PHYTOPHTHORA CRYPTOGEA IN PINE FORESTS IN SOUTH AUSTRALIA

by

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STATEMENT

This dissertation has not previously been submitted for a degree at this or any other University and is the original work of the writer, except where due reference is made in the text.

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SUMMARY

Decline and death of pine trees has frequently been observed in South Australian forest plantations. In the Adelaide hills forest reserves this disorder is often associated with sites which are subject to waterlogging in winter and drying out in summer. As the fungus *Phytophthora cryptogea* is associated with a number of decline sites its role in the decline of pines, mainly *Pinus radiata*, was investigated. In addition, factors likely to influence the susceptibility of *P. radiata* to *Ph. cryptogea* were also studied.

Field studies, mainly in the Kuitpo forest, showed that *Ph. cryptogea* was associated with healthy as well as with diseased *P. radiata*. The horizontal distribution of the fungus in a plantation, and in a cleared area was patchy, suggesting that in soil it may be associated with discrete niches probably in association with plant roots or as free-living chlamydospores. The population density of *Ph. cryptogea* was higher within the root zone of a *P. radiata* than in an area away from it.

In a field experiment with *P. radiata* and *P. pinaster* over 56% of the planted pines died during an abnormally wet winter. The experiment indicated that *P. radiata* is susceptible to *Ph. cryptogea* while *P. pinaster* is not. However, *P. pinaster* appeared to be more susceptible to waterlogging than *P. radiata*. When the experiment was repeated two years later, only about 9% of the planted young trees died, presumably because of much drier soil conditions.

In the glasshouse *Ph. cryptogea, Ph. cinnamomi, Pythium anandrum* and *P. irregulare* were pathogenic to *Pinus radiata* planted in sterilized

potting soil. Glasshouse tests also showed that waterlogging and transplanting render young *P. radiata* more susceptible to pythiaceous fungi. Transplanted young *P. radiata* were also more susceptible to waterlogging in the absence of pathogenic fungi. Deficiency of nitrogen and phosphorus in soil markedly affected growth of *P. radiata* in pot tests. *Ph. cryptogea* did not influence the growth of such deficient plants but did significantly retard the growth of young pines supplied with complete nutrient solution, and with a solution low in potassium. Although resistance of mycorrhizal pines to *Ph. cryptogea* was not demonstrated in this study, young *P. radiata* inoculated with the mycorrhizal fungus *Rhizopogon luteolus* appeared more healthy than non-mycorrhizal plants when grown in soil inoculated with *Ph. cryptogea*.

In laboratory tests *Ph. cryptogea* formed chlamydospores in roots of pines in soil; and, under the conditions used, the fungus colonized dead organic matter in soil. Production of sporangia by *Ph. cryptogea* was influenced by the temperature to which mycelium of the fungus had been pre-exposed, and the depth of water above the mycelium. Encysted zoospores of the fungus survived in Kuitpo forest soil for 14 days while germ tubes were lysed in 4 to 6 days. Zoospores of *Ph. cryptogea* were not strongly attracted to roots of *P. radiata*, and they did not accumulate in the area immediately behind the root tips. When young *P. radiata* were grown in sand inoculated with *Ph. cryptogea*, infection of roots was not confined to root tips.

It was concluded that *Phytophthora cryptogea* is a weak pathogen of *Pinus radiata* unless other factors detrimental to the trees are also present.

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