

KALANCHOE POWDERY MILDEW

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Interest in growing kalanchoe as a greenhouse pot plant has increased in North Carolina in recent years with the introduction of a number of new and improved hybrid cultivars. A limiting factor in growing kalanchoe in the greenhouse is powdery mildew, caused by the fungus, Sphaerotheca humulis f. sp. fuliginea. This article reports results of experiments conducted at North Carolina State University concerning 1) temperatures favorable for disease development, 2) evaluation of cultivars for resistance, and 3) evaluations of fungicides for control of powdery mildew of kalanchoe.

Rooted cuttings were provided through the courtesy of Mikkelsens, Inc., Ashtabula, Ohio, J and L Plants, Inc., Canyon, Texas and by New River Nursery, Hubert, N. C. Cuttings were transplanted to unamended Pro-Mix B (Premier Peat Moss Corp., N. Y.) in 4-inch clay pots. Except as indicated plants were grown during spring and summer (long days) in a greenhouse using an evaporative-cooling system and whitewash

shading in an effort to maintain temperatures of 65-85°F. To study the effect of temperature on disease development, plants were grown in separate greenhouse sections at four day/night temperature regimes: 68/48, 77/59, 86/68 and 95/77°F. These temperature ranges were maintained most of the time with the aid of air conditioning, evaporative-cooling pads and shading; however, the maximum temperatures were occasionally exceeded.

Plants were fertilized 3 to 4 weeks after potting with 1 tsp/pot of 18-9-13 Osmocote (controlled release fertilizer, Sierra Chem. Co., Newark, Calif.). Powdery mildew first became visible on leaves of 'Vulcan' and 'Exotic' 7-10 days after inoculation.

The most favorable day/night temperature regime for disease development was 77/59°F. This temperature range is also very favorable for growth of kalanchoes.

Reaction of kalanchoe cultivars to inoculation with the powdery mildew fungus varied from highly susceptible to apparent immunity (Table 1). The highly susceptible cultivars 'Vulcan', 'Zora', and the 'Exotic' types became completely covered with mildew 30 days after inoculation while all the Norbert Bull types and 'Ramona', 'Cavalier', 'Red Empress' and 'Selection' remained healthy and free of mildew. 'Kardinal' did not become completely covered with mildew but instead infected leaves rapidly became chlorotic and defoliated prematurely. An occasional spot of mildew was found on 'Gelbe Melody' but mildew on this cultivar would appear to be insignificant except, perhaps, as a carrier of mildew inoculum for more susceptible cultivars.

Fungicides were evaluated in separate trials on 'Vulcan' and 'Exotic' as eradicants and as protectants (Table 2). As eradicants, they were applied twice, 7 days apart, to plants previously inoculated and uniformly diseased. Recommended rates of Benlate^R, Karathane^R, Afugan^R, Sulfur, Topsin M^R and Cela W524^R all gave outstanding control of powdery mildew. Karathane^R, sulfur and Cela W524^R were less residual and somewhat less effective than others. Doubling the usually recommended rate generally did not increase fungicide effectiveness. Several fungicides used as eradicants were slightly phytotoxic on nonflowering plants. Scabby lesions were observed on plants sprayed with double the normally recommended rate of Karathane^R, Parnon^R and Topsin M^R.

As protectants, fungicides were applied to healthy plants once and allowed to dry 24 hours. Then plants were inoculated with spores of the powdery mildew fungus. Benlate^R was exceptional; however, all fungicides except Karathane^R and Parnon^R gave excellent control for 20 days after inoculation. After 34 days all materials, effective after 20 days, retained their protectiveness except Bravo^R and sulfur. Since the incubation period (interval of time between inoculation and the appearance of mildew) under the conditions of this test varied from 7-10 days, protection from

Table 1. Reaction of kalanchoe cultivars to inoculation with the powdery mildew fungus.

Cultivar	Rating
<u>WYSS/GROB types:</u>	
Feuerball	Resistant
Feuerzauber	Resistant
Gelbe Melody	Resistant (highly)
Kardinal	Susceptible
Rotkappchen	Resistant
Saturn	Susceptible
Solferinopurpur	Susceptible
<u>NORBERT BULL types:</u>	
Cherie	Immune
Granat	Immune
Korall	Immune
Roter Pfeffer	Immune
<u>IRWIN HYBRIDS:</u>	
Exotic	Susceptible (highly)
Exotic Gold	Susceptible (Highly)
Exotic Yellow	Susceptible (highly)
Jean	Susceptible (slightly)
Light Pink Jean	Susceptible (slightly)
<u>MISCELLANEOUS:</u>	
Cavalier	Immune
Orchid	Susceptible
Ramona	Immune
Red Empress	Immune
Salmon Pink	Susceptible (slightly)
Selection	Immune
Vulcan	Susceptible (highly)
Zora	Susceptible (highly)

infection afforded by a single application of the above fungicides was about 3 weeks. Longer protection could be expected where plants are watered without wetting the foliage.

In separate tests, fungicides were also applied as protectants on flowering plants of the Wyss/Grob and Norbert Bull types and on 'Vulcan'. Less mildew developed on the older flowering than on the younger nonflowering plants of the same cultivars. None of the materials listed in Table 2 were phytotoxic to open flowers of the cultivars listed above except Karathane^R. Karathane^R caused a slight marginal necrosis of petals of all varieties at 4 oz/100 gal and moderate to severe necrosis of petals at 8 oz/100 gal. Most severely affected were blossoms of 'Solferinopurpur'.

A more detailed account of this study is available upon request from the author.

The use of trade names in this publication does not imply endorsement by the North Carolina Agricultural Experiment Station of the products named nor criticism of similar ones not mentioned.

Table 2. Fungicides and rates used.

Fungicide		Rate
Trade Name	Common Name	oz/100 gal water
Benlate ^R 50W	benomyl	4 and 8
Bravo ^R 75W	chlorothalonil	32 and 64
Karathane ^R	dinocap	4 and 8
Parnon ^R 4EC	parinol	4 and 8
Afungan ^R 30EC	pyrazophos	2 and 4
Sulfur 95W	sulfur	48 and 96
Topsin M ^R 70W	thiophanate methyl	8 and 16
Cela ^R W524 6.5EC	triforine	50 and 100

^RThis symbol signifies "registered trademark."

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