an epidemiologically important host, supporting sporulation of both pathogens. Bleeding cankers on trunks of European beech (*Fagus sylvatica*) caused by either *P. ramorum* or *P. kernoviae* are often associated with neighboring infected *R. ponticum*. *Rhododendron ponticum* has been removed from several woodlands as an inoculum management strategy, but the long-term efficacy of plant removal is unknown, in part due to lack of knowledge of pathogen persistence in roots and in emerging seedlings.



P. kernoviae symptoms on *R. ponticum*



P. ramorum symptoms on *R. ponticum*
(Photo: Alistair Whybrow, Forest Research)

OBJECTIVES

- 1) Determine potential for root associations of *P. ramorum* and *P. kernoviae* on *R. ponticum* in infested woodlands.
- 2) Investigate potential for infection of emerging *R. ponticum* seedlings by *P. kernoviae* in woodlands cleared of *R. ponticum*.

METHODS

Objective 1:

Rhododendrons propagating by layerage in infested woodlands were identified for excavation of roots.

Collection Strategy:

- 1 *P. ramorum*-infested location
- 2 *P. kernoviae*-infested locations
- 4 root excavations/location

Sampling Strategy:

- At each point of layerage:
- roots
 - rhizosphere soil
 - overlying leaf litter
 - symptomatic foliage



Excavation of layered *R. ponticum* roots



Pathogen detection:

- Roots were thoroughly washed to remove all soil.
- Root, soil, and litter samples were baited for *Phytophthora* spp. using rhododendron leaf disks, then baits were placed on selective medium.
- Symptomatic foliage was placed directly on selective medium.
- Potential isolates of *Phytophthora* spp. were transferred to carrot agar for identification.

Objective 2:

Site Details: *R. ponticum* was removed from a *P. kernoviae*-infested site in 2005 as an inoculum management strategy. In May 2007, some emerging seedlings were symptomatic for *P. kernoviae*.



Emerging *R. ponticum* seedlings in a *P. kernoviae* management site



Symptomatic *R. ponticum* seedlings (Photo: Alistair Whybrow, Forest Research)

Sample Strategy:

19 emerging seedlings were collected, along with roots and rhizosphere soil



Symptomatic seedling with asymptomatic roots

- Rhizosphere soil was baited for *P. kernoviae* with rhododendron leaves.
- Roots were baited with rhododendron leaf disks.
- Symptomatic foliage was placed directly on selective medium.



Soil baiting with intact rhododendron leaves



Isolation of baits on selective medium

RESULTS

Site 1: Layered roots at *P. ramorum*-infested site

	Plant 1	Plant 2	Plant 3	Plant 4
Foliage	Pr	Pr	Pc	-
Leaf Litter	Pr	Pr	Pr	Pr
Soil	-	-	-	-
Roots	-	Pr	-	-

Pr= *P. ramorum*

Pc= *P. citricola*

Site 2: Layered roots at *P. kernoviae*-infested site

	Plant 1	Plant 2	Plant 3	Plant 4
Foliage	-	-	Pk	-
Leaf Litter	Pk	Pk	Pk	Pk
Soil	-	-	-	-
Roots	Pk	-	Pk	Pk

Pk= *P. kernoviae*

Site 3: Layered roots at *P. kernoviae*-infested site

	Plant 1	Plant 2	Plant 3	Plant 4
Foliage	-	-	-	-
Leaf Litter	Pk	Pk	-	Pk
Soil	-	-	-	-
Roots	Pk	-	-	Pk

Pk= *P. kernoviae*

Site 4: Emerging seedlings at *P. kernoviae*-management site

Seedling #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Foliage													Pk						Pk	
Soil																				Pk
Roots			Pk										Pk	Pk						Pk

Pk= *P. kernoviae*

CONCLUSIONS

- 1) Neither *P. ramorum* nor *P. kernoviae* were baited from soil associated with layered roots, but both were routinely baited from overlying leaf litter.
- 3) Both *P. ramorum* and *P. kernoviae* were baited from *R. ponticum* roots.

These results suggest the potential for either pathogen to persist in infested roots or directly on the rhizoplane. The lack of pathogen recovery from soil suggests that infections of layered roots may arise from inoculum in the litter layer during adventitious root production.

- 4) *P. kernoviae* was recovered from roots, foliage, and soil in emerging rhododendron seedlings at a site where *R. ponticum* was removed in 2005.

These results suggest the need for continuous removal of emergent plant tissue for years after initial removal of *R. ponticum*.

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