Sources of Curly Top Virus Resistance in *Capsicum*

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Abstract. During a natural field epidemic of curly top virus, accessions within five species of *Capsicum* were evaluated for resistance. Accessions were considered resistant if 0% to 25% of the individual plants were devoid of curly top virus symptoms. Resistance was found in three accessions each of *C. annuum* L. and *C. frutescens* L. and one accession each of *C. chacoense* Hunz. and *C. chinense* Jacq. The resistant *C. annuum* accessions were ‘Burpee Chiltepin’, ‘NuMex Bailey Piquin’, and ‘NuMex Twilight’, while the *C. frutescens* resistant accessions were USDA-Grif 9322 from Costa Rica, PI 241675 from Ecuador and ‘Tabasco’. The resistant *C. chacoense* accession was PI 273419 from Argentina and the *C. chinense* resistant accession was USDA-Grif 9303 from Colombia.

Curly top virus (syn. beet curly top virus), a geminivirus vectored by the leafhopper, *Circulifer tenellus* (Baker), is found primarily in arid and semi-arid climates. In southern New Mexico, it occurs annually in chile pepper (*Capsicum annuum* L.) fields (Muhyi and Bosland, 1989). Typical symptoms of curly top on young chile plants include yellowing of leaves, dwarfism, and death. If the plant survives, the few pods produced are deformed and small. The margins of older leaves roll upward and they become thickened and leathery (Bosland et al., 1988).

In most years, curly top damage to chile is minimal in New Mexico. During Spring 1999, the Mesilla and Hatch Valleys, including the

research plots at New Mexico State Univ., experienced extremely high levels of curly top virus infection. The epidemic may have been weather-related, with a cool spring keeping the migratory leafhoppers in the area longer than usual. The virus survives in the bodies of the leafhoppers, which transmit the virus to chile plants during feeding. The Chile Pepper Institute’s Teaching and Demonstration Garden, planted annually at the Fabian Garcia Science Center in Las Cruces, N.M., had 127 accessions of chile and 56 accessions of tomato (*Lycopersicon esculentum* Mill.) planted for the season. The curly top virus epidemic was so severe that all tomato accessions were killed. Some chile plants survived, providing an opportunity to observe possible resistance among the planted material under natural infection. An earlier survey of U.S. Dept. of Agriculture plant introductions reported resistance in some *Capsicum* accessions (Ungs et al., 1977). This note provides information on additional potential sources of resistance to curly top virus in *Capsicum*.

Each of the 127 chile accessions evaluated contained up to 12 individual plants and each plant was scored symptomatic or asymptomatic by visual assessment. A single symptomatic plant from four different accessions and one plant that had no symptoms of curly top were sent to a testing laboratory (AGDIA, Elkhart, Ind.) to confirm that curly top virus was present. The test confirmed that curly top was present, and no other viruses were detected. The plant without symptoms was free of the virus. Therefore, plants with one or more symptoms of the disease were considered infected. All symptomatic plants, whether expression was mild or severe, were classified as infected; all other plants were asymptomatic. The symptomless individuals may have been escapes, but this is unlikely because of the severity of the epidemic. However, the symptomless plants could be tolerant to the virus. Confirmation of whether the symptomless plants were truly resistant or tolerant was beyond the scope of these observations.

The accessions were grouped by percentage of plants showing symptoms (Tables 1 and 2). The data indicate that those accessions are worthy of further testing, and may be useful sources of resistance to the virus. Those accessions with 75% or more symptomatic plants may not be the best starting point for sources of resistance. Individuals within these accessions may be resistant, but the frequency is low, making identification arduous. However, the eight accessions in the 0% to 24% symptomatic group and the 10 accessions in the 25% to 50% warrant further evaluation, and could be useful sources of resistance in chile breeding programs.

Results

All eight accessions in the group with the lowest percentage of symptoms are wild types. *Capsicum chacoense* Hunz. is a wild species, and the three *C. annuum* accessions are chiltepin types. The *C. chinense* Jacq. and *C. frutescens* L. accessions are also small-fruited, wild types. The genetic diversity present in wild species plays an important role in crop improvement.

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Table 1. Reactions of *Capsicum annuum* genotypes to a natural epidemic of curly top virus.

0% to 25% symptomatic ^a plants within an accession	
Burpee Chiltepin, NuMex Bailey Piquin, NuMex Twilight	
26% to 50% symptomatic plants within an accession	
Black Olive, Milky Way, Mississippi Sport, NuMex Piñata, Ordone, PI 439378 (Jamaica), Sujata, Tarahumara Chiltepin, Thai Hot	
51% to 75% symptomatic plants within an accession	
Big Red, de Arbol, Golden Giant II, Hot Portugal, Huasteco, Jigsaw, Long Red Cayenne, Mississippi Sport, NuMex Joe E. Parker, NuMex Sunflare, NuMex Pinata, NuMex Sunglo, Peter Pepper, Pinguita de Mono, Serrano, Valencia	
76% to 100% symptomatic plants within an accession	
Ancho, Antohi Romanian, Apple, Big Bertha, Big Chile, Big Thai, Biscayne, Chilaca, Chile de Arbol, Chimayo, Cochiti, Corno de Toro, Cubanelle, Flamingo, Golden Summer, Guajillo, Isleta, Jackpot, Jemez, Jingle Bells, Kishiner, Kori Sitakne, LaMuyo, Large Red Cherry, Lavender Apple Islander, Lemon Belle, Long Slim Cayenne, Mandarin, Marconi, Mesilla Cayenne, Mirasol, Mushroom, Negro, New Mexico 6-4, NuMex Big Jim, NuMex Conquistador, NuMex Rio Grande, NuMex Sunburst, NuMex Eclipse, NuMex Sunset, NuMex Sunrise, NuMex Primavera, Ole, Orange Belle, Pasilla, Perfecto, Pepperoncini, PI 599426, Piment de Cayenne, Pimento Select, Pulla, Purple Beauty, Queen Bell, Sandia, San Felipe, San Juan, Tsile, Santaka, Santo Domingo, Sugar-chile, Super Cayenne II, Sweet Banana, Tejaswini, Thai Dragon, Yellow Cayenne, Yellow Flame	

^aSymptomatic plants had visible symptoms of curly top disease.

Table 2. Reactions of genotypes of four species of *Capsicum* to a natural epidemic of curly top virus.

Symptomatic ^z (%)	Species			
	<i>C. baccatum</i>	<i>C. chacoense</i>	<i>C. chinense</i>	<i>C. frutescens</i>
0 to 25	---	PI 273419 (Argentina)	Grif 9303 (Colombia)	Grif 9322 (Costa Rica) PI 241675 (Ecuador) 'Tabasco'
26 to 50	---	---	PI 439474 (Trinidad & Tobago)	---
51 to 75	PI 439408	---	'Habanero Red' 'Scotch Bonnet' 'Caribbean Red' 'Orange Habanero'	'Grif 9322'
76 to 100	'Aji Amarillo'	PI 439414 PI 439359 PI 439363	Grif 9235 PI 439448 PI 439472	Grif 9314 PI 188479 PI 257070
	PI 439370 PI 439372 PI 439376 PI 439380 PI 439382 PI 439412			

^zSymptomatic plants had visible symptoms of curly top disease.

Wild and weedy forms of domesticated chile are known sources of novel and useful genes (Gonzalez and Bosland, 1991). The wild relatives of domesticated chiles have not been evaluated extensively; however, this survey illustrates their potential utility for breeding curly top resistance.

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