

Apparent Resistance to Establishment of Infection by Curly Top Virus in Tomato Breeding Lines

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Cooperative investigations of the Crops Research Division, ARS, USDA, and the Washington Agricultural Experiment Station, Pullman. Scientific Paper 3526.

Accepted for publication 14 December 1970.

ABSTRACT

The nature of resistance of six tomato cultivars to curly top virus was studied. Our observations suggest that: (i) Their resistance results primarily from characteristics which reduce the chances of

being infected; (ii) resistance is effective in both the seedling and adult stages; and (iii) by and large, resistance is effective under both field and greenhouse conditions. *Phytopathology* 61:550-551.

Additional key words: *Circulifer tenellus*, contact infection, escape infection, *Lycopersicon esculentum*, mechanism of resistance.

As the first step in studying the nature of resistance to curly top virus (CTV) in some recently developed tomato cultivars, we observed their behavior in both field and greenhouse tests. Our observations suggest that the most important type of resistance in the tomato lines is an ability to escape infection.

Blood (1, 2) and Virgin (14) showed that high levels of resistance to CTV were available in wild species of *Lycopersicon*. Interspecific crosses between *L. esculentum* Mill. and the wild species resulted in the development of the tomato cultivars which possess some resistance to CTV. Two of them, Owyhee and Payette, were developed by W. R. Simpson (9, 10) of the Idaho Experiment Station, and the remaining cultivars, C193 (3), CVF4(7), C5 (8), and C27 (not yet released) were developed in our USDA breeding program.

Data is presented here only for the susceptible control cultivar, VR Moscow. But similar results were observed with the cultivars VF145 and Allen's Triumph; and previous tests (4) indicate that any standard *L. esculentum* cultivar would behave as VR Moscow.

MATERIALS AND METHODS.—Two- to 3-week-old tomatoes were transplanted into the field in rows between previously established rows of susceptible sugarbeets (*Beta vulgaris* L.). The sugarbeets were an excellent host to both the leafhopper vector, *Circulifer tenellus* Baker, and the virus; thus, the tomatoes, which do not support beet leafhoppers, were subjected to extreme CTV exposure throughout the season. The individual tomato lines were replicated in 10-plant, randomized plots. Greenhouse seedling tests were conducted according to the method of Cannon & Waddoups (5). Large numbers of leafhoppers were released on young seedlings when the cotyledons were reaching their full expansion, approx 3 days after transplanting into flats.

RESULTS.—Results from the 1966 field tests (Fig. 1) are typical of the results obtained at Prosser, Wash., over the past 4 years. The apparent rate of contacting curly top disease was slower in plants of the resistant lines than of susceptible lines. Levels of resistance varied widely among the cultivars, but resistance was

expressed as a tendency to escape infection in all the cultivars.

Results obtained in greenhouse seedling tests (Table 1) were comparable to the earliest reading in the field. C27 has consistently been somewhat more resistant in the field, however, than in the greenhouse. Nevertheless, the resistance was effective in the seedling stage of growth and was expressed under both greenhouse and field conditions.

Although fewer plants of the resistant than of the susceptible lines became infected following exposure to viruliferous leafhoppers, the symptoms of those that did become infected were as severe as those developed by susceptible plants. Infected plants of both susceptible and resistant lines generally deteriorated rapidly and died. In the greenhouse, however, infected plants of some resistant lines sometimes lingered longer than susceptible controls in a severely stunted and distorted condition before dying. This was particularly true of C27 and, to a lesser extent, of C193. In the field, single branches of an occasional C27 plant expressed symptoms for some time before the whole plant developed typical symptoms and declined.

DISCUSSION.—It seems doubtful that the ability of infected C27 and C193 plants to live longer than susceptible plants before dying could be an expression of the same mechanism which reduces the chances that these plants will be infected. If this were the case, plants of the cultivar C5, which have the greatest ability to escape infection, should also live longer than susceptible plants after infection; they do not.

Our observations suggest that resistance is an ability to escape infection. However, Smith et al. (12) suggested that the resistance in some of these lines is a form of tolerance which prevents damage after infection occurs. Their evidence was that auxin content decreased equally in plants of resistant and susceptible lines following inoculation, while only the susceptible plants developed symptoms (11). We, however, found that both susceptible and resistant plants were severely stricken when infected by CTV. We previously reported (13) that resistance was not associated with the

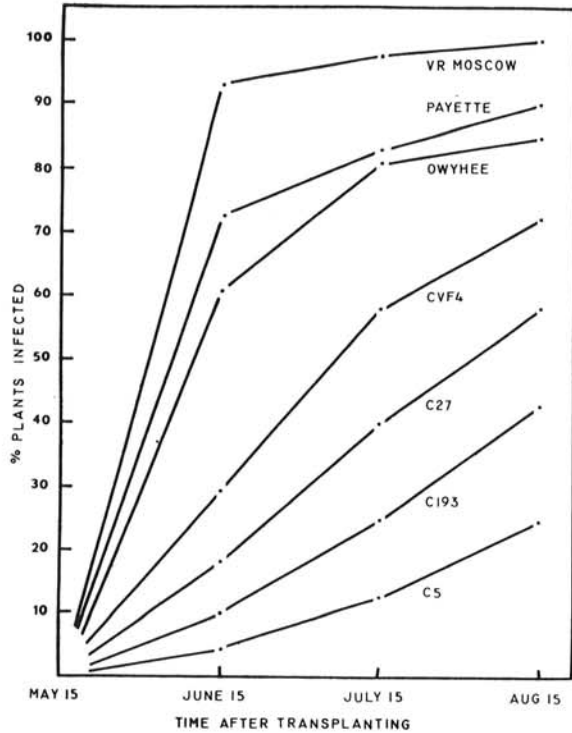


Fig. 1. Apparent rate at which healthy plants of susceptible and resistant tomato cultivars contacted curly top after being transplanted into the field.

ability of plants of resistant lines to recover. Other types of resistance might produce both the apparent capacity to escape infection that we observed and the alterations in auxin content observed by Smith and his group. One such type of resistance could be resistance to movement of the virus from points of inoculation

TABLE 1. Relative susceptibility of tomato cultivars to curly top virus infection at the cotyledonary stage in the greenhouse

Cultivar	No. tested	% Healthy
C5	3,028	90
CVF4	3,612	78
C193	632	77
C27	1,912	63
Owyhee	131	63
Payette	130	36
VR Moscow (control)	779	25

and into growing points within the plants. These and other possible mechanisms of resistance are under investigation.

All of the resistant lines used in these studies possess more field resistance than our results suggest. The exposure was far more intense and more prolonged than ever would be encountered under normal conditions of tomato production. Results of tests conducted by Martin (6) may be particularly relevant in considering the relatively poor performance of Owyhee and Payette in these tests at Prosser. In comparing levels of resistance in Owyhee and C193, he found that each was more resistant than the other in the geographic region in which it was produced.

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