Resistance of African Violet to Powdery Mildew and Efficacy of Fungicides for Control of the Disease

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ABSTRACT

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The incidence of powdery mildew (*Oidium* sp.) differed significantly among 48 cultivars of the Melodie and Ballet series of African violets (*Saintpaulia ionantha*). The incidence also differed significantly between leaves and flowers of the same cultivar. The most resistant, overall, were Allison, Brilliant Eva, Dolly, Mitzi, Pearl, and Rachel. Cultivars with the most susceptible leaves were Erica, Heidi, Julianne, Karla, Lisa, Margaret Ann, Meta, Paula, Pink Ulli, Sheri, and Suzanne. Flowers were most susceptible on Diane, Frances, Georgeanne, Helen, Jeanie, Mary, Paula, Renee, and Sheri. Benomyl at 1, 2, or 4 oz a.i./100 gal eradicated mildew from Erica African violets without causing phytotoxicity. Dinocap and sulfur were efficacious but phytotoxic to blossoms.

Powdery mildew caused by *Oidium* sp. is a major disease of African violet (*Saintpaulia ionantha*). Mildew may occur on leaves and flowers, and because blossoms are sensitive to fungicides (2), phytotoxicity is extremely important. Several fungicides (benomyl, dinocap, and sulfur) have been recommended for control (1–4), but apparently neither efficacy data for African violet nor cultivars resistant to powdery mildew have been reported.

This article reports the resistance of African violet cultivars to powdery mildew and the efficacy and phytotoxicity of fungicides for control of the disease.

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MATERIALS AND METHODS

Rooted cuttings of African violets were provided by Sunnyside Nurseries, Inc., Hayward, CA (Melodie series), and by George J. Ball Brothers, Inc., West Chicago, IL (Ballet series). Uniform plants were selected for testing. Rooted cuttings were transplanted to unamended Metro Mix 220 potting medium (W. R. Grace & Co., Cambridge, MA) in 10-cm (4-in.) clay pots set on capillary mats for subirrigation. Water was not applied to the foliage except when fungicide sprays were applied. Plants were grown in a greenhouse with an evaporative-cooling system and whitewash shading to maintain temperatures of 20–30°C. Two to three weeks after being transplanted, plants were fertilized with 5 cm^3 (1 tsp) per pot of 18-9-13 Osmocote (controlled release fertilizer, Sierra Chemical Co., Newark, CA). Each plant also received Peters 20-20-20 each week beginning 4 wk after transplanting. A 15:1 Hozon proportioner was used to apply the fertilizer solution (25 g/L) to mats.

The inoculum was produced on leaves of Irene African violet plants. Conidia were washed from leaves with sterile water containing 0.06 ml (1 drop) per liter of Tween 80, adjusted to 400 conidia/ml, and approximately 5 ml was immediately sprayed on each plant. Plants were inoculated during the first flush of blossoms, placed in a moisture chamber at near 100% relative humidity for 24 hr, and then placed on the greenhouse bench. Each test consisted of six single plant replicates per treatment arranged on the bench in a randomized block design. The test was repeated once.

Fungicides used as eradicants were applied with a hand sprayer to runoff. Fungicides tested were: 2-(1-methylheptyl)-4, 6-dinitrophenyl crotonate (dinocap, commercial product is a reaction mixture containing several isomers), methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate (benomyl), sulfur, and sodium hypochlorite (NaClO).

Plants used for the fungicide efficacy tests were previously inoculated and uniformly infected; each had a disease severity index rating of 4 (Table 1).

After the 48 cultivars were inoculated and evaluated for resistance, three plants

of each cultivar were sprayed once to runoff with the fungicides at the following rates for phytotoxicity determinations: benomyl, 4 oz a.i./100 gal; dinocap, 1 oz a.i./100 gal; sulfur, 16 oz a.i./100 gal; and NaClO, 131 ppm (0.25% Clorox).

RESULTS AND DISCUSSION

Reaction of the 48 African violet cultivars to inoculation with *Oidium* sp. varied greatly, but none were immune (Table 1). Mildew first became visible on leaves and blossoms of Frances 7 days after inoculation. Susceptibility of different tissues of the same cultivar also varied greatly, especially between foliage and inflorescence. Therefore, powdery mildew incidence and severity were rated on upper and lower leaf surfaces, petals, pedicels, peduncles, sepals, and pistils (Table 1, Fig. 1). For example, the upper leaf surface of Erica was more severely affected than the lower leaf surface. Mildew was not observed on petals of Erica and very seldom on pedicels, peduncles, or sepals. In contrast, mildew was more severe on the lower than on the upper leaf surface of Paula, and petals and pedicels were equally susceptible.

Mildew was not observed on leaves and was very infrequent on flowers of Dolly. Other culitvars that received resistant ratings for both leaves and flowers were Allison, Brilliant Eva, Mitzi, Pearl, and Rachel. In addition, leaves of Diane, Eva, Light Marta, Lucy, Marta, Mary, Roxanne, and Valerie were rated as resistant, but flowers of these cultivars were susceptible.

Cultivars with the most susceptible leaves included Erica, Heidi, Julianne, Karla, Lisa, Margaret Ann, Meta, Paula, Pink Ulli, Sheri, and Suzanne. Flowers were most susceptible on Diane, Frances, Georgeanne, Helen, Jeanie, Mary, Paula, Renee, Sheri, and Stacy.

Powdery mildew was observed macroscopically on pistils of all cultivars except Ann, Pearl, and Kathy. Incidence of mildew on pistils varied among cultivars, but data were recorded only for its presence or absence. Mildew was evident on pedicels and/or pistils of flowers of many cultivars with apparently immune petals (Table 1).

Mildew on the lower leaf surface could be easily overlooked and thereby serve as a source of inoculum for other cultivars, but all cultivars with mildew on the lower leaf surfaces also had mildew on upper leaf surfaces. Control of powdery mildew on cultivars with highly susceptible lower leaf surfaces could be difficult with nonsystemic fungicides.

Benomyl was most efficacious in eradicating mildew from Erica African violets; it was not phytotoxic at 4 oz a.i./100 gal. Benomyl gave similar control at 1, 2, or 4 oz a.i./100 gal. Dinocap (1 and 2 oz a.i.) and sulfur (16 oz a.i.) provided good control but were phytotoxic to blossoms. NaClO at 131 or 262 ppm did not provide adequate control and was phytotoxic to blossoms. Sterile distilled water, sprayed on foliage to runoff daily for 7 days, kept conidia washed off and disease ratings low, but mildew rapidly reappeared a few days after cessation of spraying (Table 2).

No phytotoxicity was noted in the 48 cultivars sprayed once to runoff with 4 oz a.i./100 gal of benomyl. The other materials caused necrotic spotting of blossoms. Dinocap most severely affected Brilliant Eva, Erica, Frances, Georgeanne, Helen, Helga, Mary, Meta, Pink Ulli, Rachel, Renee, and Vera. Sulfur was most phytotoxic on blossoms of Brilliant Eva, Erica, Georgeanne, Inge, Irene, Paula, and Pink Ulli. NaClO caused spotting on blossoms of most cultivars.

Despite many observations of the diseased tissues of the various cultivars during this study, no cleistothecia of this pathogen were found. Conidiophores of the pathogen are straight and bear conidia in chains. Mature conidia are ellipsoidal and contain vacuoles and

Table 1. Reaction of African violet cultivars to inoculation with *Oidium* sp.

Cultivar	Leaf mildew[a]			Inflorescence mildew		
	Upper surface	Lower surface	Rating[b]	Petal	Pedicel +[c]	Rating[b]
Abby	2.0	1.0	S	1.0	1.3	RH
Allison	1.1	1.0	RH	1.0	1.8	R
Angie	1.8	2.0	S	2.5	2.9	S
Ann	2.3	2.0	S	2.2	2.4	S
Anna	1.8	2.1	S	1.8	2.7	S
Beth Ellen	2.3	1.0	S	1.0	1.7	R
Brilliant Eva	1.2	1.3	RH	1.0	1.8	R
Cristina	1.9	2.1	S	1.2	2.0	S
Diane	1.3	1.2	RH	3.6	3.2	SH
Dolly	1.0	1.0	I	1.3	1.3	RH
Erica	4.0	2.6	SH	1.0	1.8	R
Eva	1.2	1.0	RH	2.2	2.3	S
Farrah	1.8	2.2	S	1.8	2.1	S
Frances	2.9	3.0	S	4.2	4.0	SH
Georgeanne	1.8	2.4	S	3.3	3.6	SH
Heidi	3.8	3.0	SH	1.0	2.9	S
Helen	2.2	2.0	S	3.9	3.7	SH
Helga	1.7	2.0	S	1.2	1.6	R
Inge	2.8	2.5	S	2.0	2.4	S
Irene	2.8	2.0	S	2.0	2.0	S
Janet	2.9	3.0	S	1.5	2.5	S
Jeanie	2.4	2.5	S	2.5	3.7	SH
Julianne	3.5	2.5	SH	1.0	2.0	S
Karla	3.6	2.5	SH	1.0	1.8	R
Kathy	2.2	1.0	S	1.0	2.6	S
Laura Ann	2.5	2.0	S	1.0	2.5	S
Laurie	1.3	2.5	S	1.0	2.7	S
Light Marta	1.4	1.0	R	1.0	2.2	S
Lisa	2.8	3.2	SH	1.2	2.9	S
Lucy	1.2	1.0	RH	1.0	2.6	S
Margaret Ann	3.4	2.1	SH	1.1	2.8	S
Marta	1.6	1.0	R	1.0	2.2	S
Mary	1.8	1.0	R	3.4	2.9	SH
Mary Ann	1.4	2.0	S	1.0	2.7	S
Meta	3.5	2.2	SH	1.4	2.5	S
Mitzi	1.1	1.0	RH	1.1	1.1	RH
Paula	2.4	3.5	SH	3.6	3.8	SH
Pearl	1.8	1.0	R	1.0	1.8	R
Pink Ulli	3.4	2.2	SH	2.2	2.5	S
Rachel	1.2	1.0	RH	1.2	1.2	RH
Renee	2.2	1.0	S	4.0	3.9	SH
Roxanne	1.1	1.0	RH	1.5	2.4	S
Sheri	2.9	4.0	SH	3.4	3.6	SH
Stacy	1.6	3.0	S	3.3	3.7	SH
Suzanne	3.3	2.2	SH	1.0	2.2	S
Ulli	1.9	2.2	S	1.1	2.3	S
Valerie	1.4	1.0	R	1.4	2.3	S
Vera	2.7	3.0	S	2.2	1.6	S
LSD 0.05	0.57	0.61		0.69	0.59	
0.01	0.76	0.81		0.94	0.78	

[a] Disease severity for all categories is rated according to a disease index: 1 = no mildew colonies, 2 = 1–4, 3 = 5–16, 4 = 17–64, and 5 = >64 mildew colonies per plant 30 days after inoculation.
[b] Disease ratings are based on the disease index above: 1 = immune (I), 1.1–1.3 = highly resistant (RH), 1.4–1.9 = resistant (R), 2.0–3.1 = susceptible (S), and >3.1 = highly susceptible (SH). The greatest disease index score for leaf surface and for inflorescence were used to assign disease ratings.
[c] These ratings were primarily for mildew on pedicels but also included that on sepals and peduncles.

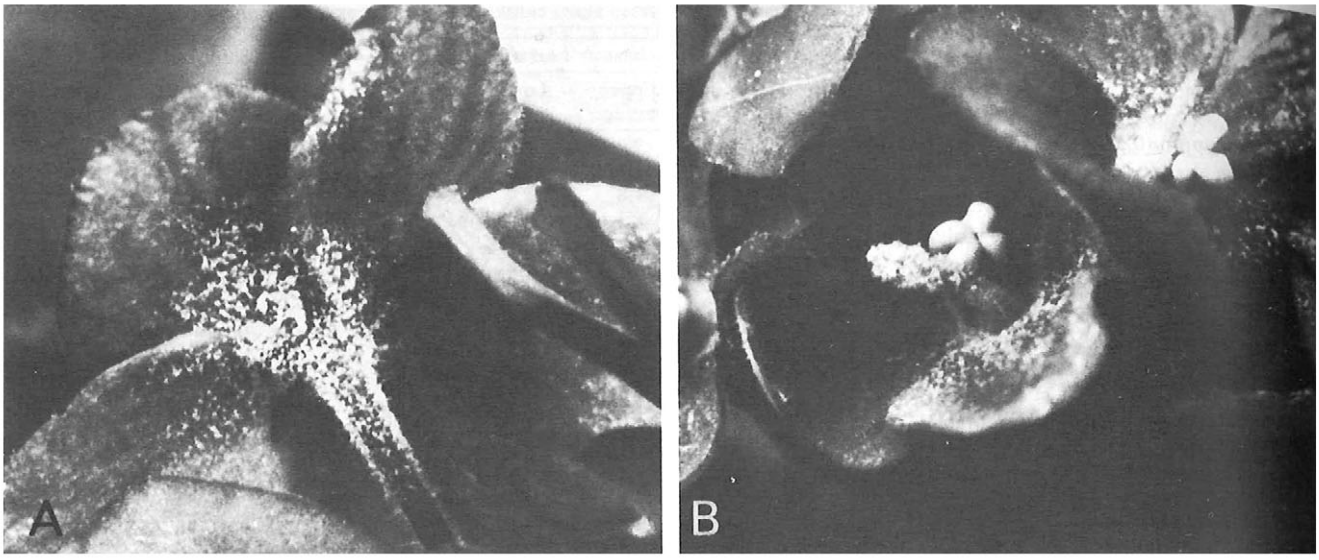

Fig. 1. Powdery mildew (*Oidium* sp.) on (**A**) sepal and pedicel and (**B**) pistil of African violet.

Table 2. Eradicative action of fungicides applied 25 May and 4 June against powdery mildew (*Oidium* sp.) of Erica African violet

Treatment (oz a.i./100 gal water[a])	Disease severity[b]						Phytotoxicity[c]
	25 May	28 May	4 June	14 June	25 June	4 July	28 May
Benomyl 50WP							
4	4	1.2	1.0	1.0	1.0	1.0	1.0
2	4	1.2	1.2	1.0	1.0	1.0	1.0
1	4	1.0	1.2	1.0	1.2	1.5	1.0
Dinocap 25WP							
2	4	2.0	2.0	1.2	1.5	2.0	3.0
1	4	2.0	1.5	1.2	1.5	2.2	2.2
Sulfur 95WP							
16	4	2.5	2.0	1.2	2.2	1.8	2.5
NaClO							
262 ppm	4	1.8	2.0	2.0	3.2	3.0	3.8
131 ppm	4	2.2	2.8	2.8	3.5	3.8	3.0
Sterile distilled water[d]	4	2.5	2.0	3.5	4.5	5.0	1.0
Control							
Inoculated	4	4.2	4.5	4.5	4.8	5.0	...
Uninoculated	1	1.0	1.5	2.0	3.2	3.5	...
LSD 0.05		0.8	0.9	0.8	0.7	0.8	1.0
0.01		1.1	1.2	1.1	0.9	1.1	1.3

[a] Except NaClO, which is given as ppm. Note that 4 oz a.i./100 gal = 114 g/380 L.
[b] Disease severity is based on the disease index: 1 = no mildew; 2 = 1–4; 3 = 5–16; 4 = 17–64; 5 = >64 mildew colonies (over 50% of the upper epidermal leaf surface covered in mildew)/plant.
[c] Phytotoxicity is indicated by a scale of 1 to 5 with 1 indicating none and 5 indicating severe necrotic spotting of blossoms. Phytotoxicity was not observed on foliage except for slight marginal necrosis and cupping with 262 ppm NaClO.
[d] For each of 7 days beginning 25 May, plants were sprayed with sterile distilled water until runoff.

fibrosin bodies. According to Yarwood's key (5), these conidial characteristics place the organism in the genus *Sphaerotheca*.

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LITERATURE CITED

1. FORSBERG, J. L. 1975. Diseases of Ornamental Plants. Univ. of Ill., Urbana-Champaign. 220 pp.
2. MANNING, W. J. 1974. Disease control for commercial floricultural plants in Massachusetts. Florogram Vol. 7, March-April. 29 pp.
3. SHARVELLE, E. G. 1969. Chemical Control of Plant Diseases. Univ. Publ., College Station, TX. 340 pp.
4. PIRONE, P. P. 1978. Diseases and Pests of Ornamental Plants, 5th ed. John Wiley & Sons, New York. 566 pp.
5. YARWOOD, C. E. 1978. History and taxonomy of powdery mildews. Pages 1-37 in: D. M. Spencer, ed. The Powdery Mildews. Academic Press, New York. 565 pp.