Project title:	**Evaluation of a range of fungicides for controlling Phoma leaf spot on *Vinca minor***
Report:	**Final**
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PRACTICAL SECTION FOR GROWERS

Objectives and background

The common periwinkle *Vinca minor* is an attractive and very popular shade plant which is commercially important. Unfortunately, during production it is very prone to leaf damage and stem die-back caused by the fungus *Phoma exigua*. Damage can be reduced by employing an irrigation system which minimises splashing and wetting of foliage and adopting plant spacing which is sufficiently generous to allow air to circulate freely around the plants. In practice, especially where plants are being grown outdoors and are exposed to whatever rainfall occurs, the scope for implementing such measures is usually limited and an effective chemical treatment is needed to help obtain control of the disease.

The objective of the work being reported was to evaluate several different potentially useful fungicides against *Phoma* on *V. minor* which either have a label recommendation for use on outdoor ornamentals or are permitted for such use at growers own risk within MAFF Off-Label Long Term Arrangements for Extension of Use. Each was used at the maximum concentration permitted and at half that rate to examine any possible phytotoxic effects.

Summary of Results

The mixture of Mildothane Liquid and Headland Zebra Flo, irrespective of which rate was used, significantly reduced symptoms caused by *P. exigua,* when assessed 6 days after the final spray in November. The disease remained active well beyond the time of the final spray and an assessment made in December, 4 weeks after the final spray, showed that Punch C at the higher rate was still giving significant protection.

None of the treatments caused damage, but the mixture of Mildothane Liquid and Headland Zebra Flo left a prominent deposit on foliage.

Action points for growers

* Significant control of unsightly leaf damage caused by *Phoma* on outdoor grown *Vinca minor* during the autumn can be obtained by spraying with a mixture of Mildothane Liquid and Headland Zebra Flo or with the higher rate of flutriafol on a 10 day schedule starting once the disease is evident on most plants and continuing until early winter.

* Spraying with a mixture of Mildothane Liquid and Headland Zebra Flow when plants which are shortly to be sent to customers will leave a deposit on the foliage which may be unacceptable. Spraying at this time with the higher level of Punch C will give protection against *Phoma* for a few weeks after spraying is stopped and will not leave an unsightly deposit on the foliage.

Practical and financial benefits from the study

The work has shown that there are significant differences in the performance of fungicides which might be expected to have activity against *Phoma* on *Vinca.* It has identified those fungicides which when used regularly in a programme will significantly reduce leaf damage caused by the disease and will enable growers to produce a larger proportion of plants of saleable quality. It has also identified how to utilise the most effective fungicides in a way that gives protection for a reasonable period after spraying ceases and avoids a possible problem of unsightly spray deposit.

NB: Some of the products evaluated have product label recommendations for use on ornamentals, although not specifically for controlling *P. exigua* on *Vinca minor.* The others used are permitted on ornamentals under the MAFF Off-Label Long Term Arrangements for Extension of Use. It is important to note that permitted use of the products label is AT GROWERS OWN RISK.

SCIENCE SECTION

Introduction

The common periwinkle, *Vinca minor,* is an attractive low maintenance ground cover plant which thrives in the shade. It is a very popular plant in the UK and is an economically important one for many commercial nursery stock growers. Unfortunately, in commercial production it is very susceptible to leaf damage and stem die-back caused by the fungus, *Phoma exigua.*

The disease is present on most if not all nuseries where *V. minor* is grown but the extent of damage it causes varies from season to season. Estimates have been made that on average each year, about 15 % of plants are rendered unmarketable because of the damage it causes. The total value of the *V. minor* crop is thought to be worth around £1.5 million and a loss of 15% amounts to a loss of revenue on average per annum of nearly £0.25 million.

Damage from the disease can be reduced by cultural measures, such as employing an irrigation system which minimises splashing and wetting of foliage and adopting plant spacing which is sufficient to enable air to circulate freely around individual plants. However, in commercial practice, especially where plants are being grown outdoors and are thus exposed to whatever rainfall may occur, the scope for implementing these sorts of measures is small and there is need for effective chemical control.

Commercial growers in the UK have been using several different fungicides thought likely to have activity against *Phoma,* but their effectiveness and safe use on *V. minor* has not been critically evaluated. A report of an investigation in the USA on fungicides for controlling *Phoma* on *V. minor* (HortScience 30, 1995), showed that none of the fungicides used gave a high level of control but useful protection was obtained with a treatment consisting of a tank mix of thiophanate-methyl and mancozeb. However, the experiment did not include several potentially useful fungicides which growers in the UK are permitted to use, either because the products containing them already have a label recommendation for use on ornamentals, or because use can be extrapolated from that on edible crops under the MAFF Long Term Arrangements for Extension of Use.

The work reported here was commissioned and funded by the HDC to evaluate the effectiveness and crop safety of a range of fungicides commercially available and permitted for use in the UK and thought likely to be effective against *P. exigua* on *V. minor.*

Materials and methods

The experiment, located on a commercial nursery in Oxfordshire, was conducted on *Vinca minor* plants growing outdoors in peat compost contained in one litre capacity round pots spaced pot thick.

The experiment was laid out as a randomised block design with four replicates per treatment. Each plot had a dimension of 1.1 m x 1.0 m and consisted of 80 plants.

Sprays were applied with a Cooper-Pegler "Professional" model sprayer with a manually operated pressurisation system. It was fitted with a single nozzle boom to which was attached a yellow code nozzle. Each plot received 500 ml of spray liquid at each application.

Spraying started once the disease was evident on plants in all plots. The first spray was applied on 7 September, with further applications on 17 and 26 September, 7, 16 and 29 October and a final one on 14 November.

The spray treatments, all stated as amount of active ingredient in 100 l water, were as follows :-

Prochloraz as Levington Octave (Levington) at 92g.

Prochloraz as Levington Octave at 46g.

Imazalil as Fungaflor (Hortichem) at 30g.

Imazalil as Fungaflor at 15g.

Flutriafol as Pointer (Zeneca) at 62g.

Flutriafol at Pointer at 31g.

Carbendazim + flusilazole as Punch C (DuPont) at 50g + 100g.

Carbendazim + flusilazole as Punch C at 25g + 50g.

Carbendazim as Bavistin DF (BASF) at 100g.

Carbendazim as Bavistin DF at 50g.

Thiophanate-methyl as Mildothane Liquid (Hortichem) at 50g + mancozeb as Headland Zebra Flo (Headland) at 514g.

Thiophanate-methyl as Mildothane Liquid at 25g + mancozeb as Headland Zebra Flo at 257g.

Chlorothalonil as Bravo 500 (BASF) at 110g.

Chlorothalonil as Bravo 500 at 55g.

Unsprayed control.

The severity of *Phoma* symptoms was assessed using the following scoring criteria :-

0 no symptoms visible

1 <1% leaf area affected

2 between 1 and 10% leaf area affected

3 between 10 and 25% leaf area affected

4 between 25 and 50% leaf area affected

5 > 50 % leaf area affected

Assessments were done on 7 and 22 September, 9 and 22 October, 5 and 20 November and 11 December on foliage contained within the central 0.25 sq m of each plot.

Results and discussion

The disease was present at low level on many plants in every plot when the first spray was applied on 7 September. It then made slow progress during the next 4 weeks or so after which on the untreated control it progressed steadily to reach a significant though not severe level by the middle of November. The most effective control, when measured six days after the last spray treatment, was obtained with the mixtures of thiophanate -methyl and mancozeb and with flutriafol at the higher rate. Levels of the disease had increased with the exception of those plants receiving the higher rate of carbendazim + flusilazole, when a final assessment was done 27 days after the final spray treatment.

A very obvious and somewhat unsightly deposit was left on the foliage following treatment with thiophanate-methyl and mancozeb.

Even the most effective treatments did not give a very high level of control as was the case with the USA results (HortScience 30, 1995). However, in the work being reported here, spraying was not started until the disease was already well established on the plants and was thus probably provided a stringent test for the chemicals used. Starting the spray programme well before this stage is reached might perhaps achieve even better performance.

In commercial practice, the problem of unsightly spray deposit with the tank mix of thiophanate-methyl and mancozeb could be overcome by switching to the higher rate of carbendazim + flusilazole rate shortly before the plants start to be marketed. Such treatment also seems to give longer lasting protection than others once spraying ceases.

Disease Assessments:

Treatment	gai/ 1001	Average disease score						
		07-Sep	22-Sep	09-Oct	22-Oct	05-Nov	22-Nov	11-Dec
prochloraz (Octave)	92	1.25	1	1	1	1.25	1.75	1.5
prochloraz (Octave)	46	1	1	1.25	1.25	1	1.75	2.25
imazalil (Fungaflor)	30	1.25	1	1	1	0.75	1.5	1.75
imazalil (Fungaflor)	15	1.25	1	1	1	1	1.25	1.75
flutriafol (Pointer)	62	1.5	1.5	1	1	0.75	1*	1.25
flutriafol (Pointer)	31	1.5	1.25	1.75	1.75	1.5	2	2
carbendazim+ flusilazole (Punch C)	50+100	1.5	1	1	1	1	1.25	1*
carbendazim+ flusilazole (Punch C)	25 + 50	1.25	1	1	1.25	1.5	2.25	1.75
carbendazim (Bavistin DF)	100	1.25	1	1	1.25	1.25	1.25	1.75
carbendazim (Bavistin DF)	50	1.5	1.5	1.25	1.5	1.25	1.25	2
thiophanate-methyl (Mildothane Liquid) + mancozeb (Headland Zebra Flo)	50+514	1.25	1	1	1	0.75	0.75*	1.25
thiophanate-methyl(Mildothane Liquid) + mancozeb (Headland Zebra Flo)	25+257	1	1.25	1	1	1	0.75*	1.25
chlorothalonil (Bravo 500)	110	1.5	1.25	1.25	2.25	1.5	1.75	2.5
chlorothalonil (Bravo 500)	55	1.25	1.25	2	2.25	2.5	3	3
unsprayed control		1.25	1.25	1.5	1.5	2	2.5	2.5

* Treatment significantly different from unsprayed control $P < 0.05$ as determined by analysis of variance using Friedman's method.

Conclusions

1. A programme of high volume spraying of outdoor commercially grown *V. minor* plants using a tank mix of thiophanate-methyl and mancozeb or the higher rate of flutriafol gives useful protection from damage to foliage caused the fungus *P. exigua*. Once spraying is stopped, carbendazim + fusilazole at the higher rate used, gives the longest lasting protection thereafter.

2. The most effective treatments can even be applied after the disease is well established and still achieve good control.

3. The tank mix of thiophanate-methyl and mancozeb, if used when plants are soon to be marketed, may result in spray deposit on the foliage which is unsightly enough to cause a problem.

References

Koelsch M.C., Cole J.C. and von Broembsen S.L. (1995). Effectiveness of Selected Fungicides in Controlling Foliar Diseases of Common Periwinkle (*Vinca minor* L.). HortScience 30(3): 554-557

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Fungicidal Control of Phoma on Vinca minor HNS 72

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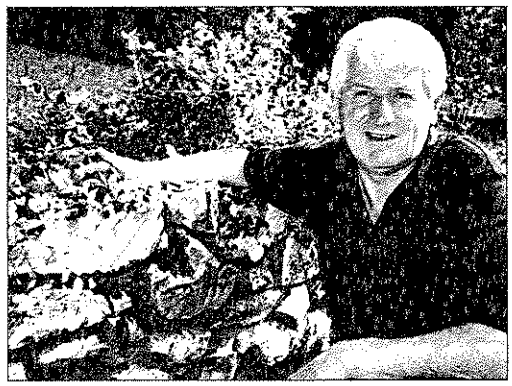

The common periwinkle, *Vinca minor,* is a popular low maintenance ground cover plant which is important for many commercial growers. However, during commercial production it is very prone to attack by the fungus *Phoma exigua,* causing unsightly spotting on leaves and discoloration and death of shoots and stems. Often, not only is growth checked but symptoms can be so extensive and severe that plants are rendered unmarketable.

Cultural methods such as using an irrigation system which minimises or eliminates splashing and wetting of foliage, or the adoption of wide spacing between plants will reduce the risk of damage from *P. exigua*. However, in commercial practice the scope for implementing these sorts of measures is often limited and an effective chemical remedy is needed.

There are several commercial fungicides either used alone or together in a mixture which commercially, growers could use and which might be effective against *P. exigua*. These have been evaluated in a trial on a commercial nursery in Oxfordshire where a range of 7 different fungicides were compared with one another and against an unsprayed control. The rates used were the maximum specified on the product label and half that amount. A programme of 7 sprays were applied at approximately 10 day intervals from 7 September to 14 November, starting once the disease was easily seen on many of the plants. The plants were grown outdoors in one litre pots spaced pot thick.

Irrespective of which rate was used, the mixture of Mildothane Liquid and Headland Zebra Flo (mancozeb) significantly reduced disease symptoms caused by *P. exigua* when assessed 6 days after the final spray. The disease remained active and the plants continued growing for some while after spraying ceased and it is interesting to note that even four weeks after the final spray, Punch C at the higher rate was still giving a significant level of control.

None of the treatments caused damage but the mixture of Mildothane Liquid and Headland Zebra Flo, one of the treatment giving best control of the disease, left a prominent deposit on the foliage, so that its use commercially would perhaps need to be avoided when the plants were about to be sold.

Delaying the start of spray treatment until the disease had become well established was a stringent test for the fungicides being evaluated and starting treatments well before this stage is reached might perhaps achieve even better performance.

Some of the products evaluated have product label recommendations for use on ornamentals, although not specifically for controlling *P. exigua* on *Vinca minor.* The others used are permitted on ornamentals under the MAFF Off-Label Long Term Arrangements for Extension of Use. It is important to note that permitted use of a product which is not specified on the product label is AT GROWERS OWN RISK.

HDC

Treatment	Rate	Average disease score 6 days after the final spray	Average disease score 27 days after the final spray
Octave	100 g/100 L	1.75	2.25
Octave	200 g/100 L	1.75	1.5
Fungaflor	150 ml/100 L	1.5	1.75
Fungaflor	75 ml/100 L	1.25	1.75
Pointer	500 ml/100 L	1.0	1.25
Pointer	250 ml/100 L	2.0	2.0
Punch C	400 ml/100 L	1.25	1.0*
Punch C	200 ml/100 L	2.25	1.75
Bavistin DF	200 g/100 L	1.25	1.75
Bavistin DF	100 g/100 L	1.25	2.0
Mildothane Liquid+ Headland Zebra Flo	100 ml + 1.13 l/100 L	0.75*	1.25
Mildothane Liquid+ Headland Zebra Flo	50 ml + 565 ml/100 L	0.75*	1.25
Bravo 500	220 ml/100 L	1.75	2.5
Bravo 500	110 ml/100 L	3.0	3.0
Untreated		2.5	2.5

* statistically valid difference from untreated

Disease assessment key :

0 = no symptoms visible
1 = < 1% leaf area affected
2 = 1 - 9% leaf area affected
3 = 10 - 24% leaf area affected
4 = 25 - 49% leaf area affected
5 = 50% or more leaf area affected