First record of *Phytophthora fallax* in Australia

James H. Cunnington^{A,C}, Ian W. Smith^B, Srikanthi de Alwis^A, Rodney H. Jones^A
and Gisele Irvine^A

^ADepartment of Primary Industries, Knoxfield Centre, Private Bag 15, Ferntree Gully Delivery Centre, Victoria 3156, Australia.

^BDepartment of Forest and Ecosystem Science, University of Melbourne, 500 Yarra Boulevard, Richmond, Victoria 3121, Australia.

^CCorresponding author. Email: james.cunnington@dpi.vic.gov.au

Abstract. The eucalypt pathogen, *Phytophthora fallax*, is reported for the first time in Australia. In June 2006 *P. fallax* was isolated from soil in Kinglake State Park, Victoria. Attempts to reisolate the pathogen from soil and eucalypts in the area were unsuccessful. The pathogen was isolated again in May 2007 from soil collected in the Mornington Shire, Victoria. In October 2007 *P. fallax* was baited from a rainwater gauge in Powelltown, Victoria. None of the findings were associated with eucalypt disease.

Phytophthora fallax is a recently described pathogen of *Eucalyptus* previously known only in New Zealand where it causes crown dieback of *E. delegatensis*, *E. fastigata*, *E. nitens* and *E. regnans* (Dick *et al.* 2006). The origin of the pathogen is unknown; however, as there are no native *Eucalyptus* species in New Zealand, it was postulated that it may exist in Australia (Dick *et al.* 2006).

In June 2006 several soil samples from a wet sclerophyll, mixed eucalypt forest in the Kinglake State Park in Victoria were sent to Department of Primary Industries (DPI) Victoria, Crop Health Services (CHS), for *Phytophthora* testing. Soil samples were baited using pears. An unusually slow-growing *Phytophthora* species was isolated from one of the samples. To identify it, the recombinant DNA (rDNA) internal transcribed spacer (ITS) region was amplified and sequenced using primers ITS5 and ITS4 (White *et al.* 1990). The sequence was lodged on GenBank as accession no. HM777513. It was found to be identical (or differing by 1 base) to that of the *P. fallax* sequences, including that from the type specimen (GenBank accessions no. DQ297391–8). Unfortunately the culture died before it could be put in long-term storage and no morphological or cultural work could be done and attempts to reisolate the pathogen failed. It could not be isolated from numerous soil samples taken from the area in October 2006 using pear or eucalyptus cotyledon baiting, although *P. cinnamomi* was isolated from several soil samples in this case. Nor could it be isolated from spots on the foliage of surrounding eucalypts. None of the eucalypts had the typical crown dieback symptoms of infected trees in New Zealand.

In May 2007, *P. fallax* was again isolated, this time from pear-baited soil collected in a native dry sclerophyll forest near Rosebud, in the Mornington Shire of Victoria. Sequence data for this isolate has been deposited in GenBank as accession no. HM777514. The sequence was identical to the earlier isolate. The pathogen was grown on carrot agar (CA) at 20°C in the dark.

The growth rate was only 1.2 mm per day; considerably slower than the 3.7 mm per day reported by Dick *et al.* (2006). Sporangia were produced after 2 days at room temperature by floating blocks of the 7-day CA culture in pond water. Oogonia were in the CA blocks after a further 3 days. The antheridia were paragynous, but in contrast to those seen by Dick *et al.* (2006), they were generally located away from the oogonial stalk and there was not any noticeable coiling of hyphae below the oogonia stalk. Other morphological characters generally agreed with those given by Dick *et al.* (2006), who noted that *P. fallax* did not produce any particularly distinct morphological features. The culture was deposited in the DPI Victoria Plant Pathology Herbarium accession no. VPRI 41222. Duplicate cultures were sent to Herbarium DAR and the World *Phytophthora* Collection at the University of California, Riverside, US. Again there was no associated eucalypt disease at the Mornington site.

In October 2007, *P. fallax* was isolated from *E. sieberi* cotyledons placed as baits in a rain-gauge in a 1939 cool temperate wet sclerophyll *E. regnans* forest near Powelltown Victoria. The rain-gauge baiting formed part of a pilot study on techniques for forest health monitoring being established by the Department of Sustainability and Environment. The technique was developed to assess the presence of airborne *Phytophthora* species. In this case it could not be isolated from the soil or from any of the other seven sites established throughout the Powelltown region. It was surprising that *P. fallax* was isolated from baits in a rain gauge when its sporangia are non-caducous (do not dehisce), as most airborne *Phytophthora* species are caducous. Again no significant disease symptoms were noted on the eucalypts, although adequate sampling of 65 m high trees was challenging. This culture has been deposited as VPRI 41245. A rDNA ITS sequence was obtained and has been placed on GenBank as accession no. HM777515. This sequence differed by three bases from the other two isolates.

Given that all sites are areas of native vegetation, and that they are 75–120 km apart, it seems likely that these are not simultaneous incursions, but that either the pathogen has been present for some time in Australia, or that it may be native to these areas. Dick *et al.* (2006) suggested that *P. fallax* could be native to Australia, but exists here in an ‘obscure equilibrium with hosts and environment’ without causing notable disease. Although only three Australian collections have been made, these three had more rDNA ITS sequence variation than the five New Zealand isolates. Greater genetic variation can be expected in the natural range of a species, than in an area where it has been recently introduced. To date, no isolation has been made from diseased plants. Further host testing is required to determine if the pathogen is restricted to eucalypts and therefore possibly native to Australia.

Phytophthora fallax may have escaped detection in the past because it is a relatively slow-growing *Phytophthora* that is easily masked in culture by *P. cinnamomi* when both are present on a bait. Its lower optimum temperature and inhibition at

temperatures of 27°C and above may be another reason why subsequent sampling failed to isolate the pathogen. Most routine soil sampling for *Phytophthora* species is undertaken during the warmer months of the year. In New Zealand the pathogen has not been isolated from soil, only from leaves (Dick *et al.* 2006). *Phytophthora fallax* may turn out to be widespread in south-eastern Australia.

References

- Dick MA, Dobbie K, Cooke DEL, Brasier CM (2006) *Phytophthora captiosa* sp. nov. and *P. fallax* sp. nov. causing crown dieback of *Eucalyptus* in New Zealand. *Mycological Research* **110**, 393–404. doi:[10.1016/j.mycres.2006.01.008](https://doi.org/10.1016/j.mycres.2006.01.008)
- White TJ, Bruns TD, Lee S, Taylor JW (1990) Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. In ‘PCR Protocols: a guide to methods and applications’. (Eds MA Innis, DH Gelfand, JJ Sninsky and TJ White) pp. 315–322.

Manuscript received 21 December 2009, accepted 18 August 2010