

## BLAST OF AVOCADOS—A BACTERIAL DISEASE

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A new fruit blemish of the avocado has been investigated since the Spring and Summer of 1925. The disease appears to be caused by the same bacterial organism, *Bacterium citriputeale*, that is responsible for citrus blast and therefore the term "blast" is suggested for this new disease. It was first found on some Knight avocados which were sent to our laboratory by Dr. J. Eliot Coit, at that time president of the Avocado Association, which has co-operated with us in the investigation.

The fruit exhibited a marked cracking, which was the most severe near the blossom end. In addition to the cracking, definite corky, brownish—or, more often, black irregular or nearly circular spots—were found which were situated near or surrounding a lenticel. The disease is superficial, being limited almost entirely to the rind. In the older spots the tissues about the lenticel have become torn and the margin appears somewhat elevated as if ruptured. The spots are slightly, if at all, depressed. They are variable in size from the younger stages, when the beginning of the spot is just visible, to a mature spot that may measure from 1/8 to 1/4-inch in diameter, or even larger by the coalescence of several spots. The cracking of the fruit is believed to follow a severe spotting (infection) of the fruit, as this condition would allow the tissue to dry out.

The organism was first isolated from two different lots of Knight avocados and this has since been isolated from the Taft and Kaufman varieties. The resemblance of the bacterial growth, as well as the spotting of the avocado fruit, suggested that the organism might be similar to that of the black pit of lemons. Artificial inoculations of lemons with the avocado organism developed into typical black pit lesions.

A few weeks following the isolation of the avocado organism some lilac leaves and twigs were sent to our laboratory. An examination of these showed them to be affected with a bacterial trouble. The casual organism was isolated and was found to resemble that of the avocado blast. Artificial inoculations in lemon fruits produced typical black pit lesions.

This Spring the lilac disease has again appeared and new isolations have been made. Artificial inoculations on lemons have developed into typical black pit lesions similar to those of last year. This lilac organism is closely related and perhaps similar to that of the avocado and citrus blast.

The cause of the avocado trouble, as has been indicated, has been found to be a motile species of bacteria that was first described<sup>1</sup> as *Bacterium citriputeale*, causing a spot on lemons known as "black pit." It has also been described on the orange as "citrus blast."<sup>2</sup> The casual organism<sup>3</sup> was isolated from this host, but was at first considered different from that of black pit. Later the two organisms<sup>4</sup> were found to be but different

manifestations of the same one and hence identical. The organism develops during the cool rainy weather, entering the rind of the avocado through the lenticels.

The blast organism can apparently adapt itself to different hosts. It has been found on citrus and avocado. It is probably responsible for a lesion on one of our native oaks, but this fact has not yet been fully proven, as the casual organism has not been directly isolated from the oak. Fawcett and Camp<sup>4</sup> were able, however, to make typical black pit lesions on lemons by inoculating them with diseased oak tissue. They were able also to produce typical lesions on oaks with the citrus blast organism. Recently a lilac disease has been studied that will cause typical black pit lesions in lemons and the fruit and twigs of avocados. The blast organism does not seem to be limited to a single host, but can infect different ones.

The blast organism, when artificially inoculated into a number of different hosts, is able to attack them, causing a localized infection or lesion surrounding the puncture. In none of the inoculations on the various hosts tested was there any great amount of tissue affected. The lesions were limited in their development to about  $\frac{1}{4}$  inch of healthy tissue. Not only the twigs, but various fruit when inoculated develop definite lesions which usually appear as slightly depressed black spots  $\frac{1}{4}$  to  $\frac{1}{2}$ -inch in diameter. A puncture or opening seems to be necessary for infection to take place. Atomizing the fruits has given us negative results. It seems extremely unlikely that the blast will be an important disease of our deciduous fruits, which mature during the dry summer months.

The following are some of the fruits that have been artificially infected by puncture inoculations: Apricots, peaches, plums, pears, apples, lemons and tomatoes. When the latter are inoculated a blackish depressed spot develops, with a zone of surrounding tissue that remains green after the fruit itself becomes the characteristic red color. When green pears are inoculated a depressed black spot  $\frac{1}{4}$  to  $\frac{1}{2}$  inch is formed.

The twigs of a number of different hosts may also be artificially infected. The spots, however, are limited in development and eventually become dried out and heal over.

On the following, definite blackened lesions have been formed: Grape stems, coprosma, oleander, lilac, natal plum or *Carissa grandiflora*, orange, white fringe, *Chionanthus virginica*. Pomelo and orange twigs were successfully inoculated by punctures with the avocado blast during the wet weather of April, 1926.

Some further inoculation tests were made in an experiment on several of the commercial varieties of avocados sent us through the courtesy of the Avocado Association. The varieties studied were the Taft, Challenge, Puebla Spinks and Fuerte. These varieties were atomized with the casual organism in water and kept for 48 hours under moist conditions. Observations of these fruits were made for several weeks and the conditions noted and compared with other control fruits. The results were all negative, possibly because of some conditions that were not favorable for infection. Perhaps the mature fruit is not so susceptible to the diseases as are the younger stages. Further tests are necessary to determine if the avocado fruit can be infected by atomizing with the casual organism, and the condition when this is possible.

Puncture inoculations on the same varieties of avocados gave more definite results. The Taft, Fuerte, Puebla and Challenge were somewhat infected, as shown by a slight

blackening of tissue about the puncture. The result on Spinks is uncertain. When the surface rind was cut away a marked blackening and hardening of the fleshy tissue about the puncture could be noted. The effect of the inoculation was localized about the puncture in the soft tissue and there was no spreading of the infection to any extent in this tissue of the fruit. The varieties tested may not have been the most susceptible ones and were mature fruit. The results might have been different had less mature fruits or more susceptible varieties been used.

A peculiar spotting of the leaves has been produced when the blast organism either from citrus or avocado is brushed on the under side of avocado leaves. This spot is rather superficial and does not kill the leaf tissue to any extent. It caused darker irregular spots of considerable size to form. These in color are in marked contrast to the glaucous color of the under side of the avocado leaf.

The occurrence of the avocado blast is as yet not well defined, but it is not thought to be widely distributed. The disease first developed in a section in Southern California where citrus blast has also been found. The following observations of the distribution and varieties affected was furnished by Dr. J. Eliot Coit.

"Blast on avocados occurs along the foothills from Pasadena to Glendora, at North Whittier Heights, East Whittier and perhaps elsewhere. Apparently it does not occur near the coast. Varieties vary in susceptibility, Knight being the most severely attacked and Fuerte very slightly. Among commercial varieties Taft alone has been noted to be affected seriously. Tafts at Pasadena, Sierra Madre and Monrovia are severely attacked, while this variety at Ventura and Chula Vista have so far been free from it."

1. Smith, C. O., Black Pit on Lemons, *Phytopathology*, Vol. 3, pp. 234-235, 1913.
2. Coit, J. E., "Univ. of Calif., Jour, of Agr, Vol. 3, pp. 234-235, 1916.
3. Lee, H. A., A New Bacterial Disease of Citrus, *Jour of Agr. Res.*, Vol. 9, pp. 1-8, 1917.
4. Fawcett, H. S.; Horne, W. T., and Camp, A. P., Citrus Blast and Black Pit, Univ. of Calif., Publ. Agr. Exp. Sta. Coll. Agr., Technical Paper No. 5, 1923.