THE EFFECT OF THE FUNGICIDE PHOSPHITE ON POLLEN GERMINATION AND FERTILITY.

M.M. Fairbanks, G.E. St J. Hardy and J.A. McComb
Division of Science, Biological Science, Murdoch University, Murdoch, Western Australia, 6150

INTRODUCTION

The fungicide phosphite (previously known as phosphonate) is a cheap and effective means of controlling *Phytophthora cinnamomi* Rands (the fungus that causes jarrah dieback) (1,2).

To date, studies have focused on the effect and mechanism of action of phosphite on *P. cinnamomi* and its effects on agricultural species and native Western Australian plants which are under threat from *P.cinnamomi*. The fungicide appears to have minimal phytotoxic effects on the vegetative parts of the plant (3). The phytotoxic effects of phosphite on flowers and reproduction has not been studied in detail.

MATERIALS AND METHODS

Pollen germination and pollen tube length was assessed using pollen grown on pollen germination media containing phosphite. We also used pollen from plants sprayed with different concentrations of phosphite and grew this *in vitro* on germination medium without phosphite. The pollen germination media contained Boric acid (100mg/L), Calcium chloride dihydrate (300mg/L) and 20% sucrose (4).

Pollen fertility was determined by removing pollen from sprayed plants and mounting it in fluorescein diacetate. (5).

Preliminary studies on petunia and *Banksia media* plants were undertaken at Murdoch University. Species from the jarrah forest were then studied. Long term studies will utilise further species from the understorey of the jarrah forest and will also include assessment of the effect of phosphite on nectar production, fruit / seed set, seed germination and seedling abnormalities.

RESULTS

Petunia pollen grown with 0.5% phosphite in the medium showed a reduction in pollen germination. When pollen was collected six days after petunia plants were sprayed to run off, pollen germination was reduced at 0.5% and pollen fertility at 1% phosphite. For *Banksia media* 0.5% phosphite in the medium reduced pollen germination. When pollen was collected four days after plants were sprayed, phosphite was found to reduce pollen germination at 0.25% and pollen fertility at 0.5%.

In the jarrah forest species studied, phosphite in pollen germination media reduced *Eucalyptus calophylla* (marri) pollen germination and tube length at 1%. *Dryandra sessilis* pollen germination was reduced by 0.25% phosphite when the phosphite was in the pollen germination medium. When pollen was removed 12 days after the plants had been sprayed 0.25% phosphite was found to have reduced both pollen germination and fertility (Table 1). For *Trymalium ledifolium* 0.25% phosphite was also found to reduce both pollen germination and fertility when pollen was collected 19 days after the plants were sprayed (Table 2).

Table 1. Pollen germination and fertility of *Dryandra sessilis* with phosphite included in the germination medium (column 1) or from plants sprayed with phosphite (column 2, 3). Values with the same letter are not significantly different (P = 0.05) according to Dunnetts test.

Phosphite %	Pollen Germ 1	Pollen Germ 2	Pollen Fert 3
0.0	26.1[a]	49.4[a]	80.6[a]
0.25	4.7[b]	22.2[b]	51.0[b]
0.5	1.0[b]	11.7[b]	41.7[b]
1.0	0.4[b]	8.5[b]	38.4[b]

Table 2. Pollen germination and fertility of *Trymalium ledifolium* plants sprayed with phosphite. Values with the same letter are not significantly different (P = 0.05) according to Dunnetts test.

Phosphite %	Pollen Germination	Pollen Fertility
0.0	24.5[a]	87.1[a]
0.25	7.8[b]	56.5[b]
0.5	4.1[b]	41.5[b]
1.0	0.3[b]	47.4[b]

DISCUSSION

Phosphite at concentrations at or below the operational level (1%) has a phytotoxic effect on plant reproduction as it significantly reduced pollen germination and fertility in the four species studied. It is not yet known whether this effect on pollen will influence seed production or germination.

REFERENCES

1. Guest, D. and Grant, B. (1991). The complex action of phosphonates as antifungal agents. *Biology Review* **66**, 159-87.
2. Coffey, M.D. and Bower, L.A. (1984). *In vitro* variability among isolates of eight *Phytophthora* species in response to phosphorous acid. *Phytopathology* **74**, 738-42.
3. Gillen, K. and Grant, M. (1997). Project 1 The control of Phytophthora in native plant communities. Part B Application of phosphonate on threatened flora populations in the Albany district. In: 'Final report to the threatened species and communities unit, biodiversity group environment Australia,' eds. Department of Conservation and Land Management, pp. 60-9.
4. Stanley, R.G. and Linskens, H.F. (1974). *Pollen: Biology Biochemistry Management*: pp. 67-89. (Springer-Verlag, Heidelberg).
5. Heslop-Harrison, J., Heslop-Harrison, Y. and Shivanna, K.R. (1984). The evaluation of pollen quality, and a further appraisal of the fluorochromatic (FCR) test procedure. *Theoretical and Applied Genetics* **67**, 367-75.