WINTER SQUASH (*Cucurbita maxima* Hubbard)   D.E. Perla and M.K. Hausbeck
(*Cucurbita maxima* Kabocha)   Michigan State University
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Sciences   Phytophthora blight; *Phytophthora capsici*   East Lansing, MI 48824

Evaluation of hard squash cultivars for age-related resistance to fruit rot caused by *Phytophthora capsici* under laboratory conditions, 2019.

Winter squash cultivars were transplanted following commercial standards at the Michigan State University Plant Pathology Farm in Lansing, MI, in a field of Capac loam soil previously planted to tomatoes. The soil was prepared by plowing and discing and roundup PowerMax (1 qt/A) was applied for weed control before planting. Raised beds were formed, black plastic was laid, and drip tape was established for irrigation on 20 May. Seeds of hard squash cultivars ('Dickinson', 'NK-580', 'Buckskin,' 'New England Cheddar,' 'Ultra,' 'Golden Delicious,' 'Autumn cup,' Space station,' 'Sweet mama,' 'Thunder,' 'Delica,' and 'Sunshine') were planted in nursery trays in a greenhouse on 23 May. A week after germination, plants were moved outdoors and allowed to acclimate for one week and transplanted into raised beds on 18 June. The plot was arranged in a completely randomized block design with four replications. Rows were 40 ft long, spaced 12 ft apart, with plants spaced 18 in. apart within a row. The trial was fertilized throughout the growing season with weekly applications of 20-20-20 via drip tape (3 lb./A). The female flowers were hand-pollinated two times a week and marked to keep track of the days after pollination, starting on 2 August and ending on 23 August. Fruits were harvested at 7-, 14-, 21-, and 40-days post-pollination (DPP). The fruits were taken to the laboratory and surface sterilized using 10% bleach. *Phytophthora capsici* isolate SP98 (A2 compatibility type, sensitive to mefenoxam, isolated from pumpkin) was used as inoculum. The long-term culture was plated on BARP (25 ppm of benomyl, 100 ppm of ampicillin, 30 ppm of rifampicin, and 100 ppm of pentachloronitrobenzene) and posteriorly transferred to amended UCV8 (3 g $CaCO_3$, 15 g agar, 160 ml unfiltered V8 juice, and 840 ml distilled water). The isolate was passed through squash fruits and recovered to ensure virulence before inoculating. The fruit was inoculated by placing a 9 mm diameter plug of *P. capsici* over the non-wounded surface of every fruit and incubated in a humid chamber (98% relative humidity at 68 ºF) for four days. Data were analyzed using (ANOVA) SAS PROC GLIMMIX procedure of the SAS system 9.4 (SAS Institute, Cary, NC). Least-square means comparisons were performed using Fisher's protected least significant difference (LSD) at *P*=0.05. The fruit were assessed for disease incidence by calculating the percentage of fruits with symptoms. Additionally, the density of lesions was evaluated using a categorical (1-4) scale where 1= water soaked, 2= light mycelium density, 3= medium mycelium density, and 4= abundant mycelium density. Disease severity was measured by calculating the lesion area (cross measuring obtaining two diameters (A B) of the lesions and using the following formula: Pi * A * B.

All fruits (100%) had disease symptoms at 7 DPP. As the fruit matured, the *C. moschata* cultivars had a reduction in disease incidence. The cultivars 'Buckskin' and 'New England Cheddar' were not infected at 14 DPP, whereas 'Ultra' (14% at 14 DPP) was not infected at 21 DPP. The cultivar 'Dickinson' (66.1% at 14 DPP, 50% at 21 DPP) was not infected at 40 DPP. In contrast, the *C. maxima* cultivars had higher than 63% disease incidence at 7, 14, and 21 DPP. The *C. maxima* cultivar 'Thunder' was not infected at 40 DPP. All cultivars showed a reduction in disease severity, as evidenced by a decrease in the area and the density of the lesions, as they matured. However, disease reduction in *C. moschata* cultivars was complete (0% disease incidence) and occurred at earlier maturities (14 DPP) than *C. maxima* cultivars. Within the *C. maxima* cultivars, only 'Thunder' showed complete resistance (40 DPP) suggesting that age-related resistance in *C. moschata* cultivars develops earlier.

Cultivars	Disease incidence (%)			
	7 DPP	14 DPP	21 DPP	40 DPP
***C. moschata* Butternut**				
Buckskin	100.0 a[*]	0.0 c	0.0 d	0.0 c
New England Cheddar	100.0 a	0.0 c	0.0 d	0.0 c
Ultra	100.0 a	14.0 c	0.0 d	0.0 c
Dickinson	100.0 a	66.1 b	50.0 c	0.0 c
***C. maxima* Hubbard**				
NK-580	100.0 a	100.0 a	100.0 a	100.0 a
Golden Delicious	100.0 a	100.0 a	100.0 a	100.0 a
***C. maxima* Kabocha**				
Sunshine	100.0 a	100.0 a	100.0 a	57.1 bc
Sweet Mama	100.0 a	100.0 a	100.0 a	33.3 bc
Delica	100.0 a	100.0 a	88.9 ab	60.0 bc
Thunder	100.0 a	100.0 a	86.0 ab	0.0 c
Autumn Cup	100.0 a	100.0 a	71.4 a-c	100.0 a
Space Station	100.0 a	100.0 a	63.0 bc	49.9 bc
P-Value	0.3611	<.0001	<.0001	<.0001

[*] Means with the same letter in each column are not statistically different using Fisher's protected LSD at *P*=0.05.

Cultivars	Area of the Lesion (cm^2)				Density of the lesion (0-4)			
	7 DPP	14 DPP	21 DPP	40 DPP	7 DPP	14 DPP	21 DPP	40 DPP
***C. moschata* Butternut**								
Buckskin	141.1 b-d[*]	0.0 e	0.0 d	0.0 b	3.6 a	0.0 c	0.0 f	0.0 a
New England Cheddar	192.6 ab	0.8 e	0.0 d	0.0 b	4.0 a	0.0 c	0.0 f	0.0 a
Ultra	157.5 a-c	23.2 e	0.0 d	0.0 b	4.0 a	0.4 bc	0.0 f	0.0 a
Dickinson	162.7 a-c	29.2 c-e	46.5 b-d	0.0 ab	3.7 a	1.7 a-c	1.2 d-f	0.0 a
***C. maxima* Hubbard**								
NK-580	202.2 a	95.3 bc	122.0 ab	78.5 a	3.6 a	3.0 a	3.1 a-c	3.0 a
Golden Delicious	154.4 bc	87.6 bc	149.4 a	4.5 b	2.2 a	2.0 a	4.0 a	3.0 a
***C. maxima* Kabocha**								
Sunshine	98.8 d	87.6 bc	90.7 a-c	40.9 ab	2.8 a	2.7 a	3.2 ab	0.3 a
Sweet Mama	115.7 dc	93.3 b	48.7 b-d	0.9 b	3.9 a	2.7 a	2.0 b-e	1.4 a
Delica	133.0 b-d	231.4 a	86.7 a-c	18.4 b	3.9 a	4.0 a	2.8 a-c	0.0 a
Thunder	99.9 d	77.7 bc	51.1 b-d	0.0 b	3.9 a	2.8 a	2.6 ab	1.0 a
Autumn Cup	129.1 b-d	24.6 ed	36.1 dc	13.2 b	4.0 a	2.0 ab	2.0 b-e	1.2 a
Space Station	122.3 dc	66.3 b-d	117.1 ab	0.2 b	3.4 a	1.1 bc	1.9 c-e	0.3 a
P-Value	<.0001	<.0001	0.0016	<.0001	0.284	<.0001	<.0001	0.115

[*] Means with the same letter in each column are not statistically different using Fisher's protected LSD at *P*=0.05.