ABSTRACT

The introduced soil-borne plant pathogen *Phytophthora cinnamomi* Rands causes the death of jarrah (*Eucalyptus marginata* Donn ex Sm.) and associated understorey species throughout the jarrah forest of south-west Western Australia. In comparison to other infested forests in Australia, it has been difficult to isolate this pathogen from upland sites. Two aspects of survival of *P. cinnamomi* on upland sites in the northern jarrah forest were examined, firstly, the survival of chlamydospores in surface soils, and secondly, the survival of *P. cinnamomi* in a common susceptible understorey species, *Banksia grandis* Willd.

Chlamydospores of *P. cinnamomi* were recovered from a lowland water gaining site, but not from an adjacent upland freely draining site at Deer Road, although there was dying vegetation on both sites. Soil moisture contents were significantly higher on the lowland site than on the upland site (*P<0.001*), and remained high over summer in the former but not in the latter. Axenically produced chlamydospores did not survive in field plots when soil moisture contents decreased below 6.25% or -101 kPa on an uninfested upland site at North-east Road (*P<0.001*). When soil moisture contents were higher, that is, during winter and early spring, chlamydospores could be recovered for up to 24 weeks. A similar pattern of survival was observed when axenically produced chlamydospores were placed into soil from the North-east Road site and maintained at four different matric potentials in the laboratory. Germination of chlamydospores and the number of chlamydospores with intact cytoplasm were significantly affected by soil moisture (*P<0.001*). These results confirmed that chlamydospores did not survive on upland jarrah forest sites when soils became dry over summer.

Stems and large roots from eight *B. grandis* trees on an upland site were excavated from an active front of dying vegetation at the end of summer. *P. cinnamomi* was recovered from the large roots and stems from four of the dead trees, but not from two healthy trees, two decayed trees or from soil. When two other trees from different upland sites were intensively sampled, *P. cinnamomi* was recovered to 40 cm below ground level in the tap and large roots and to 20 cm above ground level in the stems. When inoculated
B. grandis root sections were buried (6 cm depth) in field plots on the uninfested upland pure jarrah stand site, recovery of \textit{P. cinnamomi} decreased after 16 weeks with the onset of summer. During summer, recovery of the pathogen was very low to nil, but increased again in autumn as rainfall increased. Recovery of \textit{P. cinnamomi} from the root sections was significantly affected by soil moisture, soil temperature and rainfall (P<0.001). In glasshouse trials, \textit{P. cinnamomi} was recovered within seven days from previously uninfested upland soil which had been placed around naturally infected \textit{B. grandis} stem bases. These results confirmed that infected \textit{B. grandis} acts as both a reservoir, and a source of inoculum for \textit{P. cinnamomi}.

The management and ecological implications for the northern jarrah forest and the control of \textit{P. cinnamomi} are briefly discussed.