

OVERWINTERING OF THE CITRUS-CANKER ORGANISM IN THE BARK TISSUE OF HARDY CITRUS HYBRIDS¹

COOPERATIVE INVESTIGATIONS BETWEEN THE DEPARTMENT OF PLANT PATHOLOGY, ALABAMA AGRICULTURAL EXPERIMENT STATION, AND THE OFFICE OF CROP PHYSIOLOGY AND BREEDING INVESTIGATIONS, BUREAU OF PLANT INDUSTRY, UNITED STATES DEPARTMENT OF AGRICULTURE

By GEORGE L. PELTIER, *Plant Pathologist, Alabama Agricultural Experiment Station*, and DAVID C. NEAL, *Pathologist, Bureau of Plant Industry, United States Department of Agriculture*

During the course of our field inoculation experiments conducted in southern Alabama in the fall of 1917 to determine the resistance and susceptibility to Citrus-canker of some of the wild relatives, Citrus fruits, and the more common hybrids of the genus Citrus, a most interesting feature has recently developed in connection with the ability of the organism to survive the winter in the outer bark tissue of some of these plants.

All the plants were set in the isolation field in July, 1917, extreme precautions surrounding the experiments being maintained. By the middle of September they had made a rapid growth and were at that time in fine shape for inoculation.

Included in a series of inoculations made on September 16, 1917, were the hybrids Rusk citrange (CPB 7956A),² Savage citrange (CPB 7961), and citrandarin (CPB 40175A), and two plants each of *Poncirus trifoliata*, grapefruit (*Citrus grandis*), and Satsuma orange (*Citrus nobilis* var. *unshiu*). In making the inoculations 100 cc. of a 48-hour culture of *Pseudomonas citri* in beef bouillon were thoroughly sprayed on each plant by means of an atomizer.

Although repeated observations were made during October and November of the plants enumerated above, only *P. trifoliata* and grapefruit showed any evidence of canker infection, and this only occurred to a slight extent on the foliage. It was thought that absence of infection on the Rusk and Savage citranges, as well as on the citrandarin and other plants, could be in part accounted for by the unfavorable temperature prevailing at the time the inoculations were made. This view was also somewhat strengthened by the fact that the more susceptible plants, such as grapefruit and *P. trifoliata* revealed only a minimum amount of infection two months after making the inoculations. With such unfavorable temperatures prevailing because of the lateness of the season no positive results were obtained with the hybrids, particularly with the citranges and citrandarins.

¹ Published with the approval of the Director of the Alabama Agricultural Experiment Station.

² CPB=Crop Physiology and Breeding Investigations.

Notwithstanding the fact that all the plants were carefully observed at intervals throughout the winter, no infection was found on the hybrids, although these were in a thrifty condition, with an abundance of healthy foliage.

On April 2, 1918, positive evidence of Citrus-canker infection was observed on the Rusk and Savage citranges, as well as on the citrandarin. The plants of *P. trifoliata* (Pl. 58, B) that were inoculated at the same time (September 16, 1917) also revealed new infections. Unfortunately the grapefruit and Satsuma plants were killed by the low temperatures prevailing during the winter months, and no further data could be obtained here. The hybrid plants were heavily infected, the infection in each case being confined to the main stem and branches (Pl. 58, A, C, D). The infection appeared simultaneously and extensively on all the twigs, branches, and main stems of the plants. Although the foliage was very healthy and apparently active and had been so throughout the winter, no sign of infection was observed on the leaves.

Cankered twigs from the Rusk and Savage citranges, the citrandarin, and *C. trifoliata* were collected and taken to the laboratory to ascertain whether the organism was viable and could be recovered in culture. Within four days good colonies of the organism appeared on the plates, which left no question of their viability.

From the data at hand it would appear that the Citrus-canker organism is able to withstand the winter within the outer-bark tissues of the host. Wolf¹ states that the lenticels probably serve as portals of entrance for the organism into the stems, and from the results it would appear that this view is entirely possible. The organism probably gains entrance into the outer-bark tissue through the lenticels and remains dormant through the winter months. On the return of more favorable conditions of temperature, humidity, and rapid growth of the plant, the canker organism becomes active.

The weather records in this vicinity during the fall and winter of 1917-18 reveal a minimum temperature of 15.5° F. It would seem, therefore, that the bacteria which gained entrance into the outer-bark tissues, probably through the lenticels, at the time of inoculations, September 16, 1917, were offered sufficient protection to withstand the above temperature, whereas the foliage infections were completely killed or their virulency lowered to such an extent that infection was not possible.

From the fact that the Citrus-canker organism is able to withstand such a low temperature and remain in a dormant condition for 6½ months in the outer-bark tissues of the twigs and branches, extreme care and caution must be exercised in the use of Citrus plants from canker-infected regions in the selection of budwood from nurseries and orchards in which canker has been found within a year, in the length of the quarantine period, and in the complete eradication of Citrus-canker from nurseries and orchards, especially in plantings of *P. trifoliata*.

¹ WOLF, F. A. CITRUS-CANKER. In Jour. Agr., Research, v. 6, no. 2, p. 79. 1916.

PLATE 58

Citrus-canker spots on twigs from plants in the isolation field, inoculated on September 16, 1917. These first appeared on April 2, 1918. Photographed on May 2, 1918.

- A.—Citrandarin (CPB 40175A).
- B.—*Poncirus trifoliata* (seedling, Alabama).
- C.—Savage citrange (CPB 7961).
- D.—Rusk citrange (CPB 7956A).

