

SCALE ROT TESTS OF HARDY HYBRID LILIES¹

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Abstract

Twenty-two *Lilium* cultivars and one species showed differences in susceptibility to scale rot pathogens *Cylindrocarpon radiculicola* Wr. and *Colletotrichum dematium* (Pers. ex Fries) Duke in a pot test. In another pot test the same 22 cultivars and 2 *Lilium* species showed differences in susceptibility to the scale rot pathogen *Fusarium oxysporum* Schlecht f. *lilii* Imle.

F. oxysporum caused more rot than the other pathogens; only the cultivar 'Rose Cup' showed considerable resistance to this fungus. Several of the test entries consistently showed resistance to the other rot organisms. Further breeding work should be directed particularly towards obtaining resistance to fusarium scale rot.

Introduction

Scale and bulb rots were reported by Smith and Maginnes (5) to be limiting factors in the successful cultivation of hardy hybrid lily cultivars in Saskatchewan, particularly in heavy soils. By means of a greenhouse scale test in 1966 (5) differences in resistance to the fungal pathogens *Cylindrocarpon radiculicola* Wr., *Colletotrichum dematium* (Pers. ex Fries) Duke and *Rhizoctonia solani* Kuhn were demonstrated in six cultivars from the collection of Patterson Hybrids at the Department of Horticulture, University of Saskatchewan at Saskatoon (7). Resistance to scale rot caused by *Fusarium oxysporum* Schlecht f. *lilii* Imle was not tested in 1966. This pathogen is a common cause of severe basal rot of lilies in Saskatchewan (5) and elsewhere in North America (2). This paper reports the results of further scale tests on a wider range of lily cultivars and species in 1967 and 1968.

Materials and methods

Test 1. In 1967, 19 Patterson, 1 Preston and 2 Skinner Hybrids (4), and a parental species 'Willmott' (*Lilium davidi* var. *willmottiae*) (8) (Table 1) were included in a 10-week test for resistance to scale rot caused by *C. radiculicola* and *C. dematium*. The test fungi were isolated from diseased lily bulbs.

Test 2. In 1968, scales of the lilies as in Test 1 (1967) and bulblets of the prairie lily, *Lilium phi-*

adelphicum L. var. *andinum*⁴ (Nutt.) Ker. were included in a 12-week test for resistance to *F. oxysporum* f. *lilii*. A mixture of three isolates of the fungus from diseased lily bulbs was used as inoculum.

In both tests the methods of pathogen culture, soil and pot sterilization, pot inoculation, and scale preparation were the same as in the test already reported (5), but the scales were not wounded. Ten scales of one cultivar or species were planted in a 6-inch pot: in the case of the prairie lily, six bulblets were planted per pot. Each cultivar or species was replicated four times in inoculated and check treatments. The severity of scale rot was assessed using a 0 to 4 rating (5). Individual scale or bulblet ratings were converted to a pot index figure.

Results and discussion

Test 1. Although only "clean", undamaged scales were used, some scale rot appeared in all the cultivars grown in the uninoculated soil (Table 1). Most of this rot was due to *Penicillium* species, which frequently develop on bulbs in low temperature storage (2, 5). Occasionally scales showed insect damage and bacterial soft rot: these were recorded as rotted. The presence of rot on scales in uninoculated soil suggests that either the preliminary wash and dip in hypochlorite solution did not control incipient rot or that other rotting organisms were introduced in the top watering of the pots.

There was significantly more scale rot in *Cylindrocarpon*- than in *Colletotrichum*-inoculated soil (Table 1). Some of the cultivars were consistent in their reaction to the pathogens. 'Fuchsia Queen',

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⁴ This lily, the floral emblem of Saskatchewan, flourishes on the lighter soils of the open woodland and prairie. It was tested as a possible parental disease resistant species.

Table 1. The reaction of scales of 22 Lilium cultivars and 1 species to Cylindrocarpon radicola and Colletotrichum dematium

Parental component [†]	Cultivar	Average rot rating*			
		Overall	Check	<u>Cylindrocarpon</u>	<u>Colletotrichum</u>
	Willmott	1.05 a**	0.92 ab	1.22 a	1.00 a
W	Rose Cup	1.29 ab	1.00 abc	1.35 abc	1.52 bcdefg
	Maxwill	1.30 ab	1.15 bcd	1.60 abcde	1.15 abc
W	Lemon Queen	1.31 ab	1.05 abc	1.27 ab	1.60 cdefgh
W	Apricot Glow	1.34 abc	1.15 bcd	1.75 bcde	1.12 ab
WM	White Gold	1.34 abc	1.07 abc	1.57 abcde	1.37 abcdefg
W	Red Torch	1.39 abc	1.00 abc	1.95 defg	1.22 abcd
WM	Burnished Rose	1.43 abc	1.37 bcde	1.55 abcde	1.35 abcdef
W	Pink Charm	1.47 abc	1.25 bcde	2.00 cdefgh	1.17 abc
?	Crimson Queen	1.50 abc	1.42 bcde	1.47 abcd	1.60 cdefgh
WM	Rose Queen	1.51 abc	1.30 cde	1.95 defgh	1.27 abcde
W	Lillian Cummings	1.59 bcd	1.52 cde	1.75 bcde	1.50 abcdefg
W	Rosalind	1.60 bcd	1.47 cde	1.55 abcde	1.77 fghjk
?	Primrose Lady	1.60 bcd	1.25 bcde	2.07 efgh	1.47 abcdefg
?	crimson Beauty	1.65 bcd	0.92 ab	2.30 ghj	1.72 defghj
W	Edith Cecilia	1.72 bcd	1.50 cde	1.77 bcdef	1.87 ghjk
WM	White Princess	1.77 bcde	1.60 de	1.87 defg	1.82 fghjk
W	Bronze Queen	1.86 cdef	1.50 cde	1.85 cdefg	2.22 jk
W	Dunkirk	2.04 defg	0.62 a	3.25 l	2.25 k
W	Rose Dawn	2.07 defg	1.47 cde	2.67 jk	2.05 hjk
W	Orchid Queen	2.25 efg	2.10 e	2.45 hjk	2.22 jk
W	Fuchsia Queen	2.32 fg	2.02 e	2.75 jk	2.17 jk
W	Jasper	2.44 g	2.25 e	2.82 kl	2.25 k
Mean rot		1.65	1.34	1.64	1.95

* 0 was no visible rot and 4, complete rot.

** Duncan's multiple range test (1) at the 5% level of significance.

†

W = 'Willmott' (L. davidi var. willmottiae) (8); M = 'Maxwill' (L. X 'Maxwill') (3); ? = Parentage uncertain.

'Jasper' and 'Dunkirk' were consistently very susceptible to both pathogens. 'Willmott' was consistently resistant. 'Dunkirk', the cultivar least affected by rot in the uninoculated soil, and 'Crimson Beauty'⁵ were particularly susceptible to C. radicola. In both of these cultivars it was necessary to use small inner scales for the tests, since the outer scales of the bulbs showed severe storage rot. This may have affected their reaction in the test.

⁵ Name changed to 'Cardinal Beauty' in 1969 (6).

⁶ Name changed to 'Tiger Queen' in 1969 (6).

The ranking of the cultivars 'Dunkirk' and 'Jasper', as very susceptible, 'Lillian Cummings' and 'Crimson Queen'⁶ as intermediate, and 'Burnished Rose' and 'Apricot Glow' as less susceptible (Table 1) was in agreement with previous test results (5).

Although 'Willmott' was outstanding in its resistance to scale rot and 'Maxwill' reasonably rot resistant, cultivars derived from these parents (Table 1) showed a wide range of rot reaction. The parentage of many of the cultivars is known to be complex at least on one side. We have not yet fully determined the rot resistance of all parents, but the test method which has been developed is probably suitable for this task.

Test 2. After 12 weeks, scales of all cultivars showed rot in uninoculated soil (Table 2). The severity of this rot was of the same order as that in uninoculated soil in the previous test (Table 1). Complete bulblets of the prairie lily, however, showed no rot in uninoculated soil.

Table 2. Reaction of scales of Lilium cultivars and 1 species and bulblets of another species to Fusarium oxysporum f. lilii

Cultivar or species	Average rot rating**	
	Check	<u>Fusarium</u>
Rose Cup	1.2 bc**	2.9 a
Apricot Glow	1.3 bc	3.3 ab
Crimson Queen	1.3 bc	3.3 ab
Burnished Rose	1.2 bc	3.5 ab
Edith Cecilia	1.2 bc	3.5 ab
Lillian Cummings	1.7 bc	3.6 ab
Rosalind	1.3 bc	3.6 ab
Bronze Queen	1.1 bc	3.7 b
Crimson Beauty	1.4 bc	3.7 b
Orchid Queen	1.0 b	3.7 b
Pink Charm	1.8 c	3.7 b
Primrose Lady	1.3 bc	3.8 b
Fuchsia Queen	1.4 bc	3.8 b
White Gold	1.5 bc	3.8 b
Dunkirk	1.1 bc	3.9 b
Lemon Queen	1.5 bc	3.9 b
Red Torch	1.6 bc	3.9 b
Rose Queen	1.6 bc	3.9 b
Willmott	1.1 bc	3.9 b
White Princess	1.4 bc	3.9 b
Jasper	1.2 bc	4.0 b
Maxwill	1.2 bc	4.0 b
Rose Dawn	1.1 bc	4.0 b
<u>L. philadelphicum</u> var. <u>andinum</u>	0.0 a	4.0 b

* 0 was no visible rot and 4, complete rot.

** Duncan's multiple range test (1) at the 5% level of significance.

F. oxysporum f. lilii caused moderate to severe rotting of lily scales and bulblets of the test entries, and in all it prevented bulblet formation. The scales or bulblets of four test entries were completely rotted. Only 'Rose Cup' appeared to show some worthwhile resistance. This variety also showed overall rot resistance (Table 1). Neither 'Willmott' nor 'Maxwill' were resistant to F. oxysporum.

These results indicate that in breeding new hardy lily varieties particular attention should be paid to resistance to F. oxysporum. Several cultivars appeared to possess some resistance to the other pathogens, but only 'Rose Cup' showed any degree of resistance to F. oxysporum f. lilii. It may be profitable to test the resistance of the parents of this cultivar. Because fungicidal bulb dips and soil drenches were not effective in controlling scale rot (unpublished results), breeding for resistance may offer a practical means of control.

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