PROGRESS REPORT FOR

INTERIM FOUNDATION FOR DIEBACK RESEARCH

PROJECT: JARRAH ROOT BEHAVIOUR AND HEALTH

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CONTENTS

Experiment 342: Infection and survival of *Phytophthora cinnamomi* in jarrah roots*

Abstract

A field trial was established in the jarrah forest near Dwellingup to provide information on: (1) the components of the surface root system of jarrah which can be invaded by *Phytophthora cinnamomi* following a zoospore drench, (2) the survival of the fungus in the soil and jarrah roots, (3) the distribution and spread of the fungus in jarrah roots, and (4) the effects of the pathogen on surface fine root maintenance and development.

Preliminary data is provided for the period October 1979 - April 1980. Inoculation during spring flush of root growth led to significant infection of surface root pads primarily by entry via fine roots. Evidence suggests that infection of larger roots (3-4mm) occurs both via infection of the fine root clusters as well as via new lateral roots initiated from the large roots. As soil moisture levels dropped *P. cinnamomi* could no longer be isolated from the soil in contrast to the continued survival of the fungus in jarrah roots. The pathogen invades extraxylary tissues and spread within large roots up to 4mm in diameter was extensive in some roots and restricted in others. It is hypothesized that *P. cinnamomi* can have very destructive effects on the surface fine feeder root system of jarrah by attacking the framework to which the short feeder roots are attached.

Introduction

Phytophthora cinnamomi is widespread throughout the jarrah forest and is frequently isolated from understorey species. However, despite considerable death of jarrah (*Eucalyptus marginata*) the pathogen has been only isolated occasionally from this species. Little is known about the infection of jarrah roots by *Phytophthora cinnamomi* or about the survival of the pathogen in jarrah roots. This trial was therefore established to provide data on the infection and survival of the pathogen in jarrah roots in the field.

Methods

A nearly pure jarrah stand near Dwellingup, W.A., was selected. One hundred root pads were marked out with metal rings 25cm in diameter into two adjacent plots each with 50 rings. Each pad was inoculated (24 October 1979) with 200ml of encysted zoospore suspension (20ml suspension plus 180ml of 2% soil extract) giving approximately 10^6 zoospores $490cm^{-2}$ (area of each sub-plot). Percentage of germination of encysted zoospores in the 2% soil extract was 90% after 18h incubation at 20°C. Control sub-plots were given 200ml of 2% soil extract.

Experiment 342 contd

Five sub-plots were harvested from control and infected plots at intervals after inoculation. Six cores (each 15.7cm^3) from each sub-plot were taken and 4 used for soil plating and 2 for determining root numbers, root length. The pads were then brought back to the laboratory, washed free of soil, surface sterilized (70% E+OH, 1 min.) and plated out on PVPH isolation agar (Pimaricin 2½% suspension 0.4ml; Vancomycin 200mg; PCNB 100mg; Hymexazol 50ml; CMA 17g; DI H_2O 1000ml).

* Progress report presented at May 1980 Perth meeting of Australian Society of Plant Pathologists, with Dr S.R. Shea and Dr B.L. Shearer, Forests Department Research Station, Dwellingup.

M791: Morphology, anatomy and periodicity of growth of surface jarrah roots.

Introduction

Apart from a brief report by Shea and Dell (in press) there is no available information on the periodicity of growth of the surface feeder roots of *Eucalyptus marginata*. This project was initiated in July 1979 to attempt to establish the timing of new root growth. At the same time the structure of the various roots were investigated to provide background information relevant to studies on the infection process.

Methods

A series of quadrats were established in a pure jarrah stand near Dwellingup. Root samples collected every 2 to 3 weeks by Forests' Department were forwarded to Murdoch University and stored at 4°C. Soil was carefully washed from the roots and the numbers of new roots estimated for a series of root classes.

Discussion

Except for a short period in mid winter new non-mycorrhizal surface jarrah roots were produced throughout the year following adequate precipitation. There was considerable root growth in spring and autumn when soil temperature and soil moisture levels remained high. The reduction in root growth during winter can be related to low soil temperatures.

Experiment M801:

Aim: To determine if altering soil chemical properties will alter the infection of jarrah roots by *Phytophthora cinnamomi*.

Materials and Methods

A pot experiment was set up (May 1980) as follows:

(i) Soils - Three susceptible laterites and one resistant loam were collected from the jarrah forest.

(ii) Treatments - A factorial combination (2 x 2 x 2) of ± lime, ± macronutrients, ± micronutrients was set up for each soil. A second set of treatments will test if any effect of lime on *P. cinnamomi* suppression is due to the presence of calcium or by a change in soil pH.

After the jarrah seedlings had become established, the soils were inoculated with *Banksia grandis* plugs infected with *P. cinnamomi*.

(iii) Analysis - Root rot development, root infection and plant death will be measured and related to treatment.

Joint Research Project: SUSCEPTIBILITY OF JARRAH ROOTS TO INFECTION BY PHYTOPHTHORA CINNAMOMI

A. Participants

(i) CSIRO
Dr N. Malajczuk
Mr L. Sanfelieu

(ii) Murdoch University
Dr B. Dell
Mr I. Wallace

B. Project Aims:

The susceptibility to infection and subsequent spread by Phytophthora cinnamomi in mycorrhizal and fine feeder non-mycorrhizal roots of jarrah will be investigated in the glasshouse and in the forest. Microdroplets of motile zoospores will be applied to individual roots, following which, germination, penetration of roots and spread within roots will be monitored.

C. Outline of Project:

(i) Preliminary Trial - inoculum produced by CSIRO will be applied (June) to established plants in the glasshouse and the time course of germination and infection established.

(ii) Main Glasshouse Experiment - jarrah seedlings will be established in the following soils, 20 replicates each.

a) Amphion

b) Conducive soil 1 yr since last burnt

c) " " 5 yr " " "

d) " " 10-15yr " " "

e) Murray R. loam + conducive soil.

Plants will be grown at 17°C for 3 months before transferring to c. 11°C, 17°C, c. 21°C.

Roots will be inoculated with zoospores as above about September.

(iii) Field Trial - results obtained from above experiment will be tested in the field (September to October) by carrying out single root inoculations. Murdoch University has a preliminary trial running which will provide information on problems likely to be encountered.

D. Publications - it is envisaged that CSIRO will take major authorship for publications resulting from the glasshouse experiment and Murdoch University major authorship as a result of field investigations.

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School of Environmental and Life Sciences

FORESTS DEPARTMENT
25 SEP 1980
PERTH, W.A.

Mr B. Beggs
Chairman
Dieback Research Fund Management Committee
Forests Department
54 Barrack Street
PERTH 6000

Dear Mr Beggs,

Please find attached my 1979-80 progress report on "Jarrah Root Behaviour and Health" project which is funded by the Dieback Research Fund.

Yours sincerely

B. Dell

B. DELL

22 September 1980

Encls

FILED
By

26.9.80

A.CONSERVATOR

Mr Hammond 15/10

Dr McKinnell

XHOX

Mr Havel 22/10 Excellent report with reference to Dr. Davidson proposals as abstract