Forest Research

Steps towards integrated management of *Phytophthora kernoviae* and *P. ramorum* on magnolias in British heritage gardens

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Introduction

Phytophthora kernoviae (Pk) and *P. ramorum* (Pr) are newly invasive *Phytophthora* species in Britain causing disfigurement and death of ornamental plants and trees in nurseries, native woodlands and gardens (Figures 1 and 2). Many of the gardens have heritage value and house collections of rare and exotic plants (e.g. the 'National Magnolia Collection'). These serve as an important genetic resource but the gardens are also a significant source of tourist revenue. Some of the plant species that form the essential character of the gardens are primary foliar hosts for Pr and Pk and produce abundant inoculum when infected (e.g. rhododendrons, magnolia and pieris). Infected foliage of these showcase plants is not only disfiguring but may be subjected to plant health measures of removal and destruction. By preventing new leaf infections and controlling existing ones, inoculum production and spread to trees and other plants is reduced.

To find out if some of these valuable plants could be 'cured' of established infections, affected magnolias at two National Trust gardens were selected for study. Denman *et al*. (2008) demonstrated that Pk has bimodal peaks in disease expression (spring and autumn) and does not invade the xylem (See Fig. 3–2b). It overwinters in buds and leaf scars of magnolias (See Fig. 3–3bi) and sporulates on infected leaves, operating as a self-perpetuating disease system. The same is assumed true for Pr on magnolia. Chemical intervention could form part of an integrated disease management plan (see Fig. 3). This poster reports the result of a pilot study assessing the effectiveness of phosphonate to cure infected, deciduous magnolias.


Figure 1. Shoot tip dieback and leaf necrosis of *R ponticum*.


Figure 2. Bleeding stem lesions on *Fagus sylvatica*.

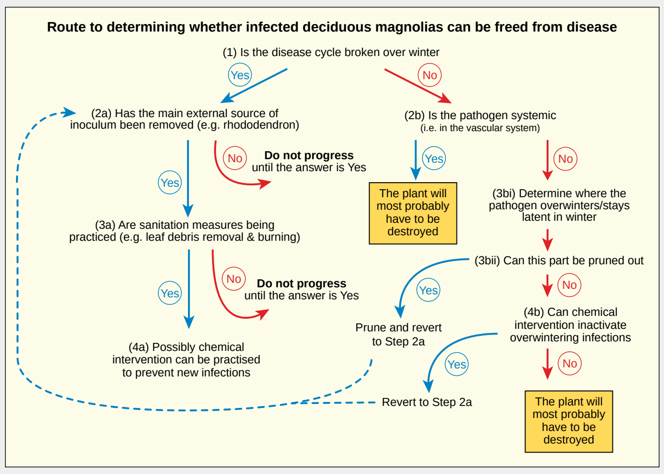

Figure 3.

Method

1. Six deciduous magnolias naturally infected with Pr were selected at site 1 (LAN) and three (one infected with Pk) at site 2 (TTN).
2. Phosphonate 20% a.i., 15 mL/m canopy diameter was applied before bud burst (6 April 2007). Control trees were not injected.
3. Evenly spaced holes were drilled around the girth of the tree stem to a depth of 30mm.
4. Spring-loaded syringes with the appropriate volume of phosphonate were pushed into the holes and the chemical solution was taken up into the xylem.
5. Levels of phosphonate in leaves were determined fortnightly for 10 weeks.
6. Leaves were tested three times in the growing season for infection.

Results

- Black ooze (phytotoxic response) exuded from all injection wounds (Fig. 4).
- Most wounds callused over by autumn; there was little external evidence of any previous bleeding (Fig. 5), although staining was visible in the wood a year after application (Fig. 6).
- Phosphonate was transported rapidly to the leaves but the concentration declined quite quickly over the growing season (Fig. 7).
- Most of the untreated control plants tested positive for Pr throughout the test period except in mid-summer (Table 1).
- Treated magnolias at LAN did not test positive for Pr except for highly susceptible *M x loebneri* 'Leonard Messel' which only became positive in autumn when phosphonate levels were low.
- Magnolias at TTN tested positive for Pr early in the season but phosphonate levels were low probably because the injection holes were not deep enough at this site (only15–20mm).


Figure 4. Stem bleeding phytotoxicity response.


Figure 5. Injection wound callused over.


Figure 6. Phytotoxicity staining in the wood.

Table 1. Presence of Pr or Pk on infected Magnolia leaves after stem injection with phosphonate.

Site	Tree number	Treatment	Leaves positive or negative for Pr or Pk Spring (May)	Summer (August)	Autumn (October)
1(LAN)	1	Injected[a]	×	×	✓
1(LAN)	2	Injected	×	×	×
1(LAN)	3	Injected	×	×	×
1(LAN)	4	Injected	×	×	×
1(LAN)	5	Control[b]	×	×	✓
1(LAN)	6	Control	✓	✓	✓
2(TTN)	7	Injected	✓	×	×
2 (TTN)	8	Injected	×	×	×
2 (TTN)	9	Control	✓	×	×

[a] Trees injected with Agris-FOS, 20% a.i., 15 mL/m canopy diameter.
[b] Controls – non-injected.

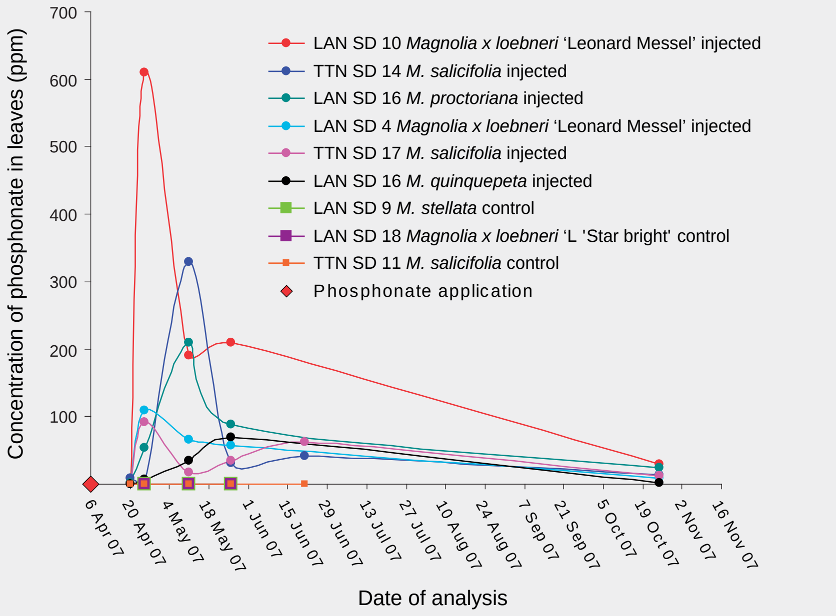

Figure 7. Phosphonate concentrations in leaves of injected magnolias

Conclusions

- Phosphonate applied as a stem injection was successful in reducing the incidence of disease in the treated trees providing high concentrations of the chemical were present in leaves during peak infection periods.
- Phytotoxic response (bleeding) occurred. Further investigation is required to determine if it is possible to mitigate these effects.
- Optimum dosages and number of applications must be determined to extend the period that active ingredient is present in leaves.

References

Denman, S., Moralejo, E., Kirk, S.A., Orton, E. & Whybrow, A. (2008) Sporulation of *Phytophthora ramorum* and *P. kernoviae* on asymptomatic foliage and fruit. In: *Proceedings of the sudden oak death third science symposium*, co-ordinators S. J. Frankel, J. T. Kliejunas and K. M. Palmieri. General Technical Report PSW-GTR-214. Pacific Southwest Research Station, Forest Service, USDA, Albany, California, 201-207.

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