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Experimentally Induced, Long-term Effects of Tristeza Virus on Trees of Valencia Orange on Citrange, Red Rough Lemon, and Trifoliate Orange Rootstocks near the California Coast

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Decline of many sweet orange trees on Troyer citrange rootstocks has been associated with citrus tristeza virus (CTV) infection especially in the coastal portion of Ventura County (1, 2, 3). We

report here the results of a five-year study of the effect of CTV infection on nucellar Olinda Valencia trees on several rootstocks. Preliminary results have been reported (2).

METHODS

Vigorous, virus-free trees of nucellar Olinda Valencia were planted in 1967-1968 at Somis in Ventura County, 19 km from the sea and about 1 km from other citrus plantings. Forty of the trees were on CRC Troyer citrange, 20 on Texas Carrizo citrange, 20 on CRC Carrizo citrange, 20 on Yuma citrange, 20 on Rubidoux trifoliate orange, and 20 on Red Rough lemon rootstock. Sixty to 70 per cent of the trees of each combination were singly inoculated at planting time with buds of one of seven

CTV-infected donor trees in Riverside or Ventura counties. Decline ratings and trunk cross-section measurements were made semiannually until May, 1972. All trees were indexed for CTV on Mexican lime in the fall of 1971. Six inoculated trees negative for CTV and three controls positive for CTV were omitted. Ten Olinda Valencia trees on Troyer and Carrizo rootstocks at Riverside were inoculated by bud grafts from Ventura County donor trees.

TABLE 1
EFFECT OF CITRUS TRISTEZA VIRUS ON GROWTH AND DECLINE OF NUCELLAR OLINDA VALENCIA ORANGE TREES ON VARIOUS ROOTSTOCKS AT SOMIS, CALIFORNIA

Rootstock	No. of inoculated trees evaluated	Av. decline rating*	Av. trunk cross-sec. May, 1972	Cross-section area infected/normal
			cm ²	per cent
Carrizo citrange (CRC)	7	2.8	30†	78
Carrizo citrange (Texas)	11	3.5	45‡	73
Troyer citrange (CRC)	20	3.3	42‡	68
Yuma citrange	13	4.8	13†	43
Rubidoux trifoliate orange.....	8	2.4	26‡	80
Red Rough lemon	10	0.2	53‡	91

* Rated in November, 1971, and May, 1972. 1 = mild; 5 = very severe.

† Four years old.

‡ Five years old.

TABLE 2
COMPARATIVE EFFECTS OF SEVEN ISOLATES OF CITRUS TRISTEZA VIRUS
FROM RIVERSIDE AND VENTURA COUNTIES ON DECLINE OF NUCELLAR
OLINDA VALENCIA ORANGE TREES ON VARIOUS ROOTSTOCKS
AT SOMIS, CALIFORNIA

Rootstock	Noninoculated control	Average decline ratings*						
		Riv. 1	Riv. 2†	Riv. 3	Riv. 4	Riv. 5	Vent. 1	Vent. 2
Carrizo citrange (CRC)	0.0	. .	. .	. .	3.0	1.5	3.2	2.5
Carrizo citrange (Texas)	0.1	3.5	2.2	. .	. .	. .	4.7	3.7
Troyer citrange (CRC)	0.1	3.0	3.0	2.5	. .	. .	3.5	4.1
Yuma citrange	0.0	. .	4.3	. .	4.8	5.0	4.8	5.0
Rubidoux trifoliolate orange..	0.7	. .	. .	2.0	. .	. .	3.3	2.3
Red Rough lemon	0.0	0.0	0.3	1.0	. .	. .	0.0	0.0

* Rated in November, 1971, and May, 1972. 1 = mild; 5 = very severe.

† Obtained in Riverside from a seedling infected with CTV by vectors.

RESULTS

Most inoculated trees on Troyer, Carrizo, or Yuma citrange rootstocks at Somis declined within 15 months. All CTV-infected trees on these rootstocks and some on Rubidoux trifoliolate orange declined within two years and, except for brief periods of improved growth, remained stunted and slightly to severely chlorotic most of the time. Trees on Yuma citrange were generally more severely affected than were those on Troyer or Carrizo citrange rootstocks. Trees on Red Rough lemon grew almost as fast as noninoculated controls and, with one exception, have not visibly declined. Effects of CTV on growth and decline of trees on different rootstocks are summarized in table 1.

Every isolate of CTV caused severe

symptoms on certain trees, but the overall reaction from different donor plants varied in severity. Isolates from the two Ventura County donor trees were especially virulent in most trees on Carrizo, Troyer, and Yuma citrange rootstocks at Somis (table 2). Ten trees inoculated at Riverside, 80 km from the sea, from these donors remained normal.

Tristeza virus was spread by vector into three of the noninoculated trees on citrange rootstocks at Somis by December, 1971, and caused some decline. Slight decline of unknown cause occurred in two noninoculated control trees. Seasonal variations in symptom severity occurred in all infected trees, with maximum decline following stress—especially hot, dry winds.

CONCLUSIONS

Sweet orange trees on Carrizo, Troyer, and Yuma citrange and on Rubidoux trifoliolate orange rootstocks are severely affected for a long time by various isolates of CTV in the climate of the coastal area of California; they are usually affected only slightly, if at all, in interior locations, such as River-

side. We suggest that, in Ventura County, mild, moist winters followed by hot, dry winds in the spring contribute to the tristeza problem by placing the tree under sudden and prolonged stress after it has been weakened by CTV infection. Under these conditions, the three citrange rootstocks and cer-

tain individual Rubidoux trifoliolate orange rootstocks can be regarded as moderately susceptible to tristeza virus. Red Rough lemon under the same conditions shows only a slight depression in

growth when infected by CTV. It is apparent that rootstock cultivars must be adequately tested in different areas to determine their susceptibility to CTV.

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