Note

Resistance to *Septoria lycopersici* in *Solanum* (section *Lycopersicon*) species and in progenies of *S. lycopersicum* × *S. peruvianum*

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ABSTRACT: Septoria leaf spot (*Septoria lycopersici*) is one of the major fungal diseases of tomatoes (*Solanum lycopersicum*) in tropical and subtropical regions with humid climates and/or in areas cultivated under sprinkler irrigation systems. Sources of resistance have been found in accessions of *Solanum* (section *Lycopersicon*) species. However, many of the described sources are not effective under Brazilian conditions. The objective of this work was to evaluate wild and cultivated *Solanum* (section *Lycopersicon*) germplasm to *S. lycopersici* isolates. A collection of 124 accessions was initially evaluated under greenhouse conditions. Ten accessions were highly resistance (HR), whereas 33 were classified as having a resistant (R) response to *S. lycopersici* isolates. Field evaluation was also conducted with a sub-set of accessions identified as either HR or R in the greenhouse experiment. This field evaluation confirmed greenhouse tests and indicated the presence of some potential sources of rate-reducing resistance. One highly resistant and eight resistant *S. habrochaites* accessions were identified as being resistant under both conditions, confirming that this wild species is one of the most promising sources of resistance to *S. lycopersici*. Five new sources with high levels of resistance were found in *S. peruvianum* accessions (PI-306811, CNPH-1036, LA-1910, LA-1984 and LA-2744). One accession derived from an interspecific cross between *S. lycopersicum* and *S. peruvianum* was also found to be highly resistant and might be useful to introgress resistance factors from this wild species into cultivated tomato germplasm. However, additional breeding efforts will be necessary to introgress into the cultivated tomato the resistance factors identified in other *S. peruvianum* accessions due to the presence of natural crossing barriers between the two species.
Key words: breeding, disease control, septoria leaf spot

Resistência a *Septoria lycopersici* em espécies de *Solanum* (Secção *Lycopersicon*) e em progênies de *S. lycopersicum* × *S. peruvianum*

RESUMO: A mancha-de-septória (*Septoria lycopersici*) é importante doença fúngica do tomateiro (*Solanum lycopersicum*) em áreas tropicais e subtropicais com alta umidade ou quando esta hortaliça é cultivada sob irrigação por aspersão. Fontes de resistência têm sido encontradas em germoplasma de *Solanum* (secção *Lycopersicon*). No entanto, muitas das fontes descritas não funcionam nas condições brasileiras. Avaliou-se uma coleção de germoplasma de tomate cultivado e selvagem (*Solanum* secção *Lycopersicon*) visando identificar novas fontes de elevada resistência. Uma coleção de 124 acessos foi inicialmente avaliada sob condições de casa de vegetação. Somente dez acessos foram classificados como altamente resistentes e 33 foram classificados como resistentes. Um ensaio de campo foi também conduzido com um subconjunto de acessos promissores identificados no primeiro experimento. Foi confirmada a resposta da maioria dos acessos avaliados em casa de vegetação e indicou a presença de fontes de resistência capazes de reduzir a taxa de progresso da doença. Um acesso de *S. habrochaites* com elevada resistência e oito acessos resistentes foram identificados, confirmando que esta espécie representa uma das mais promissoras fontes de genes de resistência a *S. lycopersici*. Cinco novas fontes com elevados níveis de resistência foram identificadas em acessos da espécie *S. peruvianum* (PI-306811, CNPH-1036, LA-1910, LA-1984 e LA-2744). Um acesso, derivado de cruzamento interespecífico entre *S. lycopersicum* e *S. peruvianum* também mostrou-se altamente resistente e poderá ser útil na introgressão deste(s) gene(s) em germoplasma de tomateiro cultivado. No entanto, esforços adicionais de melhoramento serão necessários para transferir para o tomateiro cultivado os fatores de resistência identificados em outros acessos de *S. peruvianum*, uma vez que existem barreiras naturais de cruzamentos entre estas duas espécies.
Palavras-chave: controle de doença, melhoramento genético, mancha-foliar-de-septoria

Introduction

Septoria leaf spot, caused by the fungus *Septoria lycopersici* Speg., is one of the major fungal diseases of the cultivated tomato (*Solanum lycopersicum* L. section *Lycopersicon* [Mill.] Wettst. subsection *Lycopersicon*) in

tropical and subtropical areas with high humidity and/or cultivated under sprinkler irrigation systems where severe fruit yield and quality losses might occur (Jones et al., 1991).

Sources of resistance to *S. lycopersici* have been found in germplasm of wild tomatoes [*Solanum* L. subsection *Lycopersicon*, an autonym of *Solanum* section *Lycopersicon* (Mill.) Wettst.) (Peralta et al., 2005)] evaluated under either field conditions with natural inoculum (Barksdale, 1982; Maluf et al., 1985; Poysa & Tu, 1993) or under controlled greenhouse conditions using spore suspensions (Locke, 1949; Kurozawa & Balmer, 1977; Barksdale & Stoner, 1978; Sotirova & Rodeva, 1990; Moretto & Barreto, 1993). Sources of resistance due to the presence of putative single dominant genes have been identified in accessions of *S. lycopersicum* 'Targinnie Red' (= LA-1800) (Andrus & Reynard, 1945) and *S. pimpinellifolium* PI-422397 (Barksdale & Stoner, 1978). However, this resistance appears to be unstable (Andrus & Reynard, 1945). Accessions derived from these two sources were shown to have intermediate to susceptible responses to *S. lycopersici* isolates in Brazil (Maluf et al., 1985).

Chemical control with fungicides is currently the method recommended for Septoria leaf spot control (Tu and Poysa, 1990). However, this strategy might be ineffective when the disease reaches certain severity levels, especially in highly susceptible cultivars (Jones et al., 1991). In this scenario, the identification of resistant sources with stable phenotypic response in different environments and effective against distinct *S. lycopersici* isolates would be an important contribution for tomato breeding programs and would help minimize the need of fungicides in the management of the tomato crop. The main objective of this study was to evaluate a diverse germplasm collection of *Solanum* (section *Lycopersicon*) for resistance to *S. lycopersici* under both greenhouse and field conditions.

Material and Methods

Plant material

Two experiments were conducted: one under greenhouse condition and one under field conditions, aiming to confirm the greenhouse results. One hundred-twenty-four accessions of cultivated and wild *Solanum* (section *Lycopersicon*) species were initially evaluated for resistance to *S. lycopersici* under greenhouse conditions in Brasília–DF, Brazil (latitude 15°46'47'' and longitude 47°55'47''). The germplasm collection under evaluation (Table 1) comprised the following accessions: 42 *S. lycopersicum* L. (= *Lycopersicon esculentum*); 07 *S. lycopersicum* var. *cerasiforme*; 13 *S. pimpinellifolium* L. (= *L. pimpinellifolium*); one *S. chilense* (Dunal) Reiche (= *L. chilense*); one *S. pennellii* (Corr.) D'Arcy (= *L. pennellii*); 12 *S. habrochaites* Knapp & Spooner (= *L. hirsutum*) and 42 accessions belonging to *S. peruvianum* L. (Peralta et al., 2005; Spooner et al., 2005). Six inbred lines derived from interspecific crosses between *S. lycopersicum* × *S. peruvianum* accessions obtained by the Brazilian tomato breeding program were also included in this evaluation. A sub-group of 17 accessions classified as either resistant or highly resistant based on the greenhouse test were also evaluated for *S. lycopersici* resistance under field conditions. Three *S. lycopersicum* accessions (classified as highly susceptible in the greenhouse test) were included as controls. Some accessions that displayed high levels of resistance in the greenhouse experiment were not included in the field experiment due to seed germination problems (e.g. LA-1270, CNPH-1112 and CNPH-0633).

Septoria lycopersici isolates, inoculum production, and conidial concentration for the greenhouse and for the field experiments

The *S. lycopersici* isolate used in the greenhouse experiment was obtained from an infected tomato plant in the Brasília-Federal District. The spore suspension for the field experiment was a mixture of two isolates of *S. lycopersici* from tomatoes obtained from distinct geographical origins (one collected in Brasília-Federal District and the other in Morrinhos, state of Goiás, Brazil). This mixture of isolates was used aiming to challenge the germplasm collection with a more diversified pool of pathogen isolates. However, no information was available about differences in virulence and aggressiveness of these isolates. All isolates were cultivated on Potato Dextrose Agar medium for 15 days in a BOD incubator (12 h in the dark and 12 h with black light). For the greenhouse experiment, the entire plants were spray-inoculated until run-off (15 d after transplant) with a suspension adjusted to 10^5 conidia per mL. For the field experiment, plants were sprayed at 21 d after transplanting with a spore suspension adjusted to 10^4 conidia per mL. Conidial concentration of the field experiment was lower than that of the greenhouse experiment aiming to emulate inoculum pressure under field (natural) conditions, which is usually not so high.

Greenhouse evaluation

Seeds were sown in Styrofoam trays with 128 cells filled with sterile Plantmax® substrate. Twenty days after sowing the seedlings were transplanted to 2 L plastic pots filled with a sterilized mixture of an Oxisol (150 L), sand (50 L) and organic matter (50 L of cow manure) plus 300 g of N-P-K (formulation 4-14-8) and 350 g CaO. The experiment set-up was a complete randomized block design with four replications (pots with three plants each) per accession. Plants of the accessions under evaluation and controls were kept in a damp chamber for 36 h after inoculation. Plants were cultivated under greenhouse conditions (air temperature varying from 24°C to 35°C).

Disease severity was assessed 15 d after inoculation using an ordinal leaf damage scale adapted from Maluf et al. (1985): (0 to 5) where: 0 = plant free of symptoms; 1 = foliar lesions limited to the third basal part of the plants, several lesions on bottom leaves but without coalescence of lesions; 2 = top section of the plants free of

Table 1 – Reaction of 124 wild, cultivated and inbred lines of *Solanum* (section *Lycopersicon*) accessions to Septoria leaf spot (*Septoria lycopersici*) under greenhouse conditions in Brasília-DF.

Accession code	Solanum (Section Lycopersicon) species	DSI*	Group of Reaction**
LA-1910	*S. peruvianum*	6.50 A	HR
CNPH-1036	*S. peruvianum*	8.50 A	HR
LA-1984	*S. peruvianum*	10.00 A	HR
PI-306811	*S. peruvianum*	11.50 A	HR
CNPH-0979	*lyc x per***	14.50 A	HR
LA1677	*S. peruvianum*	17.00 A	HR
LA-2744	*S. peruvianum*	17.50 A	HR
LA-1113-1	*S. peruvianum*	21.50 A	HR
CNPH-1112	*S. habrochaites*	23.50 A	HR
TX-407	*lyc x per***	25.00 A	HR
WIR-3611	*S. habrochaites*	26.00 B	R
LA-0107	*S. peruvianum*	26.50 B	R
LA-1113-2	*S. peruvianum*	28.50 B	R
PI-126445	*S. habrochaites*	30.00 B	R
PI-134417	*S. habrochaites*	30.00 B	R
LA-1270	*S. peruvianum*	30.00 B	R
TX-410	*lyc x per***	30.00 B	R
CGO-6711	*S. peruvianum*	31.50 B	R
LS-121	*S. peruvianum*	31.50 B	R
LA-1967	*S. chilense*	32.50 B	R
PI-127826	*S. habrochaites*	33.00 B	R
PI-134418	*S. habrochaites*	33.00 B	R
CGO-6708	*S. peruvianum*	33.00 B	R
TX-412	*lyc x per***	33.50 B	R
CGO-6716	*S. peruvianum*	34.50 B	R
LA-2067	*S. peruvianum*	34.50 B	R
PI-127827	*S. habrochaites*	34.50 B	R
WYR-7924	*S. habrochaites*	35.00 B	R
CNPH-0633	*S. cerasiforme*	36.50 B	R
Hawaii-7996	*S. lycopersicum*	36.50 B	R
Santa Cruz	*S. lycopersicum*	38.00 B	R
CGO-6709	*S. peruvianum*	38.00 B	R
L-03683	*S. habrochaites*	38.00 B	R
CNPH-0769	*S. pimpinellifolium*	38.50 B	R
CNPH-1033	*S. peruvianum*	38.50 B	R
ID-8624	*S. peruvianum*	40.00 B	R
CGO-8200	*S. peruvianum*	41.50 B	R
PI-126925	*S. pimpinellifolium*	42.00 B	R
LA-1342	*S. pimpinellifolium*	42.00 B	R
PI-128660	*S. peruvianum*	42.00 B	R
PI-365951	*S. peruvianum*	42.50 B	R
LA-1626	*S. peruvianum*	42.50 B	R
CNPH-0980	*lyc x per***	43.00 B	R

Continue...

Table 1 – Continuation.

CNPH-1592	*S. lycopersicum*	44.00 C	S
LA-111	*S. peruvianum*	44.50 C	S
CGO 6712	*S. peruvianum*	45.00 C	S
CNPH-0841	*S. cerasiforme*	45.00 C	S
LA-1113-3	*S. peruvianum*	45.00 C	S
PI-126449	*S. habrochaites*	46.50 C	S
CNPH-0483	*S. lycopersicum*	46.50 C	S
CNPH-0610	*S. peruvianum*	46.50 C	S
CNPH-1097	*S. cerasiforme*	46.50 C	S
CGO-7650	*S. pimpinellifolium*	46.50 C	S
CNPH-1035	*S. peruvianum*	48.00 C	S
XP-674	*S. lycopersicum*	48.50 C	S
LA-1584	*S. pimpinellifolium*	48.50 C	S
C-28	*S. lycopersicum*	48.50 C	S
LA-441	*S. peruvianum*	50.00 C	S
CNPH-0641	*S. lycopersicum*	50.00 C	S
BHRS-1,2,3	*S. lycopersicum*	50.00 C	S
LA-1614	*S. pimpinellifolium*	50.00 C	S
Rauti	*S. lycopersicum*	50.00 C	S
L-03708	*S. pimpinellifolium*	50.00 C	S
Yoshimatsu	*S. lycopersicum*	50.00 C	S
Saladette	*S. lycopersicum*	51.50 C	S
IVT-4	*lyc x per***	51.50 C	S
WYR-2020	*S. peruvianum*	51.50 C	S
Duradoro	*S. lycopersicum*	51.50 C	S
Kada	*S. lycopersicum*	51.50 C	S
LA-1333	*S. peruvianum*	52.00 C	S
LA-462	*S. peruvianum*	52.00 C	S
VFN-8	*S. lycopersicum*	53.00 C	S
Heinz 439	*S. lycopersicum*	53.50 C	S
CGO 6707	*S. peruvianum*	53.50 C	S
LA-1609	*S. peruvianum*	53.50 C	S
LA-2553	*S. peruvianum*	53.50 C	S
LA-385	*S. peruvianum*	54.50 C	S
WYR-3951	*S. habrochaites*	54.67 C	S
AG-551	*S. cerasiforme*	55.00 C	S
CNPH-1034	*S. habrochaites*	55.00 C	S
Rutgers	*S. lycopersicum*	55.00 C	S
TSW-10	*S. lycopersicum*	55.00 C	S
LA-1425	*S. cerasiforme*	56.00 C	S
CGO-6714	*S. peruvianum*	56.50 C	S
LA-1616	*S. peruvianum*	56.50 C	S
Overpack	*S. lycopersicum*	56.50 C	S
CNPH-0889	*S. lycopersicum*	56.50 C	S
CNPH-199	*S. lycopersicum*	58.00 D	HS

Continue...

Table 1 – Continuation.

CNPH-1412	*S. cerasiforme*	58.00 D	HS
LA-716	*S. pennellii*	58.50 D	HS
WYR-3957	*S. peruvianum*	58.50 D	HS
Hawaii-7998	*S. lycopersicum*	58.50 D	HS
Viradoro	*S. lycopersicum*	60.00 D	HS
732293-2v	*S. pimpinellifolium*	60.00 D	HS
Ãngela Gigante	*S. lycopersicum*	60.00 D	HS
PI-128659	*S. peruvianum*	60.00 D	HS
Florida Petit	*S. lycopersicum*	60.00 D	HS
CNPH-1358	*S. lycopersicum*	60.00 D	HS
Floradade	*S. lycopersicum*	60.50 D	HS
IPA-5	*S. lycopersicum*	61.50 D	HS
WC-134	*S. lycopersicum*	61.50 D	HS
IVT-3	*S. lycopersicum*	61.50 D	HS
CGO-6713	*S. peruvianum*	61.50 D	HS
CNPH-1039	*S. pimpinellifolium*	62.00 D	HS
PI-732293	*S. pimpinellifolium*	62.00 D	HS
L-03707	*S. pimpinellifolium*	62.00 D	HS
Ohio-8245	*S. lycopersicum*	62.00 D	HS
Alambra	*S. lycopersicum*	62.00 D	HS
BRA-013307	*S. lycopersicum*	63.50 D	HS
CNPH-0374	*S. peruvianum*	63.50 D	HS
CNPH-0956	*S. lycopersicum*	63.50 D	HS
Ponderosa	*S. lycopersicum*	63.50 D	HS
CNPH-0239	*S. lycopersicum*	65.00 D	HS
Santa Clara	*S. lycopersicum*	65.00 D	HS
LA-2172	*S. peruvianum*	65.00 D	HS
PI-126445	*S. pimpinellifolium*	65.00 D	HS
BHRS-2.3	*S. lycopersicum*	67.00 D	HS
Glamour	*S. lycopersicum*	67.00 D	HS
San Vito	*S. lycopersicum*	67.00 D	HS
WYR-2920	*S. pimpinellifolium*	70.00 D	HS
New Yorker	*S. lycopersicum*	70.00 D	HS
Yuba	*S. lycopersicum*	70.00 D	HS
CNPH-0390	*S. cerasiforme*	70.00 D	HS
MoneyMaker	*S. lycopersicum*	70.00 D	HS
CV (%)		11.20%	

*DSI (Disease Severity Index) = [S(disease rate × number of plants in each disease rate)/(total number of evaluated plants × maximum disease rate)] ×100. Disease ratings ranged from 0 to 5 where: 0 = no symptoms and 5 = plant displaying several foliar lesions. DSI values followed by the same letter in the column belong to the same cluster according to the Scott-Knott cluster analysis method (p = 0.05); **The four reaction groups were assigned as follow: HR = highly resistant; R = resistant; S = susceptible and HS = highly susceptible; ***Lines derived from interspecific crosses between *S. lycopersicum* and *S. peruvianum*.

foliar lesions, many lesions present on the basal leaves, but with rare coalescence; 3 = top section of the plants free of foliar lesions, many lesions on the basal leaves of the plants, frequently coalescent; 4 = top section of the plants free of foliar lesions, many lesions on leaves located in medium portion of the plants with coalescence, but rarely getting 50% of foliar area; 5 = top of the plant displaying several foliar lesions, many lesions on the intermediary and basal leaves with coalescence, lesions covering more than 50% of the foliar area, presence of premature leaf drop. With the obtained data a disease severity index (DSI) was calculated for each ac-

cession on each replicate (McKinney, 1923), using the following expression: DSI = [Σ(disease rate × number of plants in each rate)/(total number of evaluated plants × maximum disease rate)] ×100. The DSI data were transformed into $\sqrt{x+0.5}$. The Scott-Knott (p = 0.05) cluster analysis method for grouping means in the analysis of variance was employed with the numerical data (Scott and Knott, 1974).

Field evaluation

The field experiment was conducted in Brasília-DF using a randomized complete block design with four replications (24 plants each). The soil type was a clayey dystrophic Oxisol. The experimental plots were sprayed at a weekly basis with insecticides for the control of whiteflies (*Bemisia tabaci*) and South America moth (*Tuta absoluta*). Plots were sprinkler irrigated in order to keep the soil close to water saturation and provide the foliage with free water aiming to favor *S. lycopersici* epidemics. The irrigation regime was determined by monitoring water potential levels with a soil moisture tensiometer. The average air temperature during the field experiment was 23°C with a range of 17°C (night temperature) to 28°C (day temperature). Field plots were overhead irrigated two hours before inoculation to increase the wetness and soil moisture. Inoculation was performed just before sunset, spraying the spore suspension on the entire plants until run-off. The assessments of the disease severity were made on the four center plants in each plot, starting 15 days after inoculation. Disease assessments were performed every seven days for five weeks. A disease severity index (DSI) was calculated for each plot essentially as described before for the greenhouse evaluation (McKinney, 1923). The area under disease progress curves (AUDPC) were generated using DSI values, where: AUDPC = $\{\Sigma [(y_i + y_{i+1})/2].(t_{i+1} - t_i)\}/n$, where y_i and y_{i+1} are the values of DSI observed between two assessments, $t_{i+1} - t_i$ is the time interval between assessments and n = elapsed time between the beginning and the end of the assessment period (Fry, 1978). DSI data were also transformed using $\sqrt{x+0.5}$ for analysis of variance using the Scott-Knott cluster analysis method (p = 0.05) for grouping means in the analysis of variance. The AUDPC data were submitted to the analysis of variance and average comparisons, but without data transformation.

Results and Discussion

DSI and reactions to Septoria leaf spot in the 124 accessions evaluated under greenhouse conditions (Table 1) indicate that according to the Scott-Knott cluster analysis it was possible to classify the *Solanum* (section *Lycopersicon*) accessions in four reaction groups: highly resistant (HR), resistant (R), susceptible (S) and highly susceptible (HS). Approximately 8% of the tested accessions were considered HR, 26.6% were considered R and most (65.3%) were either S (35.5%) or HS (29.8%) to the pathogen.

The majority of the accessions from *S. lycopersicum* and its closely related botanical variety *S. lycopersicum* var. *cerasiforme* reacted in the range between S and HS. Therefore, as expected, the number of HR and/or R accessions within the cultivated tomato gene pool was scarce. The only exception was the accession from the subspecies *S. lycopersicum* var. *cerasiforme* (CNPH-0633), which was classified as R (Table 1). This accession is valuable due to the fact that there is no crossing barrier with *S. lycopersicum*. However, this accession was not evaluated under field conditions due to seed germination problems. Therefore, additional tests are needed to fully demonstrate the breeding value of this accession for Septoria leaf spot resistance.

No accession with HR response was found in the wild tomato relative (*S. pimpinellifolium*). Many accessions from this species displayed either S (30.8%) or HS (46.2%) reactions to the pathogen. A total of 23.1 % was classified as R (Table 1). These results are not in complete agreement with other studies where many *S. pimpinellifolium* accessions were classified as highly resistant (Alexander et al., 1942; Alexander, 1959; Barksdale and Stoner, 1978; Barksdale, 1982). There are a large number of *S. pimpinellifolium* accessions available in germplasm collections throughout the world, and the ones evaluated here could represent a fraction without HR accessions.

Most of the *S. habrochaites* accessions were classified as R in the present study. In addition, one accession of this species was classified as HR, which agrees with several previous reports in the literature (Alexander et al., 1942; Alexander, 1959; Barksdale and Stoner, 1978; Barksdale, 1982; Maluf et al., 1985). Accessions of this wild species have been reported as the most promising sources of resistance to *S. lycopersici* in *Solanum* (section *Lycopersicon*) (Alexander et al., 1942; Maluf et al., 1985). From a practical breeding standpoint, the high levels of resistance to *S. lycopersici* identified in *S. habrochaites* accessions may be extremely useful since they can be promptly introgressed into the *S. lycopersicum* gene pool. This wild species has no major crossing barriers with cultivated tomatoes when serving as staminate (pollen) donor (Hogenboom, 1972). Therefore, *S. lycopersici* resistance in *S. lycopersicum* could be improved by using this wild species germplasm.

Resistance to *S. lycopersici* has been already identified in some *S. chilense* accessions (Poysa and Tu, 1993). However, to our knowledge, it is the first formal report of resistance to Septoria leaf spot in the accession *S. chilense* LA-1967. This accession is of special value for the tomato breeding programs since it displays resistance response to an array of tomato pathogens including: *Fusarium oxysporum* f.sp. *lycopersici* race 3 (Reis et al., 2004) *Tomato chlorotic mottle virus* (Santana et al., 2001; Giordano et al., 2005) and potyvirus. In addition, interspecific progenies between *S. lycopersicum* and *S. chilense* LA-1967 have been obtained and the resistance to *S. lycopersici* could be incorporated into elite lines using this germplasm (Santana et al., 2001).

Accessions with resistance factors to *S. lycopersici* seem to be more common within the *S. peruvianum* when compared with other wild species of the section *Lycopersicon*, confirming the results of previous screening works (Alexander et al., 1942; Alexander, 1959; Kurozawa and Balmer, 1977; Sotirova and Rodeva, 1990). In the present work, seven out of the ten highly resistant accessions were *S. peruvianum* (Peralta et al., 2005; Sponner et al., 2005). Five *S. peruvianum* accessions (PI-306811, CNPH-1036, LA-1910, LA-1984, and LA-2744) were reported for the first time as highly resistance sources against *S. lycopersici*. In addition, fertile/self-compatible inbred lines derived from the interspecific crosses between *S. lycopersicum* and *S. peruvianum* were also classified as resistant to *S. lycopersici* (Table 1). The availability of these fertile, interspecific inbred lines opens the possibility of further genetic studies in order to identify the genetic factors associated with *S. lycopersici* resistance derived from *S. peruvianum*. So far, such studies have been conducted only with *S. pimpinellifolium* and *S. habrochaites* accessions (Barksdale and Stoner, 1978; Barksdale 1982; Maluf et al., 1985; Sotirova and Rodeva, 1990; Tu and Poysa, 1990).

Evaluation under field conditions of accessions with promising levels of resistance to Septoria leaf spot has been recommended as a standard procedure to confirm the resistant reaction (Barksdale, 1982). For this reason, a sub-set of 17 accessions displaying either HR or R reaction under greenhouse were also evaluated under field conditions with artificial inoculation in order to assure adequate levels of inoculum pressure. Most of the accessions selected as HR or R in the greenhouse experiment were also resistant in the field to the mixture of two pathogen isolates employed as inoculum. The controls confirmed their high susceptibility as well as the adequate levels of inoculum pressure (Table 2).

Transferring genes from *S. peruvianum* complex to cultivated tomatoes is very difficult via conventional crossings, but some of the genetic barriers could be overcome by *in vitro* embryo rescue techniques (Bhatia et al., 2004), which would allow for the introgression of genetic diversity in the cultivated tomato gene pool. The effort justifying the introgression of resistance to *S. lycopersici* from this germplasm pool is due to the possibility that they might represent sources of new genes/alelles. In addition, many of the multiple sources of resistance reported here are also carrying useful resistance alleles to other diseases. The accession *S. chilense* LA-1967 would deserve additional efforts especially because it has also been reported as source of resistance to other economically important tomato pathogens (Santana et al., 2001; Giordano et al., 2005).

Table 2 – Field evaluation of a sub-group of *Solanum* (section *Lycopersicon*) accessions identified with differential response to Septoria leaf blight under greenhouse conditions. Evaluation criteria were the area under disease progress curve (AUDPC) and the final disease severity index (DSI).

Accession code	CNPH code	*Solanum* (Section *Lycopersicon*) species	Greenhouse evaluation**	AUDPC	DSI
LA-1677	CNPH-0933	*S. peruvianum*	HR	323.33 A	16.67 A
PI-306811	CNPH-0101	*S. peruvianum*	HR	408.75 A	17.50 A
CNPH-0979	CNPH-0979	*S. lyc* × *S. per****	HR	598.75 A	20.00 A
WIR-3611	CNPH-0605	*S. habrochaites*	R	892.50 C	22.50 A
PI-134417	CNPH-0423	*S. habrochaites*	R	575.00 A	25.00 A
PI-126445	CNPH-0416	*S. habrochaites*	R	471.25 A	27.50 B
LA-1984	CNPH-1462	*S. peruvianum*	HR	528.75 A	27.50 B
CNPH-1036	CNPH-1036	*S. peruvianum*	HR	821.25 B	27.50 B
LA-1113-2	CNPH-0939	*S. peruvianum*	R	1071.25 C	27.50 B
LA-0107	CNPH-1435	*S. peruvianum*	R	923.33 C	30.00 B
PI-127827	CNPH-0421	*S. habrochaites*	R	766.25 B	30.00 B
TX-407	CNPH-0946	*S. lyc* × *S. per*	HR	792.50 B	32.50 B
LA-2744	CNPH-1471	*S. peruvianum*	HR	718.33 B	33.33 B
LA-1967	CNPH-0410	*S. chilense*	R	773.75 B	35.00 B
LA-1113-1	CNPH-0938	*S. peruvianum*	HR	923.75 C	35.00 B
LA-1910	CNPH-1454	*S. peruvianum*	HR	705.00 B	36.67 B
Hawaii-7998	CNPH-0865	*S. lycopersicum*	HS	1027.50 C	50.00 C
Yuba*	CNPH-0851	*S. lycopersicum*	HS	1666.25 D	72.50 D
IPA-5*	CNPH-0507	*S. lycopersicum*	HS	1595.00 D	77.50 D
CV (%)	---	---	---	13.45%	14.76%

*Susceptible controls. **HR = highly resistant; R = resistant; S = susceptible, and HS = highly susceptible. ***Lines derived from interspecific crosses between *S. lycopersicum* and *S. peruvianum*.

The results reported here confirm the relative low frequency of accessions with high levels of resistance to Septoria leaf spot in the *Solanum* (section *Lycopersicum*) germplasm. Ideally, more accessions must be evaluated, and the sources of resistance discovered in this study should be re-evaluated with different isolates of the pathogen in order to confirm their stability. As discussed, strategies for controlling *Septoria* leaf spot in tomatoes are currently based upon fungicide sprays (Jones et al., 1991; Tu and Poysa, 1990). Accessions displaying resistance to an array of *S. lycopersici* isolates under distinct environmental conditions might represent important sources of genetic variability for tomato breeding programs. The introgression of these genetic factors in commercial tomato cultivars/inbred lines would offer effective strategies for the incorporation of stable and durable resistance to this important disease.

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