

Screening for Resistance to *Pythium* Root Rot among Twenty-three *Caladium* Cultivars¹

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Pythium root rot, caused by *Pythium myriotylum* (Ridings and Hartman 1976), is a very damaging disease to caladium plants (*Caladium × hortulanum*). Use of disease-resistant cultivars has been an effective and economically viable strategy for integrated management of major diseases in numerous crops. This strategy could be used to control *pythium* root rot in caladium if resistant cultivars could be identified or developed. In an evaluation of 19 major commercial cultivars, 'Candidum', 'Candidum Jr.', 'Freida Hemple', and 'White Christmas' were found to have moderate levels of resistance to *Pythium*. To find more resistant cultivars, 23 additional commercial cultivars were screened using the same *Pythium* isolates, inoculation and evaluation procedures as described earlier (Deng et al. 2004).

Eight cultivars, 'Florida Cardinal', 'Marie Moir', 'Pink Symphony', 'Postman Joyner', 'Rosalie', 'Rosebud', 'Triumph de L'Exposition', and 'White Wing', were highly susceptible to *pythium* root rot; 35–94% of their root tissue became rotted within 10 days after inoculation and they had a rating of 2.9–1.7. 'Rosalie' and 'White Wing', two lance-leaved cultivars, were the most susceptible to *pythium* root rot; they lost more than 85% of their roots to rotting within 10 days after inoculation. Twelve cultivars, 'Buck', 'Florida Calypso', 'Jackie Suthers', 'June Bride', 'Kathleen', 'Lance Whorton', 'Mrs. Arno Nehrling', 'Pink Cloud', 'Pink Gem', 'Scarlet Beauty', 'Florida Sunrise', and 'Florida White Ruffles', were susceptible to *Pythium* infection. They had 15–35% of their root tissue rotted within 10 days after inoculation and a rating of 3.9–3.0. Three cultivars, 'Etta Moore', 'Apple Blossom', and 'Florida Blizzard', showed moderate levels of resistance to *pythium* root rot. They scored a root rot rating of 4.0–4.3, and only 5–14% of their root tissue was rotted 10 days after inoculation. The inoculated plants of 'Etta Moore' and 'Florida Blizzard' were maintained for 2 more weeks after the 10th day evaluation, and more than 50% of their root tissues still appeared healthy by the end of this extra period of time, while the inoculated plants of 'Florida Cardinal' and 'Marie Moir', two very susceptible cultivars, had all their roots rotted due to *Pythium* infection. *P. myriotylum* was re-isolated from the rotting roots from the inoculated plants. Control plants that received 5 mL of

sterile water in the experiments did not show rotting symptoms during the evaluation.

Pythium infection caused several leaf symptoms on caladium plants, including discoloration and necrotic blotches on blades, epinasty and wilting on petioles, and whole leaf collapse (Deng et al. 2004). These symptoms were observed again on the 23 cultivars screened and they appeared as early as 3 days after *Pythium* inoculation. When the severity of these leaf symptoms was rated on a scale of 1 to 5, those three cultivars showing moderate root rot resistance maintained an average leaf loss score of 3.9, the 12 susceptible cultivars had a average score of 3.2, and the eight very susceptible cultivars had an average score of 2.6 (Table 1).

A linear relationship between root rotting scores and leaf loss scorings was present in the 19 major caladium cultivars evaluated previously (Deng et al. 2004). This relationship was also observed with the 23 cultivars in this study. This relationship highlights the importance of effective management of *pythium* root rot in caladium pot plant and field tuber production, as root tissue rotting caused by *Pythium* infection could result in rapid and dramatic losses of plant leaves, and consequently lower aesthetic values of pot or landscape plants and tuber yield of propagation fields.

Commercial production of caladium tubers in Florida generally starts in March each year and extends over a 7- to 8-month period, during which the presence of *Pythium* in combination with high temperatures and high soil moisture contents could cause significant losses to the caladium growers (Ridings and Hartman 1976). The three cultivars identified in this screening, plus the four reported previously (Deng et al. 2004), may serve as an integral part of the management strategy to control this soil-borne disease and reduce its damage.

The majority (35 out of 42) of the cultivars evaluated in this study and in the previous one (Deng et al. 2004) were susceptible or very susceptible to *P. myriotylum*. This highlights the need for development of new resistant cultivars for root rot disease control. Such need is particularly strong in several leaf shape/color groups, as

four out of the seven cultivars of moderate resistance are in the fancy white cultivar group, one in the fancy red or pink and lance multicolor group each, and no resistant cultivars identified in the rest other four groups. The seven cultivars of moderate resistance may serve as an important source of resistance for breeding for new resistant cultivars or for further improvement of caladium resistance to *P. myriotylum*.

One of the recent releases, 'Florida Blizzard' (Harbaugh et al. 2002), has moderate resistance to *Pythium* (Table 1). Comparison of its resistance level to that of its parents ('Aaron' × 'White Christmas') reveals that 'Florida Blizzard' has a resistance level higher than the mid-parent value and is as resistant to *Pythium* as its resistant parent 'White Christmas'. This seems to indicate the potential of developing new cultivars that could be as resistant as these identified cultivars.

Literature Cited

Bell, M.L., G.J. Wilfret, and D.A. Devoll. 1998. "Survey of caladium tuber producers for acreage of cultivars grown." *Proc. Fla. State Hort. Soc.* 111:32–34.

Deng, Z., B.K. Harbaugh, R.O. Kelly, T. Seijo and R.J. McGovern. 2004. "Pythium root rot resistance in commercial caladium cultivars." *HortScience* 40:549–552.

Harbaugh, B.K., B.D. Miranda, and G.J. Wilfret. 2002. "Florida Blizzard – A white fancy-leaved caladium for large pots or shady landscape." *HortScience* 37:844–846.

Ridings, W.H and R.D. Hartman. 1976. "Pathogenicity of *Pythium myriotylum* and other species of *Pythium* to caladium derived from shoot-tip culture." *Phytopathology* 66:704–709.

Table 1. Root rot, leaf loss and resistance levels of 23 commercial caladium cultivars inoculated with *P. myriotylum*.

Caladium Cultivar	Leaf shape and color ^z	Root rot rating ^y	Root rot resistance ^y	Leaf loss rating ^x
Etta Moore	Lance multicolor	4.3	MR	4.1
Apple Blossom	Fancy pink	4.1	MR	4.0
Florida Blizzard	Fancy white	4.0	MR	3.6
Kathleen	Fancy pink	3.9	S	3.8
Mrs. Arno Nehrling	Fancy multicolor	3.9	S	3.8
June Bride	Fancy white	3.8	S	2.9
Pink Gem	Lance pink	3.8	S	4.0
Florida Sunrise	Fancy multicolor	3.6	S	2.6
Pink Cloud	Fancy pink	3.5	S	2.9
Jackie Suthers	Lance white	3.5	S	3.4
Florida Calypso	Fancy multicolor	3.4	S	3.2
Florida White Ruffles	Lance white	3.3	S	3.1
Lance Whorton	Lance multicolor	3.3	S	3.4
Scarlet Beauty	Fancy red	3.1	S	3.2
Buck	Fancy red	3.0	S	3.0
Pink Symphony	Lance pink	2.9	VS	3.1
Triumph de L'Exposition	Fancy multicolor	2.7	VS	2.9
Postman Joyner	Fancy red	2.2	VS	2.1
Rosebud	Fancy pink	2.2	VS	2.8
Florida Cardinal	Fancy red	2.1	VS	2.9
Marie Moir	Fancy multicolor	2.1	VS	2.5
Rosalie	Lance red	1.8	VS	2.4
White Wing	Lance white	1.7	VS	2.0

^z Leaf shape and color classification according to Bell et al. (1998).

^y Root rot ratings were made 10 days after inoculation, on a scale of 1 to 5. 1 = 100%, 1.5 = 95-99%, 2 = 85-94%, 2.5 = 84-55%, 3 = 35-54%, 3.5 = 15-34%, 4 = 5-14%, and 4.5 = 1-4%, respectively, of root tissue on the root ball surface rotted, and 5 = all roots healthy without any rotting. Resistance to pythium root rot was categorized as follows, > 4.5: resistant (R), < 4.5 but > 4.0: moderately resistant (MR), < 4.0 but > 3.0: susceptible (S), and < 3.0: very susceptible (VS).

^x Leaf loss ratings were made 10 days after inoculation, on a scale of 1 to 5. 1 = all leaves wilted or lost, 2 = most (> 50%) leaves wilted or lost, 3 = some leaves wilted (~ 30%) and showing chlorosis, 4 = almost normal, but showing chlorosis and some stunting, and 5 = all leaves growing normally.

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