Evaluation of Watermelon and Related Species for Resistance to Race 1W Powdery Mildew

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ABSTRACT. **Powdery mildew [*Podosphaera xanthii* (Castagne) Braun & Shishkoff (syn. *Sphaerotheca fuliginea* auct. p.p.)] is now a common disease on watermelon [*Citrullus lanatus* (Thunb.) Matsum. & Nakai] in the United States. In this study, the entire available U.S. Plant Introduction collection of *Citrullus* Schrad. ex Eckl. & Zeyh. species was evaluated for resistance to *P. xanthii* race 1W. The collection consists of four *Citrullus* species and one *Praecitrullus* Pangalo species [*C. lanatus* var. *citroides* (L.H. Bailey) Mansf., *C. colocynthis* (L.) Schrad., *C. rehmii* De Winter, and *P. fistulosus* (Stocks) Pangalo]. Wild-type accessions tended to be more resistant more often than the cultivated species, *C. lanatus* var. *lanatus*. None were immune, eight of the 1573 accessions exhibited high levels of resistance, and another 86 demonstrated intermediate resistance. Stem and leaf disease severity were weakly correlated (r^2 = 0.64, P = 0.001). The majority of accessions having resistance were collected in Zimbabwe. Resistance was found in four species.**

Powdery mildew affects many cucurbit crops worldwide, limiting yield and increasing the need for fungicide application. Except for a few scattered cases of this disease on watermelon fruit (Ivanoff, 1957; McLean, 1970; Robinson and Provvidenti, 1975), powdery mildew has not been a problem for this crop until recently. Since 1996, a new pathotype of powdery mildew has been damaging watermelon crops in the United States (Davis et al., 2001; Keinath, 2000; McGrath, 2001a). Outbreaks of watermelon powdery mildew pathotypes, races 1W and 2W, on watermelon have been confirmed in South Carolina, Georgia, Florida, Oklahoma, Texas, Maryland, New York, Arizona, and California and were determined using melon (*Cucumis melo* L.) differentials (Davis et al., 2001; McGrath, 2001a).

Powdery mildew can decrease plant canopy, reduce yields through decreased fruit size and number of fruit per plant, and reduce fruit quality, flavor, and storage life (Keinath and DuBose, 2004; McGrath and Thomas, 1996). The reduced canopy may also result in sunscald of the remaining fruit, making them unmarketable. Detection of powdery mildew on watermelon can be difficult because the presence of the pathogen is less apparent than on melon. There are at least two symptoms on watermelon: chlorotic spots that occur on leaves accompanied by little or no sporulation and only a small amount of mycelial development, or mycelial and conidial development on either leaf surface with or without the associated chlorotic spots (Davis et al., 2001).

Podosphaera xanthii and *Golovinomyces cichoracearum* (D.C.) V.P. Heluta (formerly *Erysiphe cichoracearum* D.C.) are the predominant fungi that incite powdery mildew in cucurbits. These organisms differ in virulence against cucurbit species, and in their sensitivity to fungicides (Bertrand, 1991; Epinat et al., 1993; McGrath, 2001a, 2001b). Only one species, *P. xanthii*, has been reported on watermelon in the United States. Using differential reactions of 10 melon (*C. melo*) genotypes, seven pathogenically distinct races of *P. xanthii* can be differentiated (McCreight et al., 1987; Pitrat et al., 1998). More recently, McCreight (2006) reported that there may be as many as 28 races of *P. xanthii* on melon based on the reported reactions of 30 melon genotypes with as many as eight variants of race 1, and six variants of race 2. The significance of these races defined on melon is not known for watermelon.

Resistance of *P. xanthii* to certain fungicides has been detected, and application of fungicides to undersides of leaves

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Table 1. Ranking of the mean disease severity rating (DSR) from six replicates of *Citrullus* species and *Praecitrullus* species PI lines that demonstrated resistance or intermediate resistance to race 1W *Podosphaera xanthii*.

	Mean DSR (1–12 scale)[z]					
Accession	Total plant	Leaf	Cotyledon	Stem	Species[y]	Seed origin
Grif 5601	2.0	2.0	2.0	2.0	P	India
PI 482255	2.5	2.5	2.5	2.5	L	Zimbabwe
PI 388770	2.7	3.0	2.5	2.5	Cc	Morocco
PI 482362	2.7	2.5	3.0	2.5	L	Zimbabwe
PI 381750	2.8	2.5	3.5	2.5	P	India
PI 459074	2.8	3.0	3.0	2.5	L	Botswana
PI 386015	3.0	3.0	3.0	3.0	Cc	Iran
PI 482248	3.0	3.3	3.0	2.7	L	Zimbabwe
PI 381742	3.2	2.5	4.0	3.0	P	India
PI 532738	3.2	3.3	3.3	3.0	c	Zaire
PI 500331	3.3	3.4	3.2	3.4	c	Zambia
PI 508443	3.3	4.0	3.0	3.0	L	South Korea
PI 560008	3.3	3.0	4.0	3.0	L	Nigeria
PI 525082	3.4	4.0	3.5	2.8	Cc	Egypt
PI 482264	3.4	3.3	3.7	3.3	L	Zimbabwe
PI 482258	3.5	3.5	3.5	3.5	L	Zimbabwe
PI 217938	3.6	3.7	3.3	3.7	P	Pakistan
PI 250145	3.6	4.0	3.3	3.3	P	Pakistan
PI 482333	3.6	3.3	3.7	3.7	c	Zimbabwe
PI 526233	3.6	4.0	3.3	3.3	L	Zimbabwe
PI 482313	3.6	3.8	3.5	3.5	L	Zimbabwe
PI 482328	3.6	3.5	3.8	3.5	L	Zimbabwe
PI 500323	3.6	4.0	3.4	3.4	L	Zambia
PI 505585	3.6	3.8	3.6	3.4	L	Zambia
PI 169241	3.7	3.0	4.0	4.0	L	Turkey
PI 179239	3.7	4.0	3.5	3.5	L	Turkey
PI 179881	3.7	3.0	4.5	3.5	c	India
PI 179885	3.7	4.0	4.0	3.0	L	India
PI 184800	3.7	4.0	3.5	3.5	L	Nigeria
PI 271749	3.7	4.0	3.7	3.3	L	Afghanistan
PI 296334	3.7	3.3	4.5	3.3	c	South Africa
PI 381731	3.7	3.5	4.0	3.5	L	India
PI 386025	3.7	4.5	3.5	3.0	Cc	Iran
PI 482251	3.7	3.3	3.8	4.0	L	Zimbabwe
PI 482278	3.7	3.8	4.0	3.3	L	Zimbabwe
PI 482295	3.7	3.5	4.0	3.5	L	Zimbabwe
PI 482302	3.7	3.3	3.8	4.0	c	Zimbabwe
PI 482355	3.7	3.3	4.0	3.8	c	Zimbabwe
PI 500332	3.7	3.3	4.3	3.5	c	Zambia
PI 512343	3.7	3.0	5.0	3.0	L	Spain
PI 525088	3.7	3.3	4.0	3.7	L	Egypt
PI 482312	3.7	3.8	3.5	3.8	c	Zimbabwe
PI 482259	3.7	4.0	3.8	3.4	c	Zimbabwe
PI 482308	3.7	4.0	3.6	3.6	c	Zimbabwe
PI 482380	3.7	3.6	3.8	3.8	L	Zimbabwe
PI 500334	3.7	3.8	3.6	3.8	c	Zambia
PI 270545	3.8	3.5	4.0	3.8	L	Sudan
PI 482268	3.8	4.3	3.5	3.5	L	Zimbabwe
Grif 5602	3.8	3.7	4.3	3.3	P	India
PI 189318	3.8	3.7	3.7	4.0	L	Nigeria
PI 500302	3.8	3.7	4.0	3.7	c	Zambia
PI 500308	3.8	3.8	4.0	3.6	c	Zambia
PI 500342	3.8	3.8	3.6	4.0	L	Zambia
PI 179875	3.8	4.0	4.3	3.3	P	India
PI 180275	3.8	3.5	4.5	3.5	P	India

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is difficult and often requires the use of systemic materials to achieve adequate control of the disease (McGrath and Thomas, 1996). Recent work by Keinath and DuBose (2004) demonstrated effective control of powdery mildew race 2W on watermelon by alternating preventative applications of two fungicides: mancozeb and azoxystrobin.

Use of resistant watermelon cultivars in addition to fungicide applications should slow development of *P. xanthii* resistance to fungicides. We initially screened 100 watermelon plant introduction (PI) accessions for resistance to watermelon race 1W of *P. xanthii* (Davis et al., 2001). This led to the release of watermelon breeding line (PI 525088-PMR), which has intermediate resistance to race 1W *P. xanthii* (Davis et al., 2006a). The inheritance of resistance in that line to race 1W is multigenic (Davis et al., 2002) and appears to be independent from resistance to *P. xanthii* race 2W (Davis et al., 2002, 2006b; Thomas et al., 2005). In the current study, we screened the entire available U.S. Department of Agriculture, Agricultural Research Service (USDA-ARS), National Genetic Resources Program (NPGS) watermelon accessions for resistance to race 1W to identify additional resistance genes for control of this race.

Materials and Methods

Plant material. A total of 1573 *Citrullus* species and tinda (*P. fistulosus*) accessions from NPGS at the Southern Regional Plant Introduction Station, USDA-ARS, Griffin, GA, were evaluated. The accessions represent 75 countries of origin and five species, belonging to *C. lanatus* var. *lanatus*, *C. lanatus* var. *citroides*, *C. colocynthis*, *C. rehmii*, and *P. fistulosus*.

Ten *C. melo* differentials were included in all experiments to determine the race of *P. xanthii* present: 'Delicious 51', 'Edisto 47', Iran H, MR-1, 'Nantais Oblong', PI 124112, PI 414723, 'PMR 45', 'PMR 5', 'PMR 6', WMR 29, and 'Top Mark'. Differentials were supplied by C. Thomas and M. Pitrat and were included in all studies to verify the

Table 1. Continued.

Accession	Mean DSR (1–12 scale)[z]				Species[y]	Seed origin
	Total plant	Leaf	Cotyledon	Stem		
PI 277971	3.8	3.8	4.0	3.8	L	Turkey
PI 277994	3.8	3.5	4.5	3.5	L	Turkey
PI 279461	3.8	4.5	3.5	3.5	L	Japan
PI 379226	3.8	3.5	4.0	4.0	L	Yugoslavia
PI 381725	3.8	4.0	3.8	3.8	L	India
PI 482318	3.8	3.8	4.0	3.8	L	Zimbabwe
PI 482341	3.8	4.3	3.8	3.5	L	Zimbabwe
PI 482365	3.8	3.8	4.3	3.5	L	Zimbabwe
PI 500337	3.8	3.0	4.0	4.5	L	Zambia
PI 500338	3.8	3.8	4.0	3.8	L	Zambia
PI 500350	3.8	4.0	4.0	3.5	L	Zambia
PI 525083	3.8	4.0	3.8	3.8	c	Egypt
PI 526239	3.8	4.5	3.3	3.8	L	Zimbabwe
PI 559994	3.8	4.0	3.5	4.0	L	Nigeria
PI 632755	3.8	3.5	4.0	4.0	R	Namibia
PI 482252	3.9	4.0	3.6	4.0	c	Zimbabwe
PI 482319	3.9	3.6	4.0	4.0	c	Zimbabwe
PI 181936	3.9	3.7	4.3	3.7	L	Syria
PI 183398	3.9	3.7	3.7	4.3	L	India
PI 233556	3.9	4.3	4.0	3.3	L	Japan
PI 278006	3.9	3.7	4.0	4.0	L	Turkey
PI 381737	3.9	3.7	4.0	4.0	L	India
PI 381748	3.9	3.7	4.3	3.7	P	India
PI 500301	3.9	3.7	4.3	3.7	L	Zambia
PI 500312	3.9	4.2	3.5	4.0	L	Zambia
PI 247398	3.9	4.3	3.8	3.8	L	Greece
PI 381753	3.9	4.0	4.0	3.8	P	India
PI 482269	3.9	4.3	3.8	3.8	L	Zimbabwe
PI 482346	3.9	4.0	3.8	4.0	L	Zimbabwe
PI 482366	3.9	4.0	3.8	4.0	L	Zimbabwe
PI 482377	3.9	4.3	3.8	3.8	L	Zimbabwe
PI 508441	3.9	4.5	3.5	3.8	L	South Korea
PI 559997	3.9	3.8	4.0	4.0	L	Nigeria
PI 482288	3.9	4.0	4.0	3.8	L	Zimbabwe
PI 482307	3.9	4.0	4.0	3.8	c	Zimbabwe
PI 482373	3.9	4.0	4.0	3.8	L	Zimbabwe
PI 482378	3.9	3.8	3.8	4.2	L	Zimbabwe
PI 505595	3.9	4.0	4.0	3.8	L	Zambia

[z]Accessions were classified into resistant, intermediate, or susceptible classifications according to the DSR of six replicates for total plant (leaf, stem, and cotyledon). Lines were considered resistant if their total plant mean DSR was ≤3.0, intermediate if 3.1–4, and susceptible if ≥4.1.

[y]L = *Citrullus lanatus* var. *lanatus*; c = *C. lanatus* var. *citroides*; Cc = *Citrullus colocynthis*; P = *Praecitrullus fistulosus*; R = *Citrullus rehmii*.

powdery mildew race present. Race 1W was the only race detected in all experiments.

Greenhouse experiments. One seed each of the available *Citrullus* species and *P. fistulosus* PI accessions was randomly planted in Speedling flats (Sun City, FL) containing Redi-earth growth media (Scotts-Sierra Horticultural Products Co., Marysville, OH) in a greenhouse experiment with six replications. Replications were not performed concurrently. Seedlings were inoculated with the Lane, OK, race 1W *P. xanthii* isolate maintained on greenhouse-grown watermelon plants. Plants were inoculated two times a week for 3 weeks by brushing an infected leaf onto each seedling, starting at the two-leaf stage of growth. The plants were maintained under normal greenhouse conditions, and night/day temperatures were maintained by an automated system between 25 and 33 °C. Ratings were taken when 50% of the leaf surface area of susceptible differentials was visibly infected. Ratings were performed no later than 2 months after planting. Three ratings were made of each plant (stem, upper side of the leaves, and cotyledons) using the nonlinear 12-point method (Horsfall and Barratt, 1945). Accessions were classified into resistant, intermediate, or susceptible classifications according to the mean disease severity rating (DSR) of six replicates for total plant (leaf, stem, and cotyledon): ≤6%, resistant; >6% and ≤12%, intermediate; and >12%, susceptible. Out of 1573 PI lines tested, 13 did not germinate or experienced early death of seedlings.

A retest was performed on 35 PI accessions chosen for their geographical diversity from the 50 PI lines with the lowest average total plant ratings. Thirteen countries and three species or subspecies (*C. lanatus* var. *lanatus, C. lanatus* var. *citroides*, and *C. colocynthis*) were represented in the retest. Five replications of one plant of each selected PI accession were planted in a randomized complete block design, inoculated, and rated as above.

Statistical analysis. Data were transformed to real numbers and the data were analyzed with PROC GLM and PROC CORR using SAS (version 7; SAS Institute, Cary, NC). The data are summarized as averages of the replications for each study in Tables 1 and 2.

Results and Discussion

Evaluation of watermelon PI accessions for race 1W *P. xanthii* resistance. The *P. xanthii* strain present was race 1 as defined by the susceptibility of the following melon differentials: 'Delicious 51', Iran H, 'Nantais Oblong', and 'Top Mark' and resistance of all the other melon race differentials. Susceptibility of watermelon indicated that it was race 1W pathotype.

In each of the six replications, there was a range of symptoms from no detectable mycelia to 97% coverage on the entire plant. The majority of the PI accessions (92%) had mean detectable mycelia covering 12% to 50% of the plant surface (data not shown). Less than 1% of the PI accessions tested showed high or intermediate resistance. The 93 PI accessions with an average DSR below four (<12% mycelia coverage) for all plant parts tested (leaf, stem, and cotyledon) are listed in Table 1. In our judgment, all 93 of these accessions

Table 2. Ranking of the mean disease severity rating (DSR) for the retested *Citrullus* species PI lines for race 1W *Podosphaera xanthii* resistance.

	Mean DSR (1–12 scale)[z]				Mean DSR (1–12 scale)[z]		
Accession no.	Total plant	Leaf	Stem	Accession no.	Total plant	Leaf	Stem
388770	1.3	1.3	1.3	526233	3.5	3.7	3.3
505585	1.5	1.5	1.5	482255	3.5	4.0	3.0
386015	1.8	2.0	1.5	482258	3.5	4.0	3.0
270545	2.0	2.0	2.0	512343	3.5	4.0	3.0
482308	2.0	2.0	2.0	482268	3.8	4.3	3.3
482312	2.0	2.0	2.0	482264	3.8	4.3	3.3
482313	2.0	2.0	2.0	482251	3.9	4.8	3.0
482333	2.0	2.0	2.0	179881	4.0	4.0	4.0
525082	2.3	2.0	2.5	184800	4.0	4.0	4.0
500323	2.5	2.5	2.5	381731	4.0	4.0	4.0
482278	2.8	3.0	2.5	560008	4.0	4.0	4.0
482328	2.8	3.0	2.7	459074	4.0	4.5	3.5
500331	3.0	3.0	3.0	500332	4.4	4.5	4.2
508443	3.0	3.0	3.0	482295	4.8	5.0	4.7
169241	3.0	3.5	2.5	532738	5.8	4.7	7.0
482259	3.2	3.3	3.0	179885	6.0	6.0	6.0
482248	3.3	3.5	3.0	482355	7.0	7.0	7.0
482362	3.3	3.8	2.8				

[z]Accessions were classified into resistant, intermediate, or susceptible classifications according to the DSR for total plant (leaf, stem, and cotyledon). Lines were considered resistant if their total plant mean DSR was ≤3.0, intermediate if 3.1–4, and susceptible if ≥4.1.

Table 3. Number and percentage of each species analyzed demonstrating resistance and intermediate resistance to race 1W *Podosphaera xanthii*.

Species	Accessions (no.)[z]	Accessions (%)[y]	Proportion of PI collection these species represent (%)
Praecitrullus fistulosus	10	11	1.9
Citrullus colocynthis	4	4	1.4
Citrullus lanatus var. *lanatus*	60	65	88
C. lanatus var. *citroides*	18	19	8
Citrullus rehmii	1	1	
Total	93	100	99.3

[z]Number of accessions analyzed from each species demonstrating low (<4) total plant disease severity ratings [DSR (1–12 scale)]. Accessions were classified into resistant, intermediate, or susceptible classifications according to the DSR for total plant (leaf, stem, and cotyledon). Lines were considered resistant if their total plant mean DSR was ≤3.0, intermediate if 3.1–4, and susceptible if ≥4.1.
[y]Percentage of accessions analyzed from each species demonstrating low (<4) total plant DSR.

had commercially useful resistance to the disease. All accessions in Table 1 were determined to be resistant (≤6% mycelia) or have intermediate resistance (between >6% and ≤12% mycelia).

When total plant DSRs were used to rank PI accessions for resistance, only eight accessions (Grif 5601 and PIs 482255, 388770, 482362, 381750, 459074, 386015, and 482248) were considered resistant with a DSR value ≤3.0. Only eight PI accessions were resistant when only the cotyledon DSRs were analyzed (Grif 5601 and PIs 482255, 388770, 482362, 459074, 386015, 482248, and 508443), but this number increased to 13 PI accessions when only the mean of the leaf rating was analyzed (Grif 5601 and PIs 482255, 482362, 381750, 381742, 388770, 459074, 386015, 560008, 169241, 179881, 512343, 500337) and increased again to 21 resistant accessions when we analyzed only stem ratings (Grif 5601 and PIs 482255, 482362, 381750, 388770, 459074, 482248, 525082, 381742, 386015, 560008, 512343, 532738, 266028, 508443, 179885, 512375, 512367, 386025, 219907, 248178). All PI accessions that demonstrated leaf resistance were also rated resistant when using the stem rating. All but one PI accession demonstrating stem resistance showed high or intermediate resistance on the leaf.

In the retest (Table 2), 15 PI accessions were rated as resistant (388770, 505585, 386015, 270545, 482308, 482312, 482313, 482333, 525082, 500323, 482278, 482328, 500331, 508443, 169241). This increase in number of resistant accessions may be due to cotyledon ratings not being considered. Four PI accessions rated resistant in the initial screen had only intermediate resistance in the retest (482248, 482362, 482255, 459074). Only PI 388770 and 386015 demonstrated total plant resistance in both experiments. No PI lines were completely free of mycelia on all plant parts when data from all experiments were combined.

PIs 459074 and 525088, reported resistant in field trials (Davis et al., 2002), were among the 40 accessions most resistant to race 1W (Table 1). PI 482291 and PI 186490, previously resistant in field trials (Davis et al., 2002), were susceptible in these greenhouse tests. The newly released race 1W powdery mildew resistant inbred PI 525088-PMR (Davis et al., 2006a) was not included in these tests, but PI 525088, which came from the same original seed source, was included and was ranked among the 40 most resistant accessions.

Correlation of DSR for leaf, stem, and cotyledon. A correlation was performed between DSR of the three tissues tested. The transformed means of the original six replicates for each of the 1573 PI accessions were used. There were significant, yet weak, correlations between leaf disease ratings and stem ratings ($r = 0.64$; $P = 0.001$), leaf and cotyledon ratings ($r = 0.20$; $P = 0.001$), and stem and cotyledon ratings ($r = 0.24$; $P = 0.001$). Similarly, the correlation between stem and leaf for the retested PI accessions was significant but weak ($r = 0.68$; $P = 0.001$). Cotyledon ratings were not taken on the retest. The data from these two experiments indicate that disease resistance for cotyledons is controlled by different genes than for leaf and stem resistance. This was also true in melon PI 313970 resistance to races 1 and 2 (McCreight, 2003). The DSR for leaf, stem, and cotyledon showed that cotyledon and leaf tissue have, on average, higher DSRs then stem. Because stems had lower DSRs overall than leaves, the limited correlation may be due to amount of mycelia present rather than presence or absence of resistance genes for these two tissues.

Because leaves make up the most significant surface area of watermelon plants, breeding for leaf resistance is likely more important than stem or cotyledon resistance. However, in severe powdery mildew cases, cotyledons can be heavily infected, stunting or even killing the seedlings. Whole-plant resistance is, therefore, desirable.

Heterogeneity of resistance within PI lines. Many of the PI accessions, which are usually open pollinated, showed phenotypic variability (heterogeneity) for disease resistance, which reduced their total plant ranking for these accessions; individuals in one accession ranged from 6% to 94% total plant coverage with mycelia. Average standard deviation of ratings within PI accessions was 20% (range, 0% to 45%). This suggests that there are accessions heterogeneous for resistance. While DSRs varied slightly between individual plants within each of the susceptible control differentials across replications, they were still clearly susceptible plants.

Resistance to *P. xanthii* race 1W in *Citrullus* species and *P. fistulosus*. There was a high percentage of *P. fistulosus* (11%) and *C. colocynthis* (4%) in the 93 accessions most resistant to race 1W (Table 3); these two species comprise <2% of the *Citrullus* species PI collection. *P. fistulosus* is distantly related to the genus *Citrullus* (Levi et al., 2005); it has a chromosome number of $n = x = 12$, while *Citrullus* has $n = x = 11$ and no interspecific crosses have been reported (Robinson and Decker-Walters, 1997).

When analyzed by geographical origin, 36% and 15% of the 93 most resistant accessions were from Zimbabwe and Zambia, respectively, although they constitute only 9% and 4% of the U.S. *Citrullus* species PI collection (data not shown). These data indicate the origin of most of the resistant accessions in this study was from this region of Africa. Accessions from 13 countries were selected in the retests and are being inbred for uniform reaction to powdery mildew race 1W. We will perform inheritance studies and allelism tests on these lines to identify multiple resistance genes, to incorporate multiple resistance sources into a single cultivar to offer greater resistance stability.

Powdery mildew on cucurbits is a rapidly evolving disease with serious impact on cucurbit production worldwide. Therefore, resistance screening to emerging races and pathotypes and development of differential lines that can be used to detect these different forms of the fungus are of great importance.

Cucurbit powdery mildew in the United States was not known to infect watermelon before 1996. A new pathotype of cucurbit powdery mildew defined by the ability to infect watermelon has since spread throughout the United States. All strains tested to date that colonize watermelon are able to colonize some of the melon differentials, but not all strains colonizing melon are able to cause disease symptoms on watermelon (Davis et al., 2006a, 2006b).

The melon differentials used in this study defined which melon race of the watermelon pathotype was present; there are no formally released *Citrullus* species powdery mildew differentials at this time. Watermelon lines are currently being developed that have homogeneous reaction to inoculation with these two watermelon pathotypes of *P. xanthii*. Once produced, it is likely that the *P. xanthii* races affecting watermelon will differ from that which infects melon. Because of this, it is suggested that the nomenclature used in this article be adapted to differentiate between the pathotypes. Races could be differentiated by indicating race 1M (or 2M or 3M) according to the reaction of a melon differential set and race 1W or 2W according to the reaction of watermelon differentials. For instance, a strain could belong to race 2M (on melon) and 1W (on watermelon).

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