

DOWNY MILDEW ON NURSERY SEEDLINGS

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Introduction

Downy mildew on seedlings is the major disease of the nursery industry in Australia. Economic losses from the disease are estimated at 10-12% or \$4 million annually. Nurserymen have experienced difficulty in controlling the disease on stocks, pansies and brassicas. One nurseryman had actually stopped growing austral stocks because of the problem. A project, supported by the Nursery Industry Association of Australia, the Horticultural Research and Development Corporation and Agriculture Victoria was developed to control downy mildew on nursery seedlings. The project evaluated fungicides, monitored spore release and reviewed the literature on downy mildews in nurseries, to develop integrated control strategies.

Symptoms

Downy mildew first appears as masses of 'downy', usually white spores, on the under surfaces of leaves. On brassicas, this is followed by black speckling on the upper surface, yellowing (Fig 1) and premature leaf fall. Downy mildew on pansies produces mauve spores on the under surface of leaves and a light green discolouration of the leaf on the upper surface. Symptoms on stock seedlings are a cream speckling and blotching of older the leaves (Fig 2).

Host range

Fungi causing downy mildew diseases are specific to particular genera of plants. Some strains of *Peronospora parasitica* only infect cruciferous crops (eg. broccoli, Brussels sprouts, cabbage, cauliflower and Chinese cabbage), whilst another strain only infects stocks. The fungus causing downy mildew on pansy is *P. violae*.

Seed

Extensive germination and grow-on tests for broccoli, Brussels sprouts, cabbage and cauliflower, under clean glass house conditions, failed to detect downy mildew on seedlings, over a month after germination. In commercial nurseries the disease was commonly detected on 15 day old seedlings. Seed does not appear to be a source of infection for spread of the disease.

Infection

Spores (asexual, i.e. vegetative) are produced overnight on the undersurface of leaves and released in the morning (Fig 3) as the relative humidity drops.

Spores need wet leaf surfaces to germinate. Infection takes up to 3 hours after spores land on leaves. The fungus then grows within the leaf. It takes 5-7 days for symptoms to appear on *Brassica* leaves after infection.

Spread

In nurseries, spores are carried on the wind from older infected seedlings to young healthy seedlings. Cruciferous weeds, such as *Capsella* species (Shepherds Purse), can spread the disease to brassica seedlings. Downy mildews prefer cool temperatures, eg. on brassicas the optimum temperature range for disease development is 8-16°C.

Control Strategies

Strategies to control the disease must consist of both management practices and fungicide spray programs. Management Practices to reduce the disease are:-

1. Controlled watering

Where possible avoid watering plants in the morning because this is the time when spores are released and available for infection. Spores need water to germinate and wet leaf surfaces to infect plants. A short, heavy watering is preferable to a long light watering.

2. Ventilation

Always maintain a well ventilated environment to lower humidity and thus reduce spore production and infection. This may mean fewer plants and trays per square meter.

3. Nutrition

Maintain a balanced program of nutrition as a potash deficiency has been shown to increase the susceptibility of seedlings to downy mildew.

4. Hygiene

Remove sources of spores in the nursery, such as heavily infected seedlings, old infected seedlings past their use by date and weeds.

Evaluation of Fungicides

The effect of fungicides on control of downy mildew was evaluated using cauliflower seedlings cv Westralian, as a model. Fungicides were initially evaluated at the Institute for Horticultural Development and at commercial nurseries. After a process of elimination, 2 systemic and 2 contact fungicides were trialed alone or in combination in a replicated trial. The systemics were applied as a drench once a fortnight and the contacts were applied as a weekly spray. Two environmental conditions were created, 'dry' (seedlings grown for 2 weeks under glass, 2 weeks under cloth and for 4 weeks outside), and 'wet' (seedlings grown for 2 weeks under glass and 6 weeks outside).

All fungicide applications reduced the incidence of the disease (Fig 4). The 'wet' environment which is more typical of a nursery situation showed that a combination of a systemic and contact fungicide program was the most effective.

Conclusion

Commercial nurseries in Victoria which have adopted the environmental management strategies and fungicide protocols developed from the research project have markedly reduced the disease on brassica and ornamental seedlings. One nursery reported no disease on their stock seedlings and a 30% increase in sales. The incidence of downy mildew (measured as the number of plants infected divided by the total number of plants counted) was high on *Brassica* seedlings in one nursery during 1995, prior to adoption of the integrated management strategies, but after adoption of these strategies in 1996 was reduced by up to 100% (Fig 5).

Fig 3 Spores of Brassica downy mildew (*P. parasitica*) trapped in a nursery over 24 hours (May 12, 1995).

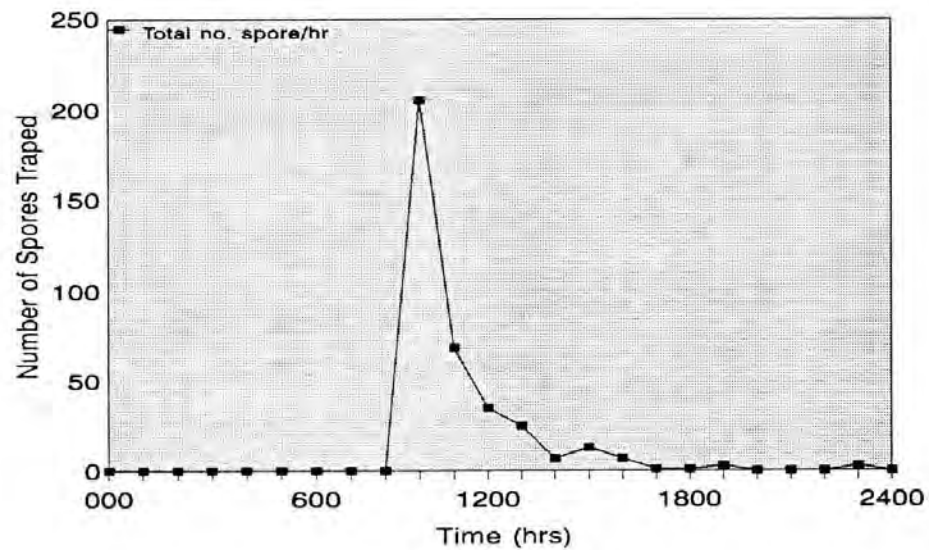


Fig 4 Efficacy of fungicides to control downy mildew on cauliflower seedling.
 (C, control; A, systemic; E, contact; M, Mancozeb; P, systemic; D, dry; W, wet)

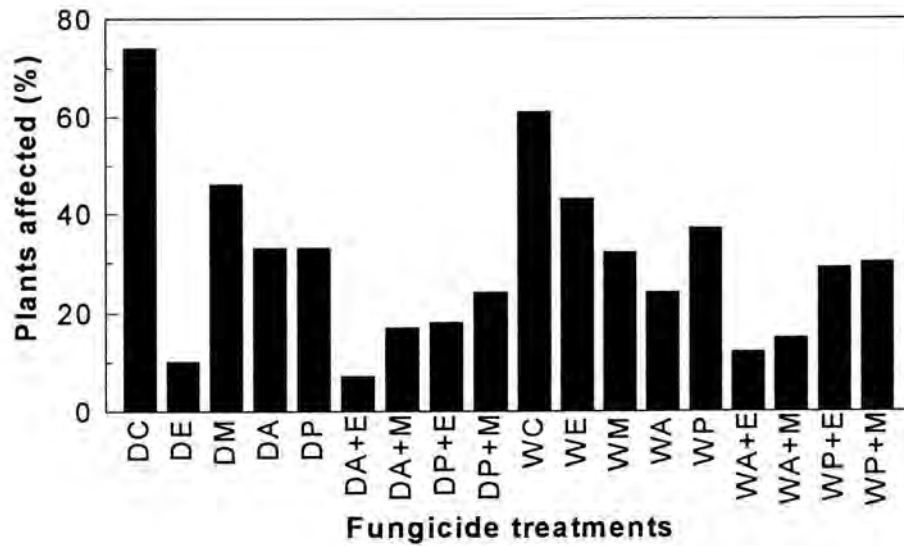


Fig 5 Incidence of downy mildew on *Brassica* seedlings during 1995 (pre adoption of strategies) and 1996 (post adoption of strategies).

