

Evaluation of Eggplant Accessions and Cultivars for Resistance to *Verticillium* Wilt

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ABSTRACT

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Four hundred seventy-three USDA plant introduction accessions and 10 cultivars of eggplant (*Solanum melongena*) were evaluated for resistance to *Verticillium dahliae*. After inoculation with 1 million spores per milliliter, the seedling plants were rated on a 10-point disease-intensity scale (1 = dead, 10 = no infection). Thirty-six plant introductions with ratings of 5 or higher were selected as potentially wilt-resistant or wilt-tolerant. The cultivars Florida Market, Harris 468 Special Hibush, and Harris Hybrid 77631 had the highest ratings.

Commercial cultivars of eggplant (*Solanum melongena* L.) lack resistance to *Verticillium dahliae* (Kleb.), which can devastate the crop. General decline in plant growth, some chlorosis of the leaves, stunting of the plant, and vascular discoloration are followed by wilting and death. Symptoms may appear before the organism is recognized, suggesting that the fungus blocks the vascular system. The fungus, which can grow at relatively cool soil temperatures, enters the plant through the fibrous roots and becomes systemic. Inoculum sources for natural infection of successive plantings persist in soil and plant debris. Resistance or tolerance to *Verticillium* wilt would be useful in eggplant-breeding programs.

Braverman (1) evaluated 290 plant introductions (PIs) of eggplant and found several *Verticillium*-tolerant selections in five PIs from Turkey: 169650, 169666, 191851, 176759, and 204731. Our objective was to evaluate the PI collection consisting of 473 lines for resistance to *Verticillium*. The collection represented PIs from four European, four Near Eastern, two African, and seven Asian countries, one accession from Martinique, and various lines from the United States and Canada.

MATERIALS AND METHODS

Every 10th accession was selected to form the individual test block consisting

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of 52 accessions per replication to guarantee random selection of the lines. Cultivars selected for testing were Black Jet, Black Knight, Black Magic, Early Royal, Florida Market, Jersey King, Long Black Beauty, Peerless, Harris Hybrid 77631, and Harris 468 Special Hibush.

Stock cultures of a cotton isolate of *V. dahliae* were maintained on Difco potato-dextrose agar. For inoculum production, Difco Czapek-Dox broth was dispensed in 250-ml Erlenmeyer flasks and sterilized at 0.021 kg/m² (121 C) for 20–30 min. Three 3-mm plugs of *V. dahliae* that had been grown on Sabouraud dextrose + chloramphenicol plates were added to the cooled sterile broth. The inoculated flasks were placed on an Eberbach reciprocating shaker for 2 wk before inoculation. The cultures were agitated at low speed at ± 20 C on a laboratory bench with an 8-hr photoperiod of cool-white fluorescent light under a photosynthetic photon flux density (PPFD) of 22 μmol s⁻¹ m⁻² as measured with a Li-Cor quantum flux sensor using procedures described by Krizek (3). For inoculum preparation, the heavily sporulating cultures were homogenized in a blender with equal parts of sterile distilled water for 15 sec to form a slurry.

Seventeen seeds of each PI line and approximately 25 seeds of each cultivar were planted in steam-sterilized wood flats filled with size 4 sterile quartz sand. The plants were grown in a growth chamber at 20 C with a 9-hr photoperiod. When the plants were about 4 cm high (usually 21 days from seeding), 10 seedlings from each line were carefully lifted from the sand-filled flats and the roots washed in tap water. The root tips of each plant were cut off to facilitate entrance of the inoculum. The 10 seedlings were placed in the inoculum in 50-ml sterile beakers for 30 min, then replanted in sterilized wooden flats containing sterile Jiffy Plus mix. Two uninoculated seedlings of each line were

similarly handled, dipped in uninoculated sterile broth, and planted as controls in a separate flat. To prevent contamination and permit adequate drainage, all flats were placed on the growth-chamber benches atop 2.5 × 2.5 cm sterilized greenhouse stakes. The chamber was maintained at 20 C with a 9-hr photoperiod of cool-white fluorescent light under a PPFD of 100 μmol s⁻¹ m⁻².

Wilt readings were recorded 10 and 20 days after inoculation using a disease-intensity rating scale based on the Horsfall-Barratt disease grading system (2), in which 1 = plant dead and 10 = no

Table 1. Relative susceptibility of 36 plant introduction accessions of *Solanum melongena* to *Verticillium dahliae* under controlled temperature conditions

PI no.	Origin	Mean disease-severity score ²
164458	India	8.13 a
381160	India	6.76 ab
381166	India	6.50 abc
381229	India	6.33 abcd
224690	Burma	6.20 abcde
381281	India	5.96 abcdef
381248	India	5.95 abcdef
115505	India	5.86 abcdef
269656	India	5.84 abcdef
381180	India	5.80 abcdef
320504	Canada	5.44 abcdef
381214	India	5.42 abcdefg
269662	India	5.35 abcdefg
386264	India	5.27 bcdefg
286099	United States	5.12 bcdefg
370051	India	5.00 bcdefg
386262	India	4.98 bcdefg
163264	India	4.82 bcdefg
381173	India	4.72 bcdefg
386256	India	4.47 bcdefg
165505	India	4.41 bcdefg
176759	Turkey	4.27 bcdefg
381219	India	4.23 bcdefg
277287	India	4.20 bcdefg
381288	India	4.17 bcdefg
164283	India	4.11 bcdefg
279875	Japan	4.07 bcdefg
180342	India	3.60 bcdefg
169651	Turkey	3.55 cdefg
320502	Canada	3.50 cdefg
320500	Canada	3.47 cdefg
179499	Turkey	3.45 cdefg
320501	Canada	3.36 defg
381232	India	3.29 defg
251506	Iran	3.09 defg
174359	Turkey	2.67 defg

² Means are based on 20 observations per replication; evaluation made on two dates. Means not followed by the same letter are significantly different at $P=0.05$ according to Duncan's multiple range test.

infection. Inoculated PI accessions that survived and their uninoculated counterparts were potted in sterile soil in 15-cm clay pots, placed on a greenhouse bench, and grown to maturity to evaluate vigor.

In plants that survived the test with limited vigor, we evaluated the systemic distribution of the pathogen by isolating it from various plant parts. The roots, crowns, stems, and yellowed leaves of infected plants were surface-disinfested with 1.5% NaOCl for 3 min and plated on a 2% water agar acidified with a drop of 50% lactophenol solution that was dispensed in the petri dish before the agar was poured. Results were recorded 72 hr after plating as number of plant parts yielding *Verticillium* per number of plant parts plated. *Verticillium* was isolated from all plant parts.

All uninoculated plants remained disease-free. In the statistical analysis of inoculated plants, test entries were arrayed from high to low, based on the mean of five observations with ratings above 5, the midpoint (test replicated once); readings were for two dates per replication. Significant differences were

determined by Duncan's multiple range test.

RESULTS AND DISCUSSION

The three accessions with the least susceptibility were PIs 164458, 381160, and 381166, all from India (Table 1). PIs 320504 (Canada) and 286099 (United States) had lower seedling-disease ratings but showed a vigor when mature that would indicate they overcame the infection or were extremely tolerant of the disease. Among surviving cultivars, Florida Market, Harris 468 Special Hibush, and Harris Hybrid 77631 had the highest ratings, followed by Black Jet, Black Knight, Black Magic, Early Royal, Jersey King, Long Black Beauty, and Peerless.

Although many PI lines in the test succumbed rapidly to infection and mortality levels were high, persistent screening and evaluation could identify more accessions with suitable resistance or tolerance to wilt, particularly if levels of the inoculum were adjusted. The use of inocula with fewer spores per milliliter might uncover lines that would hold up in

the field under less severe attacks. Also, selecting lines with field tolerance to the disease might be aided by growing plants on soils wilt-suppressed by flooding (4) and under conditions in which normal soil competitors and/or antagonists would be found.

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