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NEW DISEASE REPORT

First report of *Phytophthora pluvialis* causing cankers on Japanese larch in the United Kingdom

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In 2021 *Phytophthora pluvialis* was first detected in the UK on western hemlock (*Tsuga heterophylla*) (Pérez-Sierra *et al*., 2022) and it was classified as a quarantine pest for regulatory purposes in the UK. Official surveys were carried out by the Forestry Commission and *P. pluvialis* was also detected on a second host, Douglas fir (*Pseudotsuga menziesii*), which has been reported previously in the USA (Reeser et al., 2013). During the surveys done in England in 2022, defoliation and needle blight were observed on the lower part of a group of c. 10 Japanese larch (*Larix kaempferi*) (Figure 1). The symptoms were like those of *P. pluvialis* on western hemlock and Douglas fir. Multiple cankers were present on the affected branches (Figure 2) and in some instances on main stems.

Samples were collected from affected trees and analysed by the Tree Health Diagnostic and Advisory Service at Forest Research, UK. One *Phytophthora* species was isolated consistently on selective media (SMA) from diseased tissue. Pure cultures were obtained on carrot agar (CA) (Figure 3) and the species was identified as *P. pluvialis* by extracting DNA and amplifying and sequencing the ITS region with the ITS4/ITS6 primers. The identification was confirmed using a real-time PCR assay targeting a region of the *ypt1* gene (McDougal et al., 2021). The diseased larch samples were also tested for the presence of *P. ramorum* by real-time PCR and all tested negative (European and Mediterranean Plant Protection Organization, 2006).

Pathogenicity tests were performed on two- to three-year-old larch trees of three different species: European larch (*L. decidua*), hybrid larch (*L. eurolepis*) and Japanese larch (*L. kaempferi*). A representative isolate of *P. pluvialis* was used and eight trees of each species were inoculated on two points, one on the stem and one on a branch. Eight trees of each species were used as controls. A wound was made using a 5–6 mm diameter cork-borer and a CA plug of similar size colonised by a ten-day-old *P. pluvialis* colony was placed in the wound facing down, which was covered with cotton wool moistened with sterile distilled water and wrapped in plastic film and then aluminium foil. Controls were inoculated with a sterile CA plug. Trees were maintained in a growth chamber with a photoperiod and temperature of 17°C day (8 hours)/15°C night (16 hours) and watered on demand. After three months, symptoms such as yellow needles, wilting or defoliation were observed. Small lesions of *P. pluvialis* were observed (Figure 4) on the three species (lesions had a mean length of 2 cm). No *P. pluvialis* was recovered from the controls. The presence of the pathogen was confirmed by real-time PCR and by isolation, fulfilling Koch's postulates.

Initially *P. pluvialis* was described in USA on tanoak (*Notholithocarpus densiflorus*) and Douglas fir (Reeser et al., 2013) and later mainly on *Pinus radiata* in New Zealand (Dick et al. 2014), although

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FIGURE 1 Defoliation of the lower part of the Japanese larch (*Larix kaempferi*) caused by *Phytophthora pluvialis*



FIGURE 2 Cankers on a branch of Japanese larch (*Larix kaempferi*) caused by *Phytophthora pluvialis*

other pine species can be also affected such as stone pine (*P. pinea*)

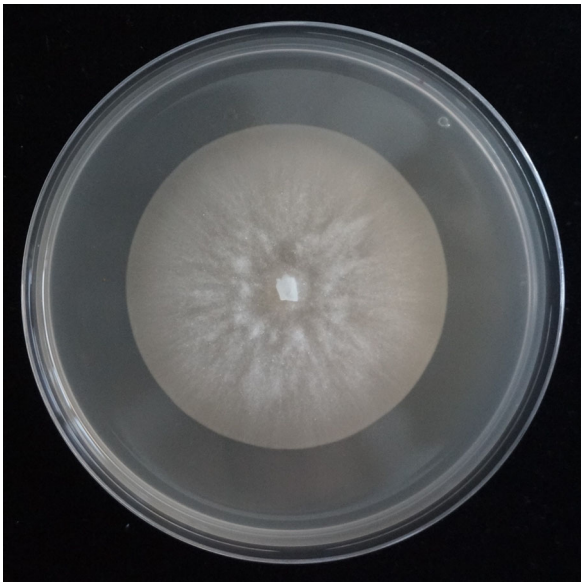


FIGURE 3 Colony morphology of *Phytophthora pluvialis* grown on carrot agar media after two weeks of growth at 17°C in the dark



FIGURE 4 Lesions observed on hybrid larch (*Larix eurolepis*) three months after inoculation with *Phytophthora pluvialis*

(McLay et al., 2023). This is the first report of *P. pluvialis* on Japanese larch causing cankers and the pathogenicity tests have shown that other larch species are potentially hosts of *P. pluvialis*. Larch is already threatened by *P. ramorum* in the UK, therefore, more research is needed to understand the possible impact of *P. pluvialis* and other *Phytophthora* species on this host.

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