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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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TABLE OF CONTENTS

	Page
SUMMARY	i
ACKNOWLEDGEMENTS	iii
I. INTRODUCTION	1
II. MATERIALS AND METHODS	8
(1) Isolation of <i>Phytophthora</i> from soil and roots	8
(2) The identification of <i>Phytophthora</i> species	10
III. THE PYTHIACEOUS FUNGI INVOLVED IN THE STUDY	11
IV. DESCRIPTION OF THE FOREST AREAS	15
V. FIELD EXPERIMENTS	17
(1) Isolation of <i>Phytophthora cryptogea</i> from healthy trees	17
(2) Presence of <i>Phytophthora cryptogea</i> in roots of two trees of different vigour	21
(3) Horizontal distribution of <i>Phytophthora cryptogea</i> in soil	21
(4) Population density of <i>Phytophthora cryptogea</i> in two areas	24
(5) Attempted isolation of <i>Phytophthora cryptogea</i> from various soil fractions	27
(6) Isolation of <i>Phytophthora cryptogea</i> from other plant species	30
(7) Discussion	30
VI. REPLANTING A DECLINE SITE IN THE FOREST	38
(1) Experimental	38
(2) Discussion	49
VII. SOME FACTORS AFFECTING GROWTH OF PINES IN GLASSHOUSE EXPERIMENTS	54
(1) Pathogenicity of some pythiaceous fungi to <i>Pinus radiata</i>	54
(2) Effect of waterlogging on growth of young <i>Pinus radiata</i>	55
(3) Effect of two temperatures and four soil moisture levels on young pines in field soil	63

	Page
(4) The effect of transplanting on the susceptibility of <i>Pinus radiata</i> to <i>Phytophthora cryptogea</i>	69
(5) Nutrient deficiency and susceptibility of <i>Pinus radiata</i> to <i>Phytophthora cryptogea</i>	71
(6) Mycorrhizas and susceptibility of <i>Pinus radiata</i> to <i>Phytophthora cryptogea</i>	76
(7) Discussion	80
VIII. LABORATORY EXPERIMENTS	85
(1) Behaviour of <i>Phytophthora cryptogea</i> in colonized roots	86
(2) Competitive saprophytic colonization of dead pine roots by <i>Phytophthora cryptogea</i>	90
(3) Effect of temperature on subsequent production of sporangia by <i>Phytophthora cryptogea</i> under sterile and non-sterile conditions	94
(4) Effect of depth of soil extract on production of sporangia by <i>Phytophthora cryptogea</i>	99
(5) Survival of zoospores and germ tubes of <i>Phytophthora cryptogea</i> in soil	102
(6) Attraction of zoospores of <i>Phytophthora cryptogea</i> to roots of <i>Pinus radiata</i>	103
(7) Infection of <i>Pinus radiata</i> by <i>Phytophthora cryptogea</i>	105
(8) Discussion	108
IX. GENERAL DISCUSSION	111
X. APPENDICES	113
Appendix 1	114
Appendix 2	116
XI. BIBLIOGRAPHY	117

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 pythiaceus 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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