New Disease Reports

Dieback and mortality of plantation Japanese larch (*Larix kaempferi*) associated with infection by *Phytophthora ramorum*

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The invasive pathogen *Phytophthora ramorum* is the cause of 'sudden oak death', a dieback and mortality of more than one million live-oak and tanoak trees along 1500 km of near-coastal native forest in California and Oregon since 1995 (Rizzo *et al*., 2002; Frankel, 2008). *P. ramorum* has also spread across Europe , mainly within the ornamental nursery trade. From 2003 onwards it was found infecting rhododendron and woodland trees outside nurseries in Britain (Brasier *et al*., 2004) and has recently spread to native *Vaccinium* swards (P. Beales, personal communication). Until now, tree infections in Britain have been comparatively few (<100), mostly foliage or stems of Fagaceae (*Fagus, Nothofagus, Quercus* and *Castanea*) in the vicinity of infected *Rhododendron* in south west England (Webber, 2008). In August 2009 extensive dieback and mortality was observed in mature (25-30 m tall) and juvenile plantation Japanese larch, *Larix kaempferi,* at multiple sites in south west England (Figs. 1, 2). Symptoms included black or purple discoloured needles (Fig. 3), aborted bud flush, wilting and senescence of dwarf shoots and needle loss. Affected trees often had copious resin bleeding on the trunk, branches and side shoots plus dieback of branches and sometimes of the entire crown. Phloem lesions were often present under resinous outer bark. These usually had deep pink to maroon-red margins, older lesion areas being rusty-brown to cinnamon brown.

When symptom-bearing needles were surface-sterilised in 70% ethanol for 30 seconds or small pieces of older phloem lesion were plated onto *Phytophthora* selective medium (Brasier *et al.*, 2005), *P. ramorum* was obtained from 25-40% of the samples. Identity was confirmed by sequencing of ITS rDNA regions (GenBank Accession No. HQ010359). *P. ramorum* was not obtained from the pink-maroon lesion margins. Pathogenicity of a *P. ramorum* isolate from *L. kaempferi* was tested by dipping 15 cm long *L. kaempferi* shoots into a zoospore suspension and damp chamber incubating for 12h light/12h dark cycle at 18^{o}C. On half the shoots all needles were wounded by tip cutting. After seven days each needle was categorised as blackened, browned/brown bands, chlorotic or green, surface sterilised and plated onto selective medium. Both unwounded and wounded blackened needles yielded *P. ramorum* at high frequency (Table 1). When needles were mounted in lactic acid cotton blue and viewed 24 h later, sporangia and occasionally chlamydospores were observed on the surfaces with an exceptional 2685 sporangia counted on one unwounded needle (Fig. 4).

P. ramorum has so far been isolated from *L. kaempferi* at 68 currently known plantations where symptoms are present in southwest England . In May 2010 larch plantations with similar symptoms were discovered in south Wales and *P. ramorum* has again been isolated at multiple sites. Overall an estimated 2400 ha or c. 0.6 million mature larch have been affected to date. A large area of juvenile larch is also affected. This is the first widespread and lethal damage caused by *P. ramorum* to a conifer and the first to a commercial plantation tree. Adjacent to some affected larch sites in southwest England , secondary infection of *Fagus sylvatica*, *Nothofagus obliqua*, *Castanea sativa*, *Betula pendula*, *Rhododendron ponticum*, *Tsuga heterophylla* and *Pseudotsuga menziesii* is also occurring, apparently as result of the high levels of *P. ramorum* inoculum produced from larch foliage.

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Figure 1

Figure 2

Figure 3

Figure 4

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