

# Does Abiotic Stress on a Plant Influence Phosphite Protection to *Phytophthora cinnamomi*?<sup>1</sup>

Daniel Hüberli,<sup>2</sup> Trudy Paap,<sup>2</sup> Nicole A. Moore,<sup>2,3</sup> Karyn Gower,<sup>2</sup>  
Nathalie Long,<sup>2,4</sup> Sarah Barrett,<sup>3</sup> Greg Freebury,<sup>3</sup> Ted Spadek,<sup>5</sup>  
Bernard Dell,<sup>2</sup> and Giles E.St.J. Hardy<sup>2</sup>

## Introduction

Large areas of indigenous forests, *Banksia* woodlands and heathlands in Australia are devastated by Phytophthora dieback disease caused by *Phytophthora cinnamomi* (Weste 1994). In southwestern Australia, some 50 percent of the 5710 plants endemic to the region are susceptible (Shearer and others 2004a). Phosphite has been shown to be effective in controlling this pathogen's impact on a wide range of plant species across different families (Hardy and others 2001).

Recently, disease extension was reduced after phosphite treatment even after fire (Shearer and others 2004b). However, very little is known about the influence of a plant's physiological status at the time of phosphite application on the subsequent efficacy of phosphite treatment to control Phytophthora dieback disease. The key seasonal stresses in an Australian ecosystem of fire and flooding are explored.

## Materials and Methods

*Adenanthos cuneatus* (resprouter), *Banksia attenuata* (resprouter) and *B. baueri* (reseeder) are all susceptible to *P. cinnamomi* and are responsive to phosphite treatment. These species were selected within four plots in an area of the Stirling Range National Park (Western Australia) that was scheduled for a fuel-reduction burn. Treatments of the plots were: 1) phosphite spray without fire, 2) phosphite spray with fire, 3) no phosphite spray without fire, and 4) no phosphite spray with fire. Phosphite treatment was applied six weeks before the fire or nine months post-fire when all resprouter species had sufficient foliage. Periodic measurements during the experiment include leaf water potential, leaf gas exchange, lesion lengths on inoculated stems, and phosphite concentration in leaves, stems, lignotubers and roots.

---

<sup>1</sup> A version of this paper was presented at the Fourth Meeting of IUFRO Working Party S07.02.09, Phytophthoras in Forests and Natural Ecosystems, August 26-31, 2007, Monterey, California.

<sup>2</sup> Centre for Phytophthora Science and Management, Biological Sciences, Murdoch University, Murdoch, WA 6150, Australia.

<sup>3</sup> Nature Conservation Section, Department of Environment & Conservation, 120 Albany Highway, Albany, WA 6330, Australia.

<sup>4</sup> Université des sciences Montpellier II, Place Eugène Bataillon, 34 095 Montpellier Cedex 5, France.

<sup>5</sup> Chemistry Centre (Western Australia), 125 Hay Street, East Perth, WA 6004, Australia.

Corresponding author: D.Huberli@murdoch.edu.au.

Waterlogging trials were conducted in the greenhouse using *B. attenuata* and *B. baxteri* (reseeded). The response of these plants and subsequent recovery from waterlogging was examined. In the main trial, a phosphite spray treatment was applied before (Experiment 1) and after (Experiment 2) one waterlogging event of either 3 or 10 days (8 days for Experiment 2) duration. Plant physiology traits, lesion development and phosphite concentrations in leaf, stem and root were taken 1 week, 1 month and 4 months after the phosphite treatment.

## Results and Discussion

Preliminary data for the fire experiment show that phosphite was present in the roots in the pre- and post-fire spray treatments. These data also suggest that lesions were reduced in all three species treated with phosphite. Further work is ongoing in this experiment.

For the waterlogging experiments, phosphite in plant tissue was at similar levels for each species and was not affected by waterlogging in Experiment 1, Week 1 harvest (fig 1), but lesions on *B. baxteri* stems were not reduced in treated plants as they were for *B. attenuata*. Photosynthesis and water potentials were reduced for waterlogged *B. attenuata* especially at the ten day waterlogging treatment, but were not impacted in waterlogged *B. baxteri*. Leaf water potentials, leaf gas exchange, lesion lengths on inoculated stems, and phosphite concentration in leaves, stems, and roots measured at one and four months for Experiment 1 and all measurement periods for Experiment 2 will be presented in a future publication.

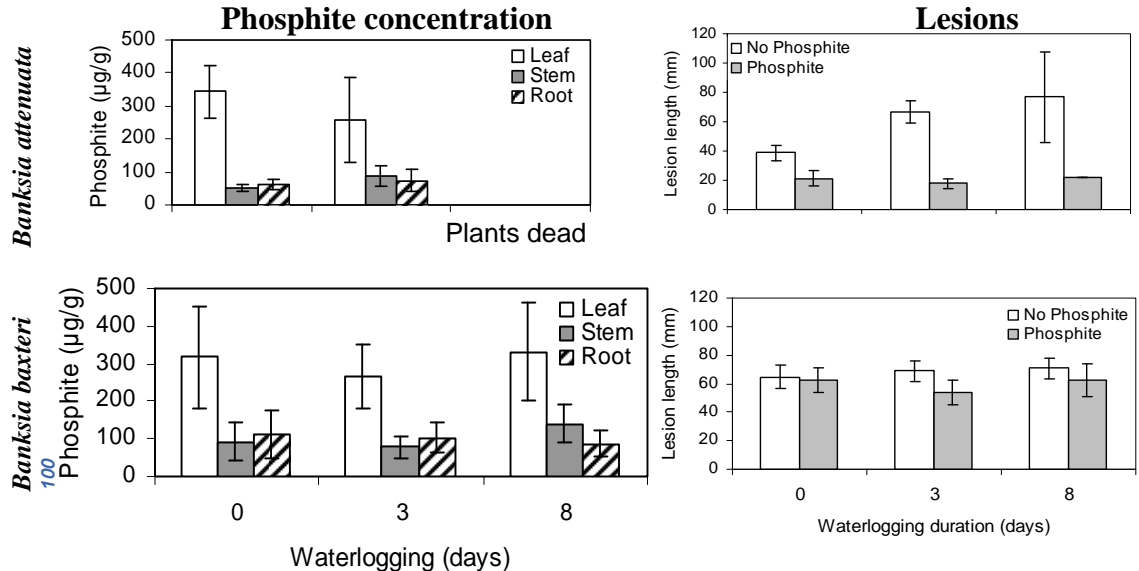


Figure 1—Mean ( $\pm$  standard error) phosphite concentrations in plant tissue and lesion lengths in stems 1 week after inoculation with *Phytophthora cinnamomi* of *Banksia attenuata* and *B. baxteri* seedlings that had been sprayed or not (controls) 1 week prior to the inoculation. Plants were treated with phosphite 1 week after waterlogging for 0, 3 and 10 days.

## Acknowledgements

We thank O. Fry, S. Jackson, T. Johnson, J. O'Brien, B. Palmer, G. Scott, and P. Scott for assistance in the field and laboratory. The project 19.2.3 was funded by the Department of Environment and Water.

## Literature Cited

- Hardy, G.E.St.J.; Barrett, S.; Shearer, B.L. 2001.** The future of phosphite as a fungicide to control the soilborne plant pathogen *Phytophthora cinnamomi* in natural ecosystems. *Australasian Plant Pathology*. 30: 133-139.
- Shearer, B.L.; Crane, C.E.; Cochrane, A. 2004a.** Quantification of the susceptibility of the native flora of the South-West Botanical Province, Western Australia, to *Phytophthora cinnamomi*. *Australian Journal of Botany*. 52: 435-443.
- Shearer, B.L.; Crane, C.E.; Fairman, R.G. 2004b.** Phosphite reduces disease extension of a *Phytophthora cinnamomi* front in *Banksia* woodland, even after fire. *Australasian Plant Pathology*. 33: 249-254.
- Weste, G. 1994.** Impact of *Phytophthora* species on native vegetation of Australia and Papua New Guinea. *Australasian Plant Pathology*. 23: 190-209.