Resistance in Tomatoes to Stemphylium floridanum and S. botryosum f. sp. lycopersici

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ABSTRACT

Tomato cultivars (*Lycopersicon esculentum*) resistant to *Stemphylium solani* were found to carry a high degree of resistance to *S. floridanum* and *S. botryosum* f. sp. *lycopersici*. Data obtained from F_1 hybrids between resistant and susceptible cultivars, indicated that resistance to both *Stemphylium* spp. is dominant. Individual plants of several accessions of *L. hirsutum* f. *glabratum*, *L. peruvianum*, *L. chilense*, and *L. pimpinellifolium* showed a higher level of resistance than *L. esculentum* cultivars.

Phytopathology 63:1542-1544

Additional key words: gray leaf spot.

Stemphylium solani Weber, *S. floridanum* Hannon & Weber, and *S. botryosum* f. sp. *lycopersici* Rotem, Cohen & Wahl, are the three species of *Stemphylium* pathogenic to tomato (*Lycopersicon esculentum* Mill.) foliage (4, 7, 8). The symptoms caused by these species are rather similar and detailed examination is needed to determine which species is actually present. Moreover, simultaneous spread of more than one species may occur: in Israel, in addition to the predominant *S. botryosum* f. sp. *lycopersici*, *S. floridanum* also may be present on the same plant or even on the same leaf. *S. solani* has not yet been found in this country.

Tomato cultivars resistant to *S. solani* have been developed. Resistance is conditioned by a single dominant gene, *Sm* (6). Screening tests involving *L. esculentum* and wild material have been related exclusively to their reaction to *S. solani* (1, 2, 5, 6). Sources of resistance to *S. floridanum* and *S. botryosum* f. sp. *lycopersici* have not been studied previously, and are the subject of the present trials. These included cultivars resistant to *S. solani*, and several accessions of wild *Lycopersicon* spp.

S. floridanum and *S. botryosum* f. sp. *lycopersici* were isolated from infected tomato plants grown in different seasons and localities. Cultures of both species were made on V-8 agar. Since no pathogenic differences were found among isolates of each species, the same isolate was used in all the inoculation tests. Test plants were inoculated at the age of 9 to 13 weeks by spraying both sides of all the leaves with a conidial suspension of ca. 7,000 conidia/ml to run-off. One percent glucose was added to the conidial suspension; this increased infection by up to ten times. The inoculated plants were kept for 48 hr in a moist chamber at 20 ± 1 C in the dark. They were then transferred to a growth chamber maintained at the same temperature, but illuminated for 12 hr. After incubation for 7 days, disease incidence was evaluated on a scale of 0 to 5 (0 = no disease; 5 = a completely wilted leaf), corresponding to the number of lesions found per leaf (3).

The *L. esculentum* lines tested for resistance to *S. floridanum* and *S. botryosum* f. sp. *lycopersici* were

TABLE 1. Reactions of individual plants of eight P.I. accessions of wild species of tomato to *Stemphylium floridanum* and *S. botryosum* f. sp. *lycopersici*

Lycopersicon sp.	No. of plants with the following grades of infection to[a]													
	S. floridanum Grade							*S. botryosum* f. sp. *lycopersici* Grade						
	0	0.5	1	2	3	4	5	0	0.5	1	2	3	4	5
L. pimpinellifolium														
P.I. 126432	1	1	5	2	1	-	-	7	-	10	-	-	-	-
L. hirsutum f. *glabratum*														
P.I. 134417	4	6	2	-	-	-	-	8	-	1	1	-	-	-
P.I. 134418	6	3	1	1	-	-	-	8	-	2	1	-	-	-
L. peruvianum														
P.I. 126945	-	2	-	1	7	-	-	3	-	4	2	1	-	-
P.I. 128643	2	-	1	-	3	4	-	2	-	4	-	10	-	-
P.I. 128660	-	2	3	3	2	-	-	5	-	3	2	1	-	-
L. chilense														
P.I. 128648	-	-	-	5	5	-	-	1	2	5	-	2	-	-
P.I. 128661	4	-	8	-	4	-	-	2	-	6	4	2	-	-

[a]Ratings from 0 = symptomless leaf, to 5 = wilted leaf.

(i) 'Anahu', 'Walter', and 'Tropic', carrying the gene *Sm* for resistance to *S. solani*; (ii) two F_1 hybrids, Anahu × 'Eilon' and Walter × 'Campbell 1327'; and (iii) the cultivars Eilon and Campbell 1327, as susceptible controls. These lines were tested in three series of trials with a total of 30 plants per line: 15 inoculated with *S. floridanum*, and 15 with *S. botryosum* f. sp. *lycopersici*. In all of these trials the homozygous *Sm*-cultivars were highly resistant to both pathogens, receiving disease ratings of 0.2 to 0.4, with standard errors (S.E.) of up to 0.1. The infection grades of the F_1 hybrids were close to those of the resistant parents, ranging from 0.8 to 1.4 (S.E. up to 0.4). The cultivars Eilon and Campbell 1327 were highly susceptible when inoculated with either of the two pathogens, and received ratings from 3.6 to 5 per leaf (S.E. up to 0.4).

From the uniform reaction of the plants which carry resistance to *S. solani* following inoculation with *S. floridanum* and *S. botryosum* f. sp. *lycopersici*, and the resistance of F_1 hybrids, it seems that the gene *Sm* confers resistance to all three pathogens. The fact that resistance appeared in F_1 hybrids, also suggests that it is dominant, as in the case with *S. solani*. However, further tests are needed to exclude the involvement of other linked genes for resistance to the *Stemphylium* complex.

In the next series of trials, three plants of each of 64 wild *Lycopersicon* accessions (P.I. lines) were inoculated separately with each species of *Stemphylium*. The test plants of 56 accessions became heavily and uniformly infected. Eight additional accessions, in which at least one of the inoculated plants was completely symptomless, were retested with 10 to 17 plants of each accession inoculated by each *Stemphylium* spp. The results, summarized in Table 1, show that individual plants within most accessions had distinctly different responses. Five accessions had a number of symptomless individuals following inoculation with either pathogen: *L. pimpinellifolium* P.I. 126432, *L. hirsutum* f. *glabratum* P.I. 134417 and 134418, *L. peruvianum* P.I. 128643, and *L. chilense* P.I. 128661. Thus, these data indicate the existence, in the wild material, of a type of high resistance superior to that present in *L. esculentum* cultivars resistant to *S. solani*. These accessions are not, however, homozygous for resistance and therefore single plant selections must be made.

The eight accessions possessing individuals with the greatest resistance to *S. floridanum* and/or to *S. botryosum* f. sp. *lycopersici* had been screened previously for resistance to *S. solani*, but none of these wild types was considered as a possible source of resistance (1). The lack of uniformity in the results obtained in the present work and those reported for *S. solani* may be attributed either to different techniques or pathogens used, or to the previously mentioned variations found in the response of individual plants. The variability in the reaction of wild plants suggests that by testing populations larger than those employed, resistant individuals might be found among accessions graded as susceptible.

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