# AEROPONIC CHAMBERS FOR INVESTIGATING THE INFLUENCE OF LOW OXYGEN LEVELS ON INFECTION DEVELOPMENT IN ROOTS OF *EUCALYPTUS MARGINATA* INFECTED WITH *PHYTOPHTHORA CINNAMOMI.*

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## INTRODUCTION

*P. cinnamomi* is a major pathogen of *E. marginata* (jarrah) in Western Australia (1). It can kill trees of all ages through infection of roots (2) or by girdling the trunks of 1-7 yr old trees in situations where the collar is ponded (3). Field observations have indicated that periods of waterlogging (low oxygen) can result in the rapid death of trees from *P. cinnamomi* (4). Flooded soils are assumed to increase disease severity by increasing the mobility of zoospores and by adversely affecting host physiology resulting in pre-disposition to disease or poor regeneration of damaged roots (5).

Soil-based studies do not allow precise control of soil oxygen levels or observation of the effect of low oxygen on root development and subsequent infection development. Thus, an aeroponic system was designed to evaluate the influence of low oxygen on disease development in clonal *E. marginata* infected with *P. cinnamomi.*

## MATERIALS AND METHODS

Seven-month old clones of *E. marginata* were transferred into aeroponic chambers and liquid feed was delivered in a fine spray, providing optimal conditions for root growth. Roots grew for 6 weeks before they were exposed to hypoxia (2 mg $O_2$ $l^{-1}$) for 6 days or anoxia (<0.05 mg $O_2$ $l^{-1}$) for 6 hours. Root tips were generally inoculated with zoospores of *P. cinnamomi*, and harvested 3 days later. Roots inoculated before the 6 day hypoxic treatment and harvested at the end of the treatment.

## RESULTS

Lesions on roots inoculated after anoxia were greater than the controls (Figure 1A, B). Lesions on roots inoculated before hypoxia were not significantly different to the controls (Figure 1A, C). When roots were inoculated immediately or 3 days after hypoxia, lesions were reduced, whilst roots inoculated 6 days after hypoxia developed lesions similar to the controls (Figure 1A, D-F).

Root growth was reduced by hypoxia and ceased after anoxia. The reduction in root growth and lesion development in roots after hypoxia was consistent when the experiment was repeated (Table 1).

**Table 1.** Reduction in root extension during, and lesion length immediately after a 6 days of hypoxic treatment for *E. marginata* clone 1JN20.

| Experiment (date) | % reduction root growtn | % reduction lesion length |
|---|---|---|
| Dec 1995 | 32.2 | 37.2 |
| Apr 1996 | 33.3 | 31.8 |
| June 1996 | 27.6 | 33.4 |
| Sept 1996 | 27.2 | 34.8 |
| Nov 1996 | 25.2 | 32.5 |

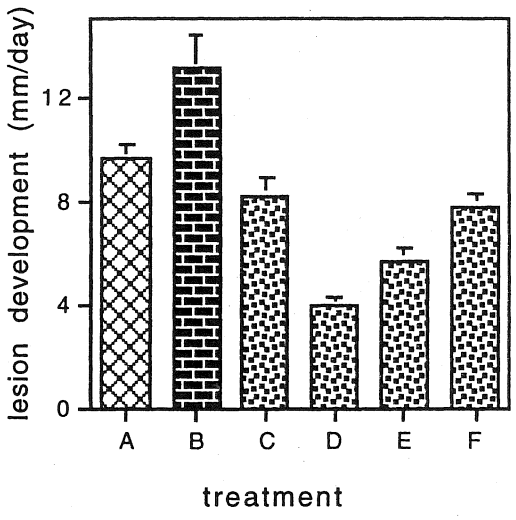


**Figure 1.** Lesion development in roots inoculated (**A**) under normal oxygen conditions, (**B** after 6 hours of anoxia, (**C**) before 6 days of hypoxia and (**D**) 0, (**E**) 3 or (**F**) 6 days after hypoxia.

## CONCLUSION

A simple and reproducible system has been designed for studying the influence of one aspect of the root environment (hypoxia) on disease development. Root extension was reduced during hypoxia and lesion development was reduced after hypoxia. There is the potential to study other factors that effect root growth such as temperature, nutrient and salt levels or fungicide and herbicide translocation while simultaneously altering the gaseous environment.

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