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Tolerance to Monosporascus Root Rot and Vine Decline in Melon (*Cucumis melo* L.) Germplasm

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Abstract. **We conducted a field screening of melon (*Cucumis melo* L.) cultigens to identify potential sources of host-plant resistance to *Monosporascus cannonballus* Pollack & Uecker. Seed were sown in Speedling trays with inoculated or noninoculated media. Plants were transplanted into a field known to be highly infested with *M. cannonballus*. Cultigens were arranged in a randomized complete block with three replications in each treatment (fumigated/noninoculated, nonfumigated/inoculated). Vine decline (1 = no symptoms to 5 = dead vines) was rated at 78 and 90 days post-transplanting. Disease symptoms were most severe and occurred earliest in the inoculated, nonfumigated plots. However, natural infection by *M. cannonballus* occurred in the fumigated plots, as all root samples collected contained perithecia. The majority of cultigens (85%) showed moderate to severe vine decline symptoms. Mean vine decline ratings of melon types from the spring test, ranked from most tolerant to least tolerant, were: Charentais = Ananas = Galia > Misc. = Honeydew = Mixed > US cantaloupe. A Fall test of the most tolerant cultigens showed similar results, in that Ananas and Charentais types had the highest tolerance; however, Galia types performed poorly, which may be due to the different environmental conditions, or differing fruit loads on the vines in the two tests. 'Deltex', an Ananas hybrid, showed the highest tolerance based on vine decline ratings in the two tests.**

Monosporascus root rot and vine decline is an increasingly important disease of melons around the world (Martyn and Miller, 1996). It has been a significant problem in the Lower Rio Grande Valley of Texas (Mertely et al., 1991), and in Arizona, and has been identified in the Imperial Valley of California (Bruton et al., 1995). *Monosporascus cannonballus* Pollack & Uecker was first described on melons in Arizona in 1974 (Pollock and Uecker, 1974), and has been reported in Israel (Reuveni et al., 1983), Japan (Uematsu et al., 1985), Spain (Ruano, 1990), Mexico (Martyn et al., 1996), Honduras (Bruton and Miller, 1997a), and Guatemala (Bruton and Miller, 1997b). A small sample of melon germplasm was screened in the greenhouse for resistance to *M. cannonballus*. Differential response to *M. cannonballus* was observed based on a root disease index and reductions in several growth parameters (root and vine fresh mass, vine length) (Mertely et al., 1993).

Development of disease-resistant cultivars is a high priority of the Texas Agricultural Experiment Station (TAES) melon breeding program. The objective of this research was to survey a wide sample of cultivated melon germplasm for resistance/tolerance to Monosporascus root rot and vine decline (MRR/VD) under field conditions with controlled inoculations. A preliminary report on part of these data was presented earlier (Wolff, 1995).

Materials and Methods

Spring 1994 test. A small quantity of *M. cannonballus* soil tube culture (Isolate 2C-18, formerly TX 90-25) was placed on potato dextrose agar (PDA) medium in 100-mm petri dishes to allow for mycelium growth and development. Seven days after inoculation of the medium, mycelia covered the entire petri plate. A 7-mm plug of mycelium and agar was transferred to multiple PDA plates to increase as a source of inoculum.

Seed of 125 cultigens representing a diverse collection of cultivated melon types were sown on 8 Mar. in sterilized medium in 72-cell Speedling trays. Each genotype was sown in noninoculated and inoculated media. Inoculation was done by placing one 7-mm mycelial plug (7-d-old culture) in each cell ≈2 cm deep. The plug was covered with media and the seed was placed on top. Trays were held at ambient greenhouse conditions (29–32 °C day, 18 °C night) until transplanting to the field on 30 Mar. 1994. Two 7-mm mycelial plugs were added to each transplant hole as the inoculated plants were transplanted in the nonfumigated rows. Noninoculated plants were transplanted into the fumigant-treated rows.

The test was conducted in a field that had repeated melon crops for several years and was known to be highly infested with *M. cannonballus.* Half of the field was fumigated with 1,3-dichloropropene (Telone II; Dow Elanco Corp., Indianapolis) at 23 $L \cdot ha^{-1}$. This treatment has shown some control of MRR/VD in field trials (Miller et al., 1992). Plots were a single, 0.2 m × 1.5 m bed, with 1 plant/30.5 cm.

A vine decline rating was taken at 78 and 90 d after transplanting (1 = no vine decline symptoms, 5 = dead vines) and the two ratings were averaged to give a season average. Roots from one plant in each noninoculated plot were excavated 97 d after transplanting to evaluate for the presence of *M. cannonballus* perithecia. Lateral roots were examined for perithecia; if no perithecia were seen, roots were incubated in a plastic bag (27–30 °C) for 14 d and examined again. A positive infection was noted if any perithecia were found on the roots.

Fall 1994 test. A subset of cultigens from the Spring test was sown on 2 August and transplanted 22 Aug. in the same field to evaluate disease symptoms during the Fall growing season. Twenty-two tolerant selections plus susceptible checks ('Caravelle', 'Magnum 45') and three TAES breeding lines were planted in a randomized complete block with four replications. Plot size and spacing were the same as above. Vine decline was rated every 7 d during each cultigen's maturity period. These weekly ratings were averaged to give a total season rating.

Data were analyzed using analysis of variance procedures of SAS software, version 6.10.

Results and Discussion

Spring 1994 test. Vines appeared healthy early, but as the season progressed, plants in the nonfumigated, inoculated plots showed more stunting than did plants in the fumigated, noninoculated plots. As fruit maturity approached, typical MRR/VD symptoms appeared. Yellowing followed by collapse and death of the crown foliage was first evident in the inoculated plots. Mean vine decline ratings were significantly more severe for plants in the inoculated than in the noninoculated plots (Table 1). As the season progressed, vine decline symptoms became more severe under both treatments. Even in the fumigated, noninoculated plots, severe vine decline occurred, evidenced by the season rating of 3.50 (Table 1). There was not a significant cultigen × inoculation interaction, therefore data were combined for further analysis (six total replicates per cultigen).

Vine decline symptoms were severe in the majority of cultigens. Only 15 cultigens (12%) had a seasonal average vine decline rating <2.50, indicating possible tolerance. We define tolerance as the ability of the vine to remain functional and support fruit development even with root colonization by *M. cannonballus*. The distribution of cultigens based on vine decline ratings shows the majority

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classified as having low tolerance (Fig. 1). Table 2 lists the disease rating of all the cultigens, ranked from the most tolerant to the least tolerant. Abundant perithecia were found on roots from all of the noninoculated plots, indicating that the natural infestation of *M. cannonballus* was high and uniform. Perithecia were observed on all cultigens, irrespective of their vine rating. Tolerant genotypes in this test may have reduced infection and/or colonization by *M. cannonballus*. This could be tested by adapting the recently published in vitro ascospore germination technique (Stanghellini et al., 1996) for use as a germplasm screening procedure to quantify ascospore germination on different genotypes. Further work will be needed to determine the mechanism and genetic control of the observed tolerance. Most likely, tolerance is controlled by many genes (quantitative); this was hypothesized by Cohen et al. (1996), who did a preliminary inheritance test of tolerance to vine collapse in an oriental pickling melon breeding line P6a.

Each cultigen was classified into one of seven melon types (US Cantaloupe, Honeydew, Charentais, Ananas, Galia, Mixed, Miscellaneous) to determine if any types performed better under MRR/VD infection. Certain types showed more tolerance to MRR/VD than others (Table 2). US cantaloupes, for example, are found mostly in the susceptible end of the scale. By comparing the mean disease rating of each melon type, Charentais, Ananas, and Galia types were significantly more tolerant than honeydew and mixed melons, and US cantaloupes (Table 3). Data from Arizona also indicate that 'Ananas' has high tolerance (Stanghellini et al., 1995). In order to determine differential tolerance within melon types, more replicated tests would be needed, and yield response to MRR/VD should be measured.

Fall 1994 test. Seasonal average vine decline ratings of the cultigens ranged from 4.40 for 'Caravelle', the susceptible check, to 1.36 for 'Deltex' (Table 4). 'Deltex' was significantly more tolerant than all other genotypes except TAES 2024. Both Ananas and Charentais types showed high tolerance, similar to the Spring 1994 test. Galia types, however, showed severe vine decline symptoms, in contrast to their performance in the Spring test. This may be due to an interaction between the different environmental conditions during the Spring and Fall growing season. Another reason for the different response could be different fruit loads on the vines during the two tests. We have observed delayed and reduced vine decline symptoms when fruit are removed from melon vines soon after fruit set (Wolff, 1996). A genotype may appear tolerant based on low disease symptoms, but this may be the result of an environmentally or genetically controlled reduced fruit set.

The reaction of melon cultigens to *M. cannonballus* is determined by several factors. Differential tolerance has been identified and is generally associated with different melon types; however, exceptions to these general trends exist. Certain US cantaloupe hybrids

Table 1. Mean vine decline ratings of inoculated and noninoculated plots of all melon cultigens at two rating dates and the season average.

			Vine decline		
Inoculation[z]	Fumigation[y]	N	Rating 1[x]	Rating 2	Season avg
Yes	No	125	3.59[w]	4.58	4.09
No	Yes	125	2.83***	4.16***	3.50***

[z]See Materials and Methods for inoculation technique.
[y]Telone II at 23 $L \cdot ha^{-1}$.
[x]Rating 1 and 2 were 78 and 90 d after transplanting, respectively.
[w]1 = no vine decline symptoms, 5 = dead vines.
***Significantly different from inoculated plots at $P \leq 0.001$.

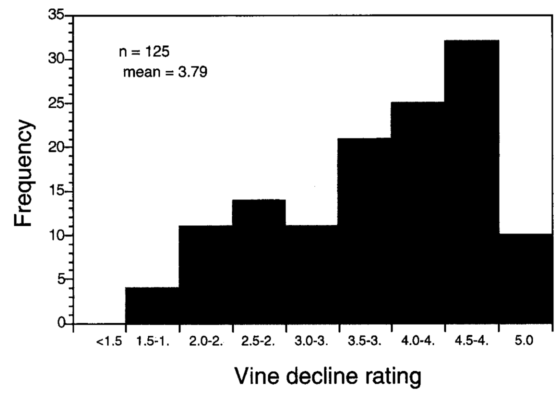

Fig. 1. Seasonal average vine decline rating (1 = no vine decline symptoms, 5 = dead vines) of melon cultigens. A rating <2.5 indicates tolerance to MRR/VD.

Table 2. Season average vine decline ratings of all melon cultigens, ranked from most tolerant to least tolerant, Spring test.

Cultigen	Melon type	Vine decline rating[z]
Galia	Galia	1.50 ± 0.41[y]
Charlynne	Ananas	1.75 ± 0.31
Deltex	Ananas	1.75 ± 0.38
Rocky Sweet	Galia	1.83 ± 0.36
Doublon	Charentais	2.08 ± 0.40
[PI 124111xFC]xWMR29	Misc	2.08 ± 0.33
Spice	Ananas	2.08 ± 0.33
Israeli	Ananas	2.17 ± 0.42
Creme de menthe	Honeydew	2.25 ± 0.25
Morning Ice	Honeydew	2.25 ± 0.36
Santa Clause	Mixed	2.25 ± 0.38
Charentais	Charentais	2.33 ± 0.48
Rocio	Honeydew	2.33 ± 0.49
Israel Ogen	Galia	2.42 ± 0.44
Viva	Charentais	2.46 ± 0.31
Vine Peach	Misc	2.50 ± 0.22
Casaba Golden Beauty	Mixed	2.58 ± 0.27
Magic-To-Dew	Honeydew	2.58 ± 0.57
Moonshine	Honeydew	2.58 ± 0.60
Primo	US cantaloupe	2.58 ± 0.20
Smith's Perfect	US cantaloupe	2.58 ± 0.60
Persian	Mixed	2.67 ± 0.17
U.C. Honeyloupe	Honeydew	2.67 ± 0.48
Ananas	Ananas	2.75 ± 0.38
MR-1	Misc	2.75 ± 0.57
Oriental Sweet	Misc	2.75 ± 0.25
Saticoy	US cantaloupe	2.75 ± 0.31
Sugar Queen	US cantaloupe	2.75 ± 0.54
HD Greenflesh	Honeydew	2.92 ± 0 60
Marygold	Mixed	3.00 ± 0.53
Schoon's Hard Shell	US cantaloupe	3.08 ± 0.47
TAM Dew Improved	Honeydew	3.08 ± 0.65
W1	US cantaloupe	3.08 ± 0.37
Carole	US cantaloupe	3.17 ± 0.48
Eden	US cantaloupe	3.25 ± 0.62
Meckty White	Misc	3.25 ± 0.46
Roadside	US cantaloupe	3.33 ± 0.44
Banana	Misc	3.42 ± 0.44
D21 1005	US cantaloupe	3.42 ± 0.30
Cavaillon	Ananas	3.50 ± 0.43
Earli-dew	Honeydew	3.50 ± 0.47
Honeydew Babyslip	Honeydew	3.50 ± 0.56
Honeydew Orange Flesh	Honeydew	3.50 ± 0.26
Harvest Queen	US cantaloupe	3.50 ± 0.34

continued on next page

Table 2. Continued.

Cultigen	Melon type	Vine decline rating[z]
White Crenshaw	Mixed	3.58 ± 0.30
Classic	US cantaloupe	3.67 ± 0.65
Dallas	US cantaloupe	3.67 ± 0.46
Daybreak	Honeydew	3.67 ± 0.54
Sweet Delicious	Honeydew	3.67 ± 0.33
Crenshaw	Mixed	3.75 ± 0.48
Honeybrew	Honeydew	3.75 ± 0.31
Lutina	Mixed	3.75 ± 0.36
Seminole	US cantaloupe	3.75 ± 0.31
Toledo	Mixed	3.75 ± 0.63
W3	US cantaloupe	3.75 ± 0.50
Corin	US cantaloupe	3.79 ± 0.26
Honeydew Gold Rind	Honeydew	3.83 ± 0.36
Hearts of Gold	US cantaloupe	3.83 ± 0.25
OldTime Tennesee	US cantaloupe	3.92 ± 0.45
Passport	Galia	3.92 ± 0.54
TAM Mayan Sweet	Mixed	3.92 ± 0.44
Tasty Sweet	US cantaloupe	4.00 ± 0.41
71-151	Honeydew	4.08 ± 0.33
Durango	US cantaloupe	4.08 ± 0.45
Giant Perfection	US cantaloupe	4.08 ± 0.35
Hymark	US cantaloupe	4.08 ± 0.30
Meckty Green	Misc	4.08 ± 0.33
Meckty Green	Misc	4.08 ± 0.33
Pronto	US cantaloupe	4.08 ± 0.24
Solo	Mixed	4.08 ± 0.64
Supreme	US cantaloupe	4.08 ± 0.33
Goldrush	US cantaloupe	4.17 ± 0.46
Valencia	Mixed	4.21 ± 0.40
Bush Midget	US cantaloupe	4.25 ± 0.38
Green Nutmeg	US cantaloupe	4.25 ± 0.57
HMX1600	Honeydew	4.25 ± 0.21
Honey Rock	Honeydew	4.25 ± 0.36
Ironhorse	US cantaloupe	4.25 ± 0.40
Tesoro	US cantaloupe	4.25 ± 0.36
Topmark	US cantaloupe	4.25 ± 0.34
Cruiser	US cantaloupe	4.33 ± 0.36
Edisto47	US cantaloupe	4.33 ± 0.31
Goldmark	US cantaloupe	4.33 ± 0.31
Otero	US cantaloupe	4.33 ± 0.28
W4	US cantaloupe	4.33 ± 0.36
AUrora	US cantaloupe	4.42 ± 0.42
Perlita 45/21	US cantaloupe	4.42 ± 0.30
Cinco	US cantaloupe	4.46 ± 0.26
Galleon	US cantaloupe	4.46 ± 0.26
Cystobal	US cantaloupe	4.50 ± 0.22
Imperial #45	US cantaloupe	4.50 ± 0.34
Planter's Jumbo	US cantaloupe	4.50 ± 0.34
TAM Uvalde	US cantaloupe	4.50 ± 0.26
TAM Sun	US cantaloupe	4.54 ± 0.25
Delicious 51	US cantaloupe	4.58 ± 0.24
Sierra Gold	US cantaloupe	4.58 ± 0.20
TAM Yellow Canary	Mixed	4.58 ± 0.42
W6	US cantaloupe	4.58 ± 0.24
Corona	US cantaloupe	4.67 ± 0.21
FMX 165	US cantaloupe	4.67 ± 0.21
Golden Gopher	US cantaloupe	4.67 ± 0.25
Super45	US cantaloupe	4.67 ± 0.25
Gulfcoast	US cantaloupe	4.75 ± 0.25
PMR8	US cantaloupe	4.75 ± 0.17
Tekos	US cantaloupe	4.75 ± 0.25
Caravelle	US cantaloupe	4.83 ± 0.17
Hales Best #36	US cantaloupe	4.83 ± 0.17
Iroquois	US cantaloupe	4.83 ± 0.17
Mainpak	US cantaloupe	4.83 ± 0.11
Mission	US cantaloupe	4.83 ± 0.11
Rocky Ford GF	US cantaloupe	4.83 ± 0.17
Earlimarket	US cantaloupe	4.92 ± 0.08
EarlyStar	US cantaloupe	4.92 ± 0.08
Explorer	US cantaloupe	4.92 ± 0.08
Laredo	US cantaloupe	4.92 ± 0.08
Magnum.45	US cantaloupe	4.92 ± 0.08
Perlita	US cantaloupe	4.92 ± 0.08
Superstar	US cantaloupe	4.92 ± 0.08
Early Pennsweet	US cantaloupe	5.00 ± 0.00
Hale's Best Jumbo	US cantaloupe	5.00 ± 0.00
HSR228	US cantaloupe	5.00 ± 0.00
Laguna	US cantaloupe	5.00 ± 0.00
MR#45	US cantaloupe	5.00 ± 0.00
Mainstream	US cantaloupe	5.00 ± 0.00
Marco Polo	US cantaloupe	5.00 ± 0.00
Valley Gold	US cantaloupe	5.00 ± 0.00

[z]1 = No vine decline symptoms, 5 = dead vines.
[y]Mean (6 obs.) ± SEM.

have shown field tolerance to MRR/VD (Alcantara et. al., 1995), and we have observed in subsequent experiments tolerance comparable to 'Deltex' in certain hybrids (unpublished data). These data, along with that showing the effect of fruit load and temperature on symptom expression (Wolff, 1996), indicate that tolerance to MRR/VD is expressed variably, depending on physiological (large sink-fruit load) and environmental stresses. Genotypes with a concentrated fruit set (e.g., most US cantaloupe hybrids) appear more susceptible to vine decline, due possibly to stress caused by a heavy fruit load. Differential reaction to *M. cannonballus* may also be due to differing root vigor/size of different genotypes. The complexity of this character will make breeding for improved tolerance to MRR/VD difficult and tedious.

Based on vine decline rating data presented here, 'Deltex' had the best performance over both seasons. To better characterize differential tolerance to MRR/VD, yield response should be measured. We are currently evaluating the yield response of several commercial US cantaloupe hybrids to determine which perform best under MRR/VD pressure with drip irrigation and plastic mulch.

Literature Cited

Alcantara, T.P., S.L. Rasmussen, D.H. Kim, N. Oebker and M.E. Stanghellini. 1995. Field tolerance of melons to *Monosporascus cannonballus*. Phytopathology 85:1192. (Abstr.)

Bruton, B.D., R.M. Davis, and T.R. Gordon. 1995. Occurrence of *Acremonium* sp. and *Monosporascus cannonballus* in the major cantaloupe and watermelon growing areas of California. Plant Dis. 79:754.

Bruton, B.D. and M.E. Miller. 1997a. Fungi associated with vine decline disease of melons in Honduras. Plant Dis. 81:694.

Bruton, B.D. and M.E. Miller. 1997b. Fungi associated with vine decline of cantaloupe in Guatemala. Plant Dis. 81:696.

Cohen, R., Y. Elkind, Y. Burger, R. Offenbach, and H. Nerson. 1996. Variation in the response of melon genotypes to sudden wilt. Euphytica 87:91–95.

Martyn, R.D. and M.E. Miller. 1996. Monosporascus root rot and vine decline: An emerging disease of melons worldwide. Plant Dis. 80:716–725.

Martyn, R.D., J.S. Batten, Y.J. Parks, and M.E. Miller. 1996. First report of Monosporascus root rot/vine decline of watermelon in Mexico. Plant Dis. 80:1430.

Mertely, J.C., R.D. Martyn, M.E. Miller, and B.D. Bruton. 1991. Role of *Monosporascus cannonballus* and other fungi in a root rot/vine decline disease of muskmelon. Plant Dis. 75:1133–1137.

Mertely, J.C., R.D. Martyn, M.E. Miller, and B.D. Bruton. 1993. An expanded host range for the muskmelon pathogen *Monosporascus cannonballus*. Plant Dis. 77:667–673.

Miller, M.E., R.D. Martyn, and B.D. Bruton. 1992. Yield of muskmelon (*Cucumis melo* L.) as affected by fumigants in fields infested with *Monosporascus cannonballus*. Phytopathology 82:1091. (Abstr.)

Pollock, F.G. and F.A. Uecker. 1974. *Monosporascus cannonballus*, an unusual ascomycete in cantaloupe roots. Mycologia 66:346–349.

Reuveni, R., J. Kirkun, and U. Shani. 1983. The role of *Monosporascus eutypoides* in a collapse of

Table 3. Mean vine decline ratings of melon cultigens classified by melon type.

Melon type	No. cultigens	Vine decline rating[z]
Charentais	3	2.29 d[y]
Ananas	6	2.33 d
Galia	4	2.42 d
Misc.	7	2.98 c
Honeydew	18	3.26 bc
Mixed	12	3.51 b
US Cantaloupe	75	4.29 a

[z]1 = No vine decline symptoms, 5 = dead vines.
[y]Mean separation by Waller–Duncan multiple range test, $P \leq 0.05$.

Table 4. Vine decline ratings of melon cultigens in the Fall field test.

Cultigen	Melon type	Vine decline rating[z] (Season avg)
Deltex	Ananas	1.36 g[y]
TAES 2024	US Cantaloupe	1.92 fg
TAES 2042	US Cantaloupe	2.12 ef
Viva	Charentais	2.17 ef
Spice	Ananas	2.21 ef
Rocio	Honeydew	2.25 ef
Israeli	Ananas	2.30 ef
Doublon	Charentais	2.40 ef
TAES 2018	US Cantaloupe	2.49 def
Eden	Ananas	2.50 def
Morning Ice	Honeydew	2.50 def
Sugar Queen	US Cantaloupe	2.67 de
Creme de menthe	Honeydew	2.70 de
Cruiser	US Cantaloupe	2.82 de
Charentais	Charentais	2.84 de
Rocky Sweet	Galia	3.17 cd
Magnum.45	US Cantaloupe	3.20 cd
Charlynne	Ananas	3.62 bc
Primo	US Cantaloupe	3.71 bc
Galia	Galia	3.82 abc
Casaba Golden Beauty	Mixed	3.85 abc
Santa Clause	Mixed	4.17 ab
Israel Ogen	Galia	4.29 a
Persian	Mixed	4.31 a
Caravelle	US Cantaloupe	4.40 a

[z]1 = no vine decline symptoms, 5 = dead vines.
[y]Mean separation by Waller–Duncan multiple range test, $P \leq 0.05$.

melon plants in an arid area of Israel. Phytopathology 73:1223–1226.

Ruano, M.L. 1990. Colapso del melon producido por hongos del genero *Monosporascus*. Bol. San. Beg. Plagas (Spain) 16:701–707.

Stanghellini, M.E., D.H. Kim, and S.L. Rasmussen. 1996. Ascospores of *Monosporascus cannonballus*: Germination and distribution in cultivated and desert soils in Arizona. Phytopathology 86:509–514.

Stanghellini, M.E., S.L. Rasmussen, D.H. Kim, and N. Oebker. 1995. Vine-decline of melons caused by *Monosporascus cannonballus* in Arizona: Epidemiology and cultivar susceptibility. Veg. Rpt., Univ. of Arizona, College of Agr., Ser. P-100.

Uematsu, S., S. Onogi, and T. Watanabe. 1985. Pathogenicity of *Monosporascus cannonballus* Pollack and Uecker in relation to melon root rot in Japan. Ann. Phytopathol. Soc. Jpn. 51:272–276.

Wolff, D.W. 1995. Evaluation of melon germplasm for resistance to Monosporascus root rot/vine decline, p. 224–228. In: J.R. Dunlap and G.E. Lester (eds.). Cucurbitaceae 94: Evaluation and enhancement of cucurbit germplasm. Gateway Printing, Edinburg, Texas.

Wolff, D.W. 1996. Genotype, fruit load, and temperature affect Monosporascus root rot/vine decline symptom expression in melon (*Cucumis melo* L.), p. 280–284. In: M.L. Gomez-Guillamon, C. Soria, J. Cuartero, J.A. Tores, and R. Fernandez-Munoz (eds.). Cucurbits towards 2000: Proc. Seventh Eucarpia Meeting on Cucurbit Genetics and Breeding. C.S.I.C., Malaga, Spain.