



# *Phytophthora siskiyouensis* causing stem lesions and cankers on *Alnus incana*

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In late summer 2013, stem cankers and sparse foliage were reported on European grey alder (*Alnus incana*) growing on a 500 ha site recently-planted with broadleaf and coniferous trees in south-west England. A site visit showed that approximately 10% of more than 1000 grey alders (thought to have been imported from Europe and planted in the late 1990s) had symptoms including bleeding stem lesions similar to those caused by *Phytophthora alni* (Gibbs *et al.*, 2003). In November 2013, samples were collected from stem lesions (Fig. 1), roots (internal lesions tracking-down from stem lesions) and rhizosphere soil from symptom-bearing trees. Tissue from root and stem lesion margins was plated onto *Phytophthora* selective medium (SMA) (amended as per Brasier *et al.*, 2005) and incubated at 20°C for 48 hrs. Green apples were used as baits for soil samples by inserting a few grams of soil under a flap cut in the side of the apple and incubating for 4-7 days at 20°C. Isolation from developing SMA mycelial cultures and incubated apple baits onto potato dextrose agar (PDA) and carrot agar (CA) was then undertaken.

After 14 days on PDA at 20°C in the dark, colonies exhibited a distinctive stellate growth pattern (Fig. 2a). On CA they had a diffuse 'frosty' appearance (Fig. 2b). On CA, oogonia with predominantly paragynous antheridia and aplerotic oospores were abundant. Partially-caducous sporangia formed when plugs from colonies on CA were submerged in unsterile pond water held at 20°C in the dark. Sporangia (46-51 µm wide) were semi-papillate and were ovoid, reniform, elongated or irregular in shape (Fig. 3). Sporangial morphology and dimensions corresponded to *Phytophthora siskiyouensis* (Reeser *et al.*, 2007) and sequences of ITS and *coxII* regions supported this identification (GenBank Accession Nos. KP207601 and KP207602).

One isolate of *P. siskiyouensis* was obtained from each of three different symptomatic trees; one from a root lesion, one from a stem lesion and one from associated soil. Koch's postulates were tested by inoculating two-year-old potted *A. incana* saplings with the three isolates. A small wound was made on the stem 10 cm above soil level. A CA plug colonised by *P. siskiyouensis* was inserted and the wound was sealed with Parafilm. Nine saplings were inoculated per isolate and maintained at 20°C with a 12-hr-photoperiod. Three control saplings were inoculated with sterile CA plugs. After 20 days, cankers and bleeding were visible externally on all of the trees inoculated with *P. siskiyouensis* (Fig. 4). The bark was peeled away to reveal phloem lesions extending approximately 2-4 cm above and below the

inoculation point. No lesions developed on control trees. After re-isolation onto SMA, a *Phytophthora* sp. was recovered from all of the inoculated trees but not from the controls and it was identified as *P. siskiyouensis* by morphology (Reeser *et al.*, 2007) and sequencing of the ITS region.

*Phytophthora siskiyouensis* is a recently-described species in the USA, isolated from stem lesions on myrtlewood (*Umbellularia californica*) and tanoak (*Lithocarpus densiflorus*; synonym of *Nothocarpus densiflorus*) and from soil and stream water, in south-west Oregon (Reeser *et al.*, 2007). It has also been reported causing stem lesions on Italian alder (*Alnus cordata*) in California (Rooney-Latham *et al.*, 2007). This is the first report of *P. siskiyouensis* in the UK and, to our knowledge, in Europe, and the first report of *P. siskiyouensis* causing stem cankers on *A. incana*. Its occurrence within a recently-planted site suggests a possible origin on introduced nursery stock. *P. siskiyouensis* has the potential to cause further damage to *Alnus* spp. and other plant species in Europe. Its comparative pathogenicity on various alder species is under investigation.

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Figure 1

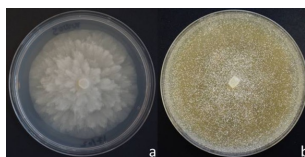


Figure 2



Figure 3



Figure 4

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