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**MULTIPLE VIRUSES OF TOMATO INDUCING
FRUIT MALFORMATION AND LEAF SYMPTOMS**

**SYMPTOMS OF THE CELERY-CALICO VIRUS
ON TOMATO PLANTS**

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SYMPTOMS OF THE CELERY-CALICO VIRUS ON TOMATO PLANTS¹

HENRY H. P. SEVERIN

DURING THE SPRING of 1949 tomato plants naturally infected with the celery-calico virus were common at Berkeley, Alameda County, but during the autumn some of the plants developed symptoms of spotted wilt consisting of a bronzing of the leaflets (plate 1) which killed the leaves outright (plate 2).

The symptoms of the tomato spotted-wilt virus on the fruit were pale-yellow areas in the normal green skin (plate 3, *A*), pale-red areas embedded in white areas (plate 3, *D*), pale-red, circular areas surrounded by yellow and dark rings (plate 3, *E*), and numerous pale-red, circular areas, each surrounded by a white ring embedded in the normal red skin of a ripe tomato (plate 3, *F*).

In this paper are described the geographical distribution and the symptoms of the celery-calico virus produced on the leaves and fruit of tomato plants of the Marglobe variety. Symptoms on tomato plants induced by the celery-calico virus are compared with those caused by the western-cucumber-mosaic virus, described in the preceding paper (Severin, 1950), in order to differentiate these two diseases.

MATERIALS AND METHODS

The original source of the celery-calico virus was naturally infected celery obtained near Milpitas in the Santa Clara Valley. The carborundum method of inoculation described by Rawlins and Tompkins (1936) was used.

CELERY-CALICO VIRUS

Geographical Distribution. The celery-calico virus is a strain of a cucumber-mosaic virus. It is common in the coastal fog belt and also occurs in the hot interior regions of California. Celery calico has been found in all of the large celery districts of the state (Severin and Freitag, 1938). The geographical distribution of the celery-calico virus includes California, Washington, and Idaho (Severin, 1942).

Symptoms on Leaves of Mechanically Inoculated Tomato Plants. The first symptom of the celery-calico virus two weeks after inoculation of tomato plants is cleared veinlets on the inoculated leaves (plate 4, *A*). The lower leaves develop small to large, dark-green, circular areas (plate 4, *C*) and later, on the intermediate leaves, chlorotic areas (plate 5, *A*), followed by green blisterlike elevations (plate 4, *B*) accompanied by distortion of the leaflets (plate 6). In old plants a lemon-yellow or orange discoloration appears on a portion of each leaflet (plate 7) and spreads until the entire leaf is affected. A progressive orange discoloration of the lower leaves of the main stem and lateral branches occurs, but the younger leaves remain green. This symptom of calico may be readily overlooked, since a natural yellowing of the lower leaves occurs on healthy check or control plants, especially on old

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plants. Near the apical end of the stem, the midribs bend downward and the leaflets are cupped inward. A slight yellowing of the youngest leaflets occurs. In the advanced stage of the disease, necrosis of the leaflets occurs (plate 5, B, C).

These symptoms developed in a low-temperature greenhouse at 16° to 19° C. The infected plants were not stunted, growing four to five feet tall, and bearing an abundance of normal fruit.

The absence of filiform and fern leaf symptoms with the celery-calico virus differentiates this disease from that produced by the western cucumber mosaic described in the companion paper (Severin, 1950).

APHID VECTORS

Nine species of aphids have been reported to transmit the celery-calico virus to perennial delphiniums (Severin, 1942) and 11 aphid species to pansies and violas (Severin, 1947).

SUMMARY

The sequence of symptoms of the celery-calico virus on the leaves of tomato plants of the Marglobe variety (*Lycopersicon esculentum*) is cleared veins and veinlets on the inoculated leaves; small to large dark-green, circular areas and later chlorotic areas on the intermediate leaves; green blisterlike elevations accompanied by the distortion of the leaflets, and a lemon-yellow or orange discoloration of the lower leaves.

The absence of filiform-leaf and fern-leaf symptoms with the celery-calico virus differentiates this disease from that produced at low temperatures by the western-cucumber-mosaic virus described in the companion paper (Severin, 1950).

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Plate 1. Symptoms of tomato-spotted-wilt virus on leaf of naturally infected tomato plant (*Lycopersicon esculentum*) showing characteristic bronzing of the leaflets.



Plate 2. Symptoms of tomato-spotted-wilt virus on naturally infected tomato seedling (*Lycopersicon esculentum*) showing leaves killed outright by bronzing.

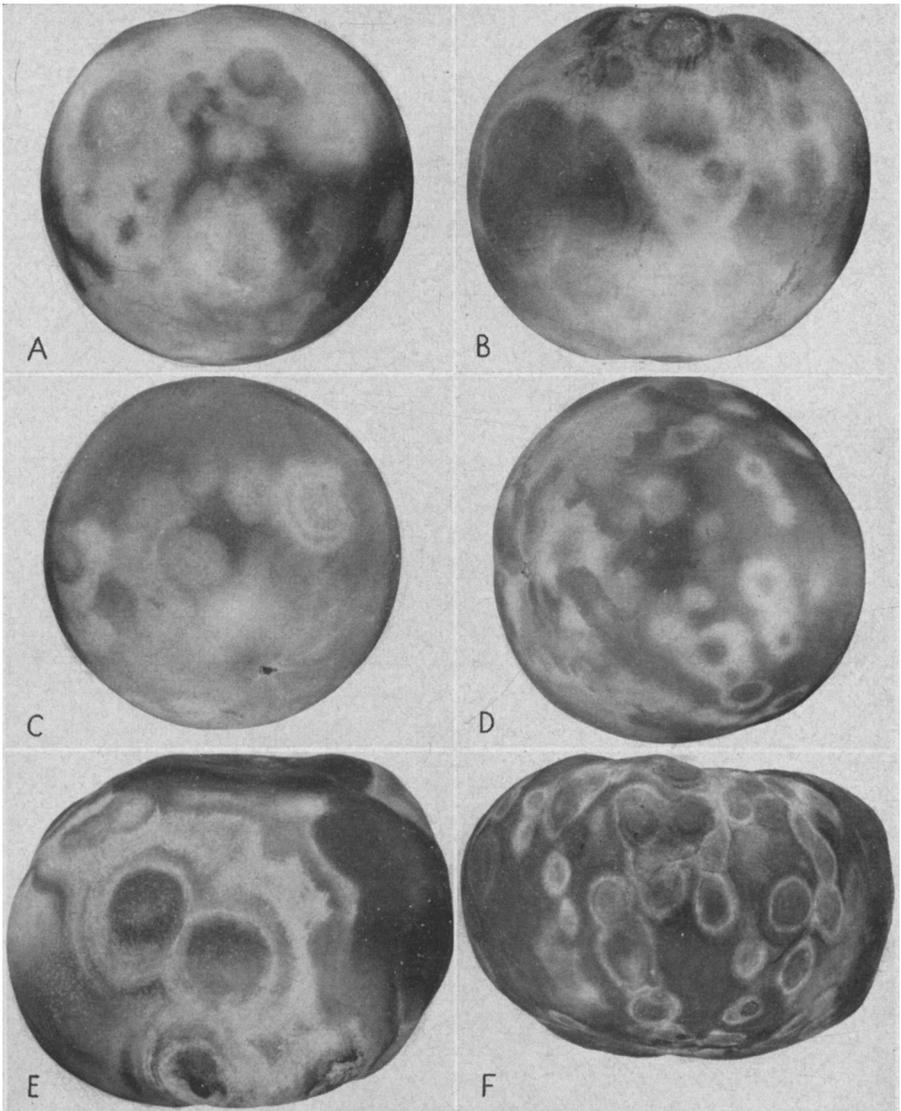


Plate 3. Symptoms of tomato-spotted-wilt virus on fruit of naturally infected tomato plants (*Lycopersicon esculentum*): *A*, pale-yellow areas in normal green skin; *B*, pale-red areas in the normal green skin; *C*, concentric circles; *D*, pale-red areas embedded in white areas; *E*, pale-red, circular areas surrounded by yellow and dark rings; *F*, numerous pale-red, circular areas each surrounded by a white ring embedded in the normal red skin of a ripe tomato.

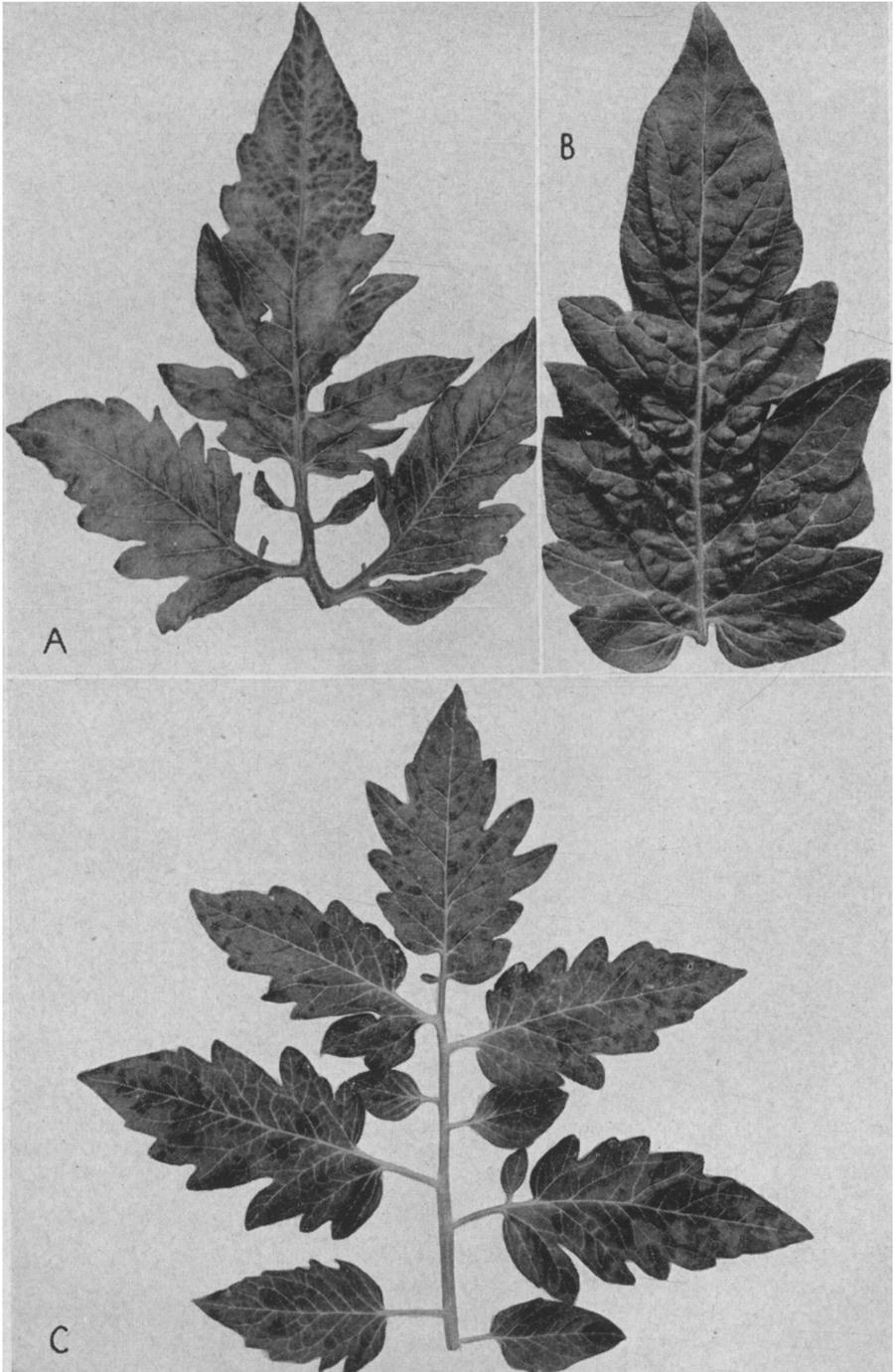


Plate 4. Symptoms of celery-calico virus on leaves of mechanically inoculated Marglobe tomato plants (*Lycopersicon esculentum*): *A*, cleared veinlets; *B*, blisterlike elevations; *C*, small to large, dark-green, circular areas.

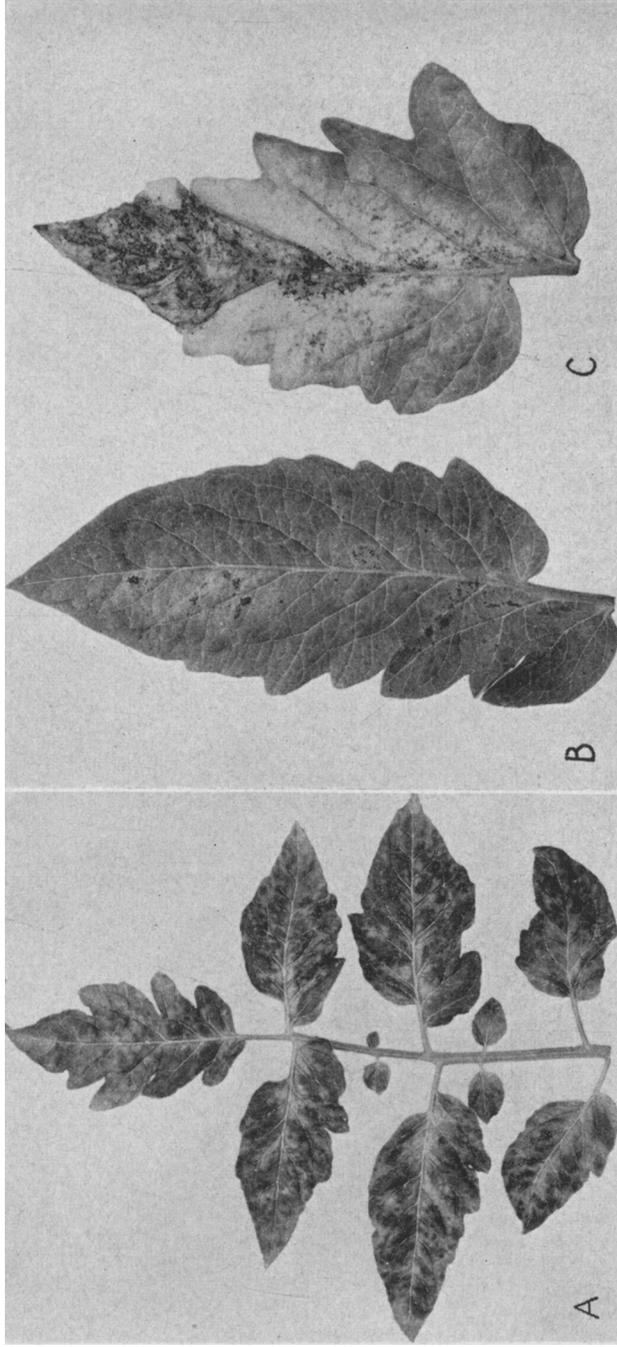


Plate 5. Symptoms of celery-calico virus on leaves of mechanically inoculated Marglobe tomato plants (*Lycopersicon esculentum*): A, chlorotic areas on intermediate leaves; B, C, necrosis of leaflets.

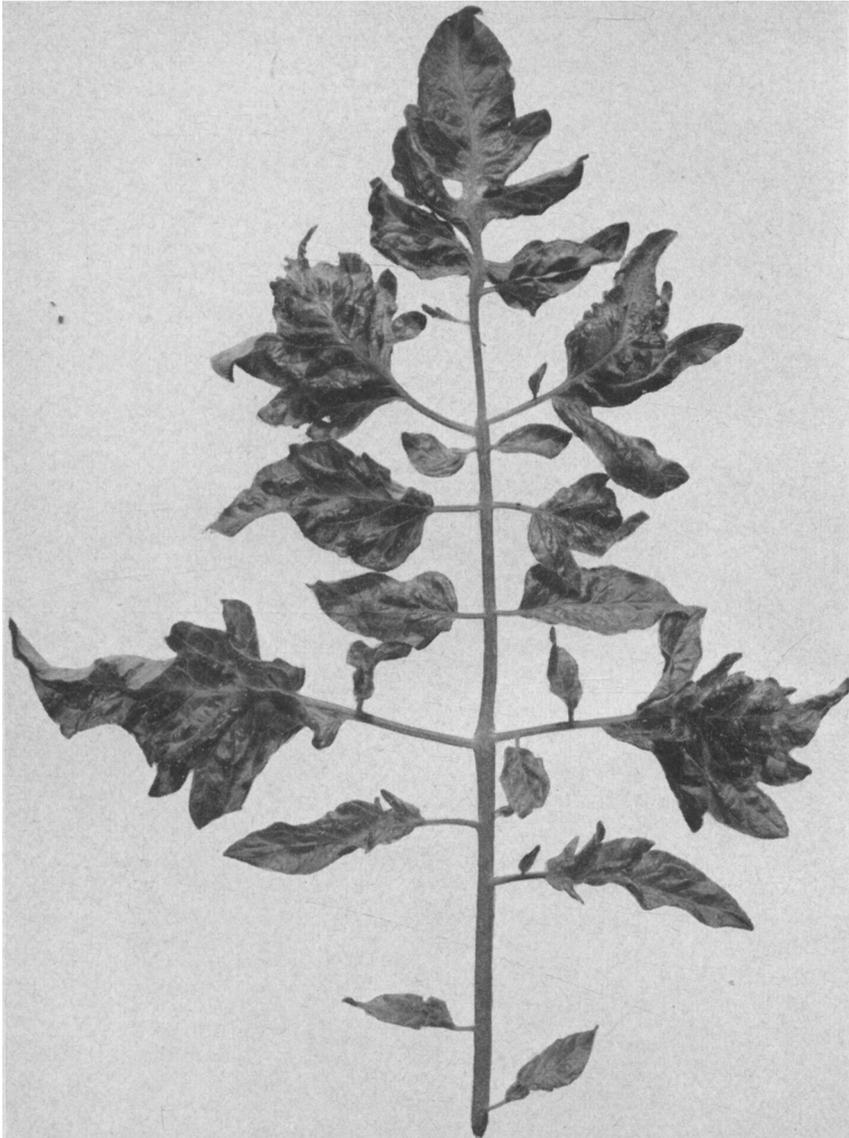


Plate 6. Symptoms of celery-calico virus on leaf of mechanically inoculated Marglobe tomato plant (*Lycopersicon esculentum*) showing green blisterlike elevation and distorted leaflets.



Plate 7. Symptom of celery-calico virus on leaflets of mechanically inoculated Marglobe tomato plant (*Lycopersicon esculentum*) showing orange discoloration.

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