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Control of Powdery Mildew on *Hydrangea* and *Crapemyrtle* with Antitranspirants

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Abstract. **Antitranspirants ('Vapor Gard' and 'Wilt Pruf') effectively controlled powdery mildew on *Hydrangea macrophylla* Thunb. and *Lagerstroemia indica* Nana. A 2% antitranspirant emulsion was sufficient to suppress the pathogen's development without causing visible phytotoxic effect or plant growth inhibition. The antitranspirants were as effective, and in some cases more effective ('Vapor Gard'), than the systmic triazole fungicide 'Tilt' in controlling the disease. *Hydrangea* and dwarf *Lagerstroemia* (crapemyrtle) are grown commercially as flowering pot plants. Disease-free plants are required. Powdery mildew (*Erisiphe polygoni* DC) often causes severe damage on greenhouse-grown hydrangea. This fungus usually appears 1st on the lower leaf surface, where it produces a white, loose, cottony mycelium. Yellowish or purple-white blotches with mycelium also can be observed on the upper surface of the leaf. When the disease develops under favorable environmental conditions, the symptoms cover not only the entire leaf surface but also the bud clusters and flowers (11). Various fungicides control powdery mildew under greenhouse conditions.**

The most serious disease of crapemyrtle is powdery mildew (*Erisiphe lagerstroemia* E. West), especially during spring and autumn (10). The leaves, shoots, and flower buds become encrusted with a white powder cover that distorts shoot and leaf growth and prevents buds from opening (10). The common treatment to control the pathogen and to prevent an epidemic is fungicidal spray applied during the spring and autumn. Several crapemyrtle cultivars are susceptible to powdery mildew and chemical control becomes necessary. Intensive use of several fungicides, mainly systemic, has resulted in the development of fungicide-resistant strains of the targeted pathogen.

Polymers such as waxes, silicones, and various plastics, have been used in agriculture mainly as film-forming antitranspirants (6, 8, 15). These antitranspirants affect water loss more than carbon dioxide exchange in leaves (5). There exists little information on the effect of foliar-coating films on control of plant diseases. Recent reports (14, 15, 16) demonstrated effective control of foliar diseases with epidermal coating polymers. The use of nontoxic antitranspirants as disease control agents in pot plants contributes to improved plant quality and reduces water loss under moisture stress conditions during transplanting, shipment, and handling (9). In this study, we examined the effect of antitranspirants for control of powdery mildew in hydrangea and crapemyrtle.

Hydrangea plants at the flowering stage were grown in 3-liter pots to an average height of 30 cm, with 2–3 branches and 28 leaves per plant. The *Lagerstroemia* plants were grown in 0.8 liter pots to one branch (14 cm height, with 8.5 pairs of leaves). Both species were grown in a greenhouse in a 2:1 tuff (volcanic ashes 0.8 mm) peatmoss medium (v:v) under illumination of 400 μmol m^{-2}s^{-1}. The plants were irrigated daily for 10 min through a dripper delivering 2 liters/hr of water containing 20N–9P–17K fertilizer at a rate of 80 ppm N. Seven replicate plants comprised each treatment within a completely randomized block design.

The experiment was started on 1 Sept. 1983, and terminated on 31 Oct. 1983. There were 4 treatments: 1) 'Vapor Gard', di-l-p-menthene (the active ingredient in this product is pinolene; Miller Chemical and Fetilizer Co., Hanover, Pa). The spray was applied as a 2% emulsion in distilled water. 2) 'Wilt

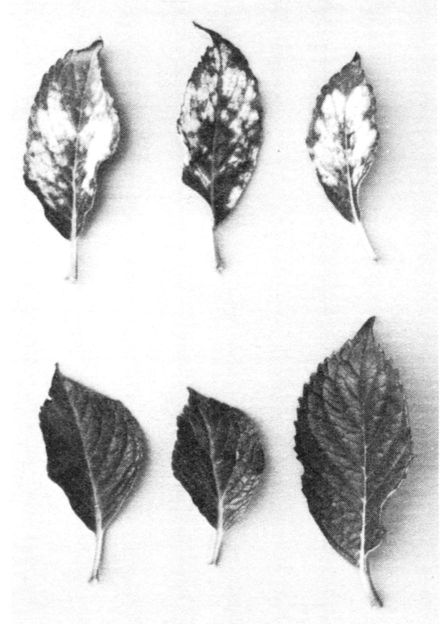

Fig. 1. The effect of 'Vapor Gard' on powdery mildew development on *Hydrangea* leaves (lower) compared to untreated leaves (upper).

Table 1. Effect of antitranspirant and fungicidal treatments in controlling powdery mildew of *Hydrangea*.

Treatment	Days from infection 28	35	43	54	60
	Disease level (%)[z]				
None (control)	11.7 a[y]	34.2 a	57.9 a	68.4 a	72.3 a
Tilt[x]	9.3 ab	6.1 b	7.4 b	7.6 b	8.5 b
Wilt Pruf	6.1 b	7.1 b	7.1 b	7.2 b	8.8 b
Vapor Gard	4.5 b	6.0 b	6.4 b	6.4 b	7.6 b

[z]Mean powdery mildew coverage of total leaf area per plant.
[y]Values in each vertical column followed by the same letter do not differ significantly at $P = 0.01$, according to Duncan's multiple range test.
[x]The fungicide was applied 30 days after infection.

Table 2. Effect of antitranspirant and fungicide treatments in controlling powdery mildew of *Lagerstroemia*.

Treatment	Days from infection 18	35	38	44	51
	No. of spots/plant				
Untreated	0.0	6.7 a[z]	24.2 a	36.7 a	89.1 a
Tilt[y]	0.0	9.5 a	2.1 b	2.5 b	2.6 b
Wilt Pruf	0.0	0.4 b	1.1 b	3.6 b	3.7 b
Vapor Gard	0.0	0.2 b	0.3 c	0.3 c	0.4 c

[z]Values in each vertical column followed by the same letter do not differ significantly at $P = 0.01$, according to Duncan's multiple range test.
[y]The fungicide was applied 40 days after infection.

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Pruf', beta pinene polymer (Nursery Specialty Products, Greenwich, Conn.). The spray was applied as a 2% emulsion in distilled water. 3) 'Tilt' fungicide (propiconazole; p,2-(2,4 dichlorophynel)-4 propyl-1,3 dioxalan-2-methyl-lH-1,2,4 triazole; Ciba-Geigy). Tilt was applied when 1st visible symptoms of the disease appeared, as is common in horticultural practice, at a rate of 0.1% in distilled water. 4) Untreated control.

The plants in all treatments were sprayed with a 500-ml hand sprayer (Polyspray No. 2 ASL) to run-off. 'Vapor Gard' and 'Wilt Pruf' were applied at the beginning of the experiment, and after 21 and 28 days. Twenty-four hours after treatment, 28 healthy hydrangea or crapemyrtle plants were placed among 14 heavily infected plants serving the powdery as the source of inoculum.

Disease level was measured 5 times, starting when the 1st visible symptoms appeared and continuing biweekly. The assessment of the infection rate on hydrangea plants was based on the percentage of leaf area covered by pathogenic mycelium. The assessment of powdery mildew on crapemyrtle plants was based on the number of mildew spots per plant. The 'Tilt' treatment, given one month after the infection date, provided a comparison with antitranspirants in effectiveness in controlling powdery mildew.

The development of powdery mildew on uncoated hydrangea plants was significantly higher than on the coated ones (either 'Vapor Gard' or 'Wilt Pruf') or on fungicide-treated plants (Table 1). The fungicide 'Tilt' reduced disease development and maintained it at a low level. Both antitranspirants effectively suppressed development of the pathogen. The growth rate of the plants was the same in all treatments.

The coated leaves of both hydrangea and crapemyrtle plants were relatively disease-free up to 2 months after the last treatment. The effect of the antitranspirants on disease development in hydrangea is shown in Fig. 1. Similar results were obtained with crapemyrtle (Fig. 2). The 1st visible symptoms of mildew on this plant were determined one month after infection, and the disease developed to a high level within 50 days after the infection date (Table 2).

Both 'Tilt' and the antitranspirants stopped disease development in comparison with the untreated controls. 'Vapor Gard' seems to be more effective in controlling powdery mildew than 'Wilt Pruf' (Tables 1 and 2), but the difference between them, while obvious on crapemyrtle, was not statistically significant on hydrangea.

Various hypotheses exist about the inhibitory mechanisms of natural coatings in preventing foliar surface, diseases. Physical barriers constitute an important plant disease defense mechanism (1, 3, 4, 5, 8). The cuticle may prevent penetration either by a physical or by a chemical mechanism (3). The relationship between cuticle thickness and the lack of penetration of germinated fungal spores into the host tissue was described by Dickenson (2). The film-forming antitranspirants, which were used in this experiment, were found to be water repellent in preliminary tests.

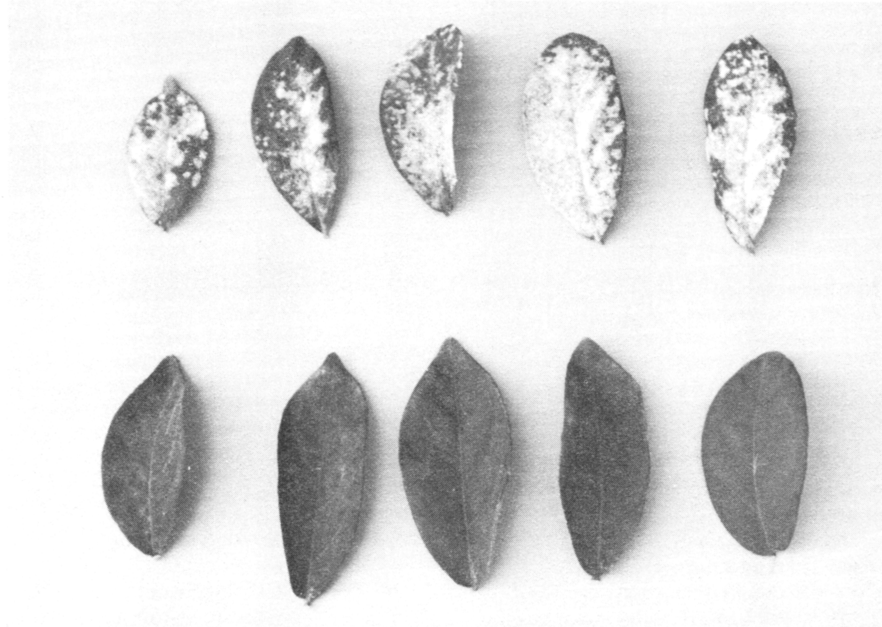

Fig. 2. The effect of 'Vapor Gard' on powdery mildew development on *Lagerstroemia* leaves (lower) compared to untreated leaves (upper).

Various film-forming antitranspirants, such as those tested here are organically biodegradable, and nontoxic to plants and mammals. They protect plants from water loss caused by excessive transpiration through the leaves. These antitranspirants do not interfere with plant growth, and they increase crop yield under conditions of moisture stress (5). Several polymers are flexible and do not crack or peel under heavy rainfall or intense solar radiation.

The commercial use of antitranspirants in the agroecosystem seems safe and economical. Because of rising costs of fungicides and the development of various fungicide-tolerant strains of fungal pathogens, integrated strategies of foliar-disease are imperative (14, 16). Antitranspirants could become part of an integrated pest management control system thus reducing both environmental pollution and selection pressure on pathogen populations, especially in pot plants.

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