CONTROL OF POWDERY MILDEW OF GRAPES WITH PLANT EXTRACTS

GABRIELE HERGER*, IAN HARVEY, TIM JENKINS
and ROBERT ALEXANDER

MAFTech, P.O. Box 24, Lincoln

*Institut für Biologische Schädlingsbekämpfung der BBA,
Heinrichstrasse 243, 6100 Darmstadt, FRG

SUMMARY

Powdery mildew of grapes was controlled in the field using 1% - 2% w/v extracts of the leaves of the giant knotweed (*Reynoutria sachalinensis*). Acceptable levels of control were obtained by applying the extract to the leaves at weekly intervals commencing before infection was present or when only trace amounts were noted on the plants.

INTRODUCTION

Powdery mildew of grapes, caused by *Uncinula necator* (Shw.) Burr., is one of the most damaging diseases of vines, causing reduced growth, yield and winter hardiness, and affecting grape quality (Pearson and Goheen 1988). In New Zealand, it is found throughout the grape growing areas of the country, being common on both outdoor and glasshouse crops (Dingley 1969). Traditionally, the disease has been controlled using dust or colloidal preparations of sulphur. More recently, several systemic and protectant fungicides have been registered in New Zealand for this purpose (O'Connor 1987).

Organic growers of grapes are permitted to use both sulphur and copper to control powdery and downy mildews, but there are limits to the number of sprays that can be applied and the effects of the sprays on soil nutrients, phytotoxicity, beneficial fauna ecology and, later, fermentation performance have been questioned (Wicks *et al* 1988; Zuur 1988). Thus alternatives to copper, sulphur and industrially synthesised compounds for control of the mildew diseases are being sought and evaluated in many countries (Zuur 1988).

In Germany, Herger *et al* (1988) reported that a 1% aqueous extract from the leaves of the giant knotweed plant, *Reynoutria sachalinensis* (F. Schmidt) Makai (Polygonaceae), was effective in controlling powdery mildews on apple, begonia, cucumber and wheat when applied as a prophylactic treatment. Preparations from this plant were tested for their ability to control the powdery mildew of grapes in the field in Canterbury.

METHODS

Dried and milled preparations of the leaves of the giant knotweed were supplied from West Germany. Mature leaves of giant knotweed growing in New Zealand were harvested, air dried for 4 to 6 days, and milled to a fine powder. Extracts were prepared by adding tap water at the required rate to give a 1% preparation w/v. A surfactant (Citowett) was added at 0.05% v/v, the preparation was left to stand for 1 h and then filtered through double cheese cloth.

At Larcomb vineyard on 8 December 1988, 1 year old vines of the cultivars Blauburger, Pinot Noir and Chardonnay were treated. One 400 m row of each cultivar was included in the trial, with groups of three randomised plants constituting a replicate, each plant within a group receiving either leaf extract, a fungicide or no treatment. In Pinot Noir, there were 30 groups, in Chardonnay 30, and in Blauburger 15. Powdery mildew was assessed by estimating the area of each leaf on all plants that was infected. Initially this was done only on the undersides of leaves, but as the disease

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progressed, the area affected on the top sides was also estimated. At the time of the first treatment, the disease was established on some of the plants in one area of the trial in Blauburger, and only just detectable in the Chardonnay. No disease was detectable in the Pinot Noir at the initiation of the trial.

Plants were sprayed to run-off with either a 1% aqueous extract of the West German *R. sachalinensis* leaf preparation, or with the fungicide triadimefon (Bayleton 100EC) at the rate of 25 g/100 litres. Sprays were applied at weekly intervals until 16 February, while assessments were at 2 weekly intervals to 16 March.

At St. Helena vineyard 3 year old Chardonnay vines were treated at weekly intervals from 30 January 1989 to 28 February. The disease was assessed at 2 week intervals until 21 March. The trial was a randomized block design with four plants per treatment in each block. The three blocks were in one vineyard row. Five treatments were applied: preparations from Christchurch leaves and West German leaves at 1 and 2% concentration (w/v) plus a nil treatment. These treatments were randomised within each of the four blocks. Levels of infection of powdery mildew, downy mildew, caused by *Plasmopara viticola* (Berk. & Curt.) Berl. & de Toni, and grey mould caused by *Botrytis cinerea* Pers. were assessed on the developing grape bunches on February 28, March 14, and April 1.

All results were statistically analysed with the disease progress data being described by a logistic curve using the following functional form:

$$\% \text{ infection} = \exp(a + b.d)/(1 + \exp(a + b.d))$$

Where d = days from beginning of treatment

a = initial infection in the treatment group

b = rate of increase on a logit scale

RESULTS AND DISCUSSION

Larcomb trial

Leaf extract prepared from West German giant knotweed, significantly reduced the level of powdery mildew in the cultivars Blauburger and Chardonnay ($P < 0.001$). This treatment also gave a dramatic reduction in infection in the cultivar Pinot Noir, but as this occurred only over a 4 week period at the end of the season, the estimate of the rate of disease increase had too large a standard error to give a statistically significant difference between treatments (Table 1).

Logistic curves were fitted to the percentage infection levels for Chardonnay and Blauburger. With Pinot Noir, only the recordings for the last three sampling dates were analysed, as there was negligible infection on the leaves before then. Thus the difference between the treated and the untreated was not significant. The slope values for these curves are given in Table 1, and contrasts show that the treatments in Chardonnay and Blauburger were significantly different to the untreated. The curves showed a small but significant degree of lack of fit in some cases. In Blauburger, this was due to the sudden increase in leaf area affected on the fourth assessment date in both treated and untreated. In the treated Chardonnay, it was due to a zero estimate of infection at the fourth assessment date.

The disease developed differently on each cultivar. The ability of the extract to control the disease was a reflection of the amount of disease on the plants at the beginning of the trial and the susceptibility of that cultivar to powdery mildew (Table 1). There was a characteristic early rise in infection level and a flattening out over the late January early February period, when conditions were not conducive to disease development in the spaced plants. All untreated vines then showed a rapid increase in the level of infection after mid-February with all cultivars ending with between 40 and 50% leaf area affected. The treated plants showed a much slower increase in development over this period, even though the application of leaf extract had ceased. These effects were visually detectable up until leaf fall, 2 months after treatment ceased. Treated vines retained leaves much longer and these leaves did not become further mildewed. There were no black mildew lesions on the treated canes as they hardened off for the winter. This suggests that the extract treatment not only protected the vines

against the mildew through its action on the invading fungus, but also assisted the plant to resist further disease attack, confirming previous results (Herger *et al* 1988).

The extract did not give the same level of control as the fungicide, triadimefon, which allowed only a trace of the disease to be detected on all cultivars at the end of the trial. The post treatment characteristics of the triadimefon treated plants were identical to that noted above for the extract-treated ones.

TABLE 1: Percentage leaf area and logit slope values of grape leaves infected with *Uncinula necator*, treated with 1% *Reynoutria sachalinensis* leaf extract — Larcomb vineyard.

Cultivars	Blauberger		Pinor Noir		Chardonnay	
	Treated	Nil	Treated	Nil	Treated	Nil
Assessment date (dd/mm)						
08/12*	0.8 ¹	0.5	0.0	0.0	0.1	0.02
22/12	1.0	2.2	0.0	0.0	0.01	0.1
04/01	1.9	5.0	0.0	0.0	0.06	0.9
18/01	6.7	14.0	0.0	0.0	0.0	6.4
01/02	7.3	16.1	0.0	0.0	1.1	11.2
16/02*	6.3	17.9	0.0	2.0	1.3	21.0
01/03	10.7	36.4	3.8	32.3	2.0	43.4
16/03	12.0	45.5	3.5	39.5	2.7	52.6
Logit slope values	0.0232	0.0379	0.0678	0.0897	0.0398	0.0570
CONTRASTS:		***		ns		***

* Date of first and last spray application; sprays being at weekly intervals.

¹ Mean percentage leaf area infected with powdery mildew from assessment of all leaves on 1 year old plants in each treatment.

Note: All plants treated with triadimefon had only traces of mildew, even at the end of the trial.

TABLE 2: Percentage leaf area and logit slope values of grape leaves (cv. Chardonnay) infected with *U. necator* after treatment with two preparations of leaf extracts of *R. sachalinensis* — St. Helena vineyard.

Treatment	W. German prep.			Christchurch prep.	
	Nil	1%	2%	1%	2%
Assessment date (dd/mm)					
30/01*	0.2 ¹	0.2	0.3	0.1	0.4
08/02	0.2	0.2	0.2	0.3	0.4
21/02	0.3	0.3	0.3	0.4	0.4
28/02*	3.1	0.7	0.4	0.6	0.5
06/03	5.8	1.0	0.5	0.5	0.5
21/03	11.1	1.5	1.1	0.7	1.0
Logit slope values	0.0809	0.0469	0.0363	0.0233	0.0196
CONTRASTS:	Nil treat. vs treated			***	
	Christchurch vs W. German			**	
	1% vs 2%			ns	
	Interaction (Source vs Rate)			ns	

* Date of first and last spray application; sprays being at weekly intervals.

¹ Mean percentage leaf area infected with powdery mildew, from assessment of 100 leaves of each plant on 3 year old vines.

St. Helena trial

Table 2 shows that powdery mildew did not develop to the same level in this vineyard compared to the Larcomb vineyard. All treatments gave a significant decrease ($P < 0.001$) in the level of infection, and the Christchurch extract at both concentrations gave a significantly better ($P < 0.01$) level of control than the West German extract. These differences were not calculated on the disease assessed at the end of the trial, but on the rate of change of disease severity with time, taking into account the level of disease at the beginning of the trial.

Logistic slope values for disease progress for the treated and untreated are given in Table 2. Fits of the logit curves to the assessment points were very good, with no evidence of lack of fit. These results simply show that the treatment with extracts effectively reduced the rate of increase of the epidemic.

Treatment with the extracts had no effect on the levels of botrytis grey mould on the bunches of ripening grapes. Downy mildew was not noted to be controlled until the last assessment on 1 April. Some control of powdery mildew on the developing fruit was obtained with the extracts.

Full scale trials in New Zealand are limited at this stage by the availability of leaf extracts. Research has been initiated both here and in West Germany on the culture of the plant. Studies indicate that the nature of the action of the extract on both pathogenic fungi and host plants is a complex one and that there is probably more than one elicitor involved (Herger unpub.).

CONCLUSIONS

These trials show that the extracts from the giant knotweed are capable of controlling powdery mildew infection on grape vines in Canterbury. They also show that the extracts are best applied as a prophylactic treatment. The carry over effect noted on the Larcomb vineyard was pronounced and the vines entered the winter in a much healthier state than the untreated vines. Doubling the concentration of extract spray from 1% to 2% in the St. Helena vineyard afforded only a small, non-significant increase in the level of disease control. This small increase would not appear to be of practical benefit.

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