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GA 1565-2-4 BWT, GA 219-1-2 BWT, GA 1095-1-4 BWT, and GA 1405-1-2 BWT Bacterial Wilt-tolerant Tomato

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Bacterial wilt, caused by the soil-borne pathogen *Pseudomonas solanacearum* E. F. Sm., causes major economic losses in tomato (*Lycopersicon esculentum* Mill.) production in many warm, humid regions of the world (6, 8). Selections of *L. esculentum* (GA 1565-2-4 BWT, GA 219-1-2 BWT and GA 1095-1-4 BWT) and of *L. esculentum* x *L. pimpinellifolium* (Jusl.) Mill. (GA 1405-1-2 BWT), all possessing high tolerance levels to *P. solanacearum*, are jointly released by the ARS/USDA and the Univ. of Georgia.

Origin

In 1984, we evaluated 2064 cultivars and PI numbered entries of which 1782 were *L. esculentum*, 72 *L. pimpinellifolium*, 60 *L. peruvianum* (L.) Mill., 4 *L. hirsutum* Humb. & Bonnl., 6 *L. hirsutum* f. *glabratum* C. H. Mull., and 140 interspecific crosses for bacterial wilt resistance. Seeds were obtained from the North Central Plant Introduction Station, Ames, Iowa; the Georgia Department of Agriculture; and various seed and canning companies.

About 100 seeds per entry were planted in the field in late March and early April at a rate of 42 seeds/m in four rows. Plants were ≈25 cm tall by mid-May when the maximum air and 5-cm soil temperatures were between 32° and 38°C (9) and when the first natural bacterial wilt symptoms usually appear in southern Georgia.

The soil was heavily infested with the indigenous strain race 1, biotype 1 of *P. solanacearum*. To increase the disease pressure, the plants were artificially inoculated eight times by clipping (5, 7–9) between 15 May and 9 July, and three times by mild sand blasting and spraying with a bacterial suspension of 10^7 colony-forming units (cfu)/ml between 6 and 28 June (1, 2). There were 184,231 healthy tomato plants at the beginning of the test, but most were killed by a natural or artificial inoculation by early July.

All of the live plants were transplanted on 10 July into 4-liter containers in the greenhouse. Most of the plants brought to the greenhouse died from *P. solanacearum* before producing mature fruit; however, 108 plants from 72 different entries lived to produce mature fruit. Twenty seeds from each of the 108 selections (S_1) were planted in the greenhouse. The S_1 plants were artificially inoculated with *P. solanacearum*. Scissor blades were dipped into a bacterial suspension of 10^7 cfu/ml prior to clipping across the fourth to fifth mature compound leaf (7).

The initial field test was a randomized complete block design with two replications of the 2064 entries. The number of entries was too many for available computer programs to perform mean separations (such as Duncan–Waller or others). Therefore, a standard analysis of variance data procedure was employed to obtain estimates of experimental error (10).

The objective of the research was to select the most *P. solanacearum*-tolerant entries from a large population (2064 entries) subject to extremely severe disease pressure as described above. The Gupta–Sobel test (3) provided the statistical model for selection based on relevant variance of all entries examined.

Selections with the highest percentage of plants living to produce mature fruit are presented in Table 1. GA 1565-2-4 BWT was a selection from PI 263722 (*L. esculentum)*; GA 219-1-2 BWT from PI 126408 (*L.esculentum*); GA 1095-1-4 BWT from PI 196298 (*L. esculentum*), and GA 1405-1-2 BWT from PI 251323 (*L. pimpinellifolium*). High *P. solanacearum* resistance under natural conditions has been reported in PI 126408 and PI 263722 (11). Moderate to high *P. solanacearum* resistance has also been reported in 'Saturn' (4). However, out of 61 'Saturn' plants in our test, none lived to produce fruit.

Description

GA 1565-2-4 BWT, GA 219-1-2 BWT, GA 1095-1-4 BWT, and GA 1405-1-2 BWT plants had the highest degree of bacterial-wilt tolerance compared to the other 2060 entries, a vigorous indeterminate growth habit, and jointed pedicels. All of the bacterial-wilt tolerant releases contained virulent bacteria in the shoots at fruit harvest in the 1984 evaluation, except GA 1565-2-4 BWT. Many of the GA 1565 plants in the 1984 test had a hollow stem, where up to 45 cm of the shoot split open and produced a flat stem. Except for the abnormal shoot, these plants appeared healthy and no bacteria were found in the stems at harvest. The stem malformation indicated that many GA 1565 plants became infected but later overcame the *P. solanacearum* infection.

GA 1565-2-4 BWT fruit are 3.3 to 4.5 cm wide, 2.8 to 3.2 cm deep, flattened globe shape, red when ripe, weigh 25 g, and have five locules. GA 219-1-2 BWT fruit are 2.9 to 3.4 cm wide, 2.1 to 2.2 cm deep, flattened globe shape, red when ripe, weigh 12 g, and have four to five locules. GA 1095-1-4 BWT fruit are 3.4 to 5.0 cm wide, 2.2 to 2.6 cm deep, irregular to globe shape, crimson when ripe, weigh 24 g, and have seven to nine locules. GA 1405-1-2 BWT fruit are 1.4 to 1.7 cm wide, 1.5 to 1.7 cm deep, globe shape, red when ripe, weigh 3 g, and have two locules.

Availability

A small quantity of seed can be obtained from S.C.P.

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Table 1. Tomato germplasm showing the highest tolerance to *P. solanacearum* as determined by selections with highest percent of plants living to produce mature fruit.

		Plants living to produce fruit[z]			
		First generation		Second generation	
Selection	No. plants	(%)	(Group)[y]	(%)	(Group)[y]
GA 1565-2-4 BWT	37	50	1	80	1
GA 219-1-2 BWT	89	2	3	55	2
GA 1095-1-4 BWT	75	1	4	44	3
GA 1405-1-2 BWT	127	2	3	26	4
Saturn	61	0	4	---	---

[z] Gupta and Sobel (3) critical value is 1.4% at the $P < 0.05$ level.
[y] Different numbers indicate different grouping of selections within generations.

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