SELECTING PLANTS RESISTANT TO *PHYTOPHTHORA CINNAMOMI*

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INTRODUCTION

Phytophthora cinnamomi is the most devastating forest disease world wide. It is mostly an introduced pathogen as in southern Australia where it devastates native forests, woodlands and heaths, directly and indirectly affecting vegetation types from a wide range of families. *P. cinnamomi* has also been introduced into European and North American hardwood and softwood forests. The pathogen is now cosmopolitan in the horticultural industry and it is a particular problem in nurseries. The significance of this is that *P. cinnamomi* has the opportunity to interact with and the potential to evolve in association with a wide range of new hosts and in a wide range of ecosystems. Distribution of the pathogen at the local, national and international level is of concern to the management of forest, native vegetation and horticulture industries.

Selecting, breeding and deploying resistant plants, including Australian native species, is one avenue for controlling the effects of the pathogen and rehabilitating natural ecosystems prone to the disease. *P. cinnamomi* is an introduced in southern Australia but it may be indigenous in some regions of the north east. In the south, disease resistance in native vegetation involves non-coevolved host-pathogen associations and resistance is most probably due to general and not host-specific genetic resistance factors. In southern Australian plant communities there are wide differences in field resistance among species of some genera and increasing evidence for variable resistance within some species.

P. cinnamomi is a highly variable pathogen worldwide. In Australia, isolates vary considerably in pathogenicity, physiological and morphological phenotypes (1, 2,). Genetic variation within isoenzyme groups has now been shown unequivocally (3, 4). Recent evidence has increased for major interactions among three components: pathogenicity, host resistance and environmental factors. Host-*P. cinnamomi* interactions occur at several levels.

Resistance, expressed at the sub-species level is being evaluated in breeding programmes for valuable forest and horticultural species.

Environmental factors interact with host resistance and *P. cinnamomi* capacity to cause disease (Figure 1).

Disease control in long-lived woody plants is a long term venture. Programmes selecting and breeding for disease resistance in Australian native forest, woodland, heath and woody horticultural species are challenged by the need to develop 'long-term' resistance.

METHODS

We have developed a factorial approach to disease resistance screening for woody vegetation incorporating a set of isolates differing in pathogenicity host age factors, host tissue water content and temperature, with each factor being selected because it induces distinct host-resistance responses. Screening also includes pathogen detection as lack of lesion development may merely be masking pathogen colonisation. Subsequent lesion development may proceed if environmental conditions change.

RESULTS AND DISCUSSION

A significant feature of disease expression due to *P. cinnamomi* is the change in association with a range of site, soil and seasonal environmental factors (5, 6). Variation in temperature and moisture, independently and synergistically, affect all aspects of the pathogen life cycle and they host-pathogen disease cycle. Importantly for disease interpretation, lesion development is changed by temperature and moisture.

Our recent research results are consistent with the view that screening for disease resistance to *P. cinnamomi* may have increased long-term outcomes if it takes account of host, pathogen and environmental factors which change disease expression.

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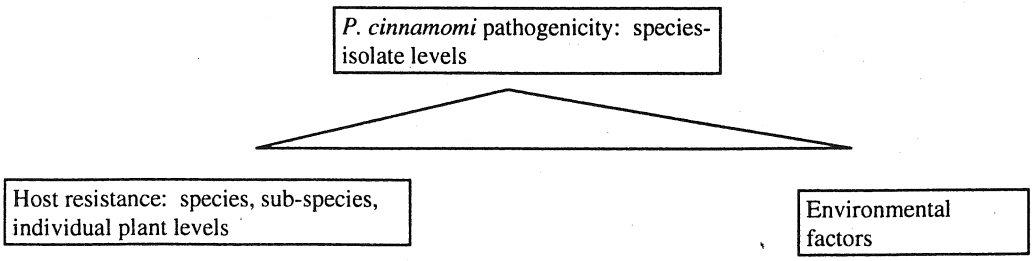

Figure 1. Plant-*P. cinnamomi* interactions occur at the levels of host plant species, sub-species or individual plants and respectively, *P. cinnamomi* species or individual isolates. Interaction levels involving *P. cinnamomi* sub-species groups have yet to be identified.