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A BARK DISEASE OF AVOCADO TREES

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Description of the Disease.—In May, 1914, attention was called to a bark disease of avocado trees by K. A. Ryerson, who sent part of a diseased trunk of an avocado tree with the request for information regarding the nature of the trouble. The bark was killed and slightly sunken over an area of 8 inches in length and 2¼ inches (one-half the circumference) in greatest width. A kind of gum had exuded and hardened in small beads on the surface, and in addition a white, powdery, crystalline substance was deposited over the surface at the lower part and below the diseased area. The freshly killed bark and wood were still firm, not soft or watery. The wood was not affected more than one-eights of an inch inward. This was typical, as was afterwards learned, of a bark disease occasionally occurring on avocados in a number of localities in Southern California. The following information regarding its occurrence was obtained from Mr. Ryerson. The disease occurs most often on the trunk not far from the surface of the soil, but occasionally it is found higher up and on limbs, beginning especially at the base of a leaf. It occurs not only on the trunks of larger trees, but is found on small seedlings, especially if overwatered or if the drainage is not good. This disease, while not frequent enough to cause serious damage unless on particularly valuable trees, is likely to appear suddenly and spread fairly rapidly in spite of care exercised to check it. It does not appear to be confined to any particular variety, but has been found on a number of different kinds.

Isolation of *Pythiacystis* Fungus.—Three culture tests were made from this specimen from Mr. Ryerson, by flaming the surface, cutting off the surface of the bark, flaming again, cutting out small bits of the bark and wood from the junction of the dead and live tissue, and dropping them into slant cornmeal agar tubes. A *Pythiacystis* fungus grew out from the pieces in the three tubes.

In July, 1914, specimen of an affected avocado limb which had been unsuccessfully treated by cutting away the diseased bark and disinfecting the area, was sent from the same locality as the first. The bark had begun to heal at the cut edges, but the wood underneath was dark in color. The same fungus was again isolated from three different places in the darkened wood about one-fourth of an inch from the surface and in one case 4 inches beyond the point where bark had been cut away for treatment. In five out of six tubes made as before, the *Pythiacystis* fungus grew out from the pieces.

Inoculation Experiments With the Fungus.—On October 6, 1914, the trunks of two Mexican seedling avocado trees at the Whittier laboratory were inoculated with this *Pythiacystis* by inserting into longitudinal cuts three-fourths of an inch long, bits of the mycelium from the culture of the fungus. The cuts were then covered with paraffined paper held with raffia. On one tree a cut of the same kind without inoculation was made

and covered as the others to serve as a check.

When the inoculated trunks were first examined on October 22, 1914, a watery, slightly colored liquid was running from both cuts, and below one of them the white crystalline substance seen on the original specimen, was being deposited as the exuding liquid dried. The check cut was already beginning to heal without any deposit.

On January 14, 1915, a considerable deposit of the white crystalline substance had formed at both of the inoculated cuts and the larger area of killed bark was three-fourths of an inch wide and two and one-half inches long. The wood was affected only to a slight depth. The affected bark and wood were cut out at this time to save the trees and four culture tests made as described before from the advancing edge of one of the diseased areas. Three of these cultures developed *Pythiacystis* as before. The incision on the check tree healed rapidly without apparent injury to the adjoining bark.

One of the original cultures was kept alive by transfers every one to five months, and on March 28, 1916, further inoculations were made into avocado trunks with it and also with the fungus *Pythiacystis citrophthora* isolated from diseased bark of lemon Gummosis. Two inoculations from each culture were made and two additional cuts were made to serve as checks. All were wrapped in the same manner as in the previous inoculation. All inoculated cuts were showing the white crystalline deposit by April 7, 1916, and the bark about the cuts was discolored. On May 15, a large deposit of this white substance had formed below all the inoculated cuts. The effect on avocado of the lemon *Pythiacystis* was about the same as the avocado *Pythiacystis*. A diseased area of each kind was cut out. These showed the cambium killed over an area of three-fourths of an inch, wide and two and one-half inches long. The avocado *Pythiacystis* was again recovered from the advancing edge of a diseased area. The cuts serving for checks healed rapidly without apparent injury to the tree.

The same two cultures were tested out on young orange trees at the same time. The lemon *Pythiacystis* produced Gummosis on the orange with killing of bark adjacent to the cut. The avocado *Pythiacystis*, however, produced no effect, the cuts healing almost as rapidly as the checks.

Preventive Measures Suggested.—Since the fungus itself and the effects of the disease are similar to that of *Pythiacystis* on citrus trees, the same methods for prevention and treatment, if carefully carried out, will probably apply to a large extent at least to the avocado. Good drainage, an avoidance of too much water at the base of the tree, keeping the soil from washing in and piling up against the trunks and avoiding planting too deep, especially on heavy soils, will undoubtedly serve to prevent the disease. If it occurs on large trees and is found before it has gone too far, the dead bark can be carefully dissected out and the wound thus made disinfected. After the cut edges begin to heal the exposed wood can then be covered with wax or other good covering. If the bark is killed all the way round when discovered, the tree will, of course, eventually die. Mr. Ryerson writes, "The spots were not common and in reality did not cause serious damage unless found on particularly valuable trees. They were likely to appear suddenly and spread rapidly in spite of the care exercised to check them. Sometimes with the use of Bordeaux paste, after very careful removal of all diseased tissue, the trouble was overcome."

Summary.—That a *Pythiacystis*, similar to *Pythiacystis citrophthora*, may, under certain conditions become at least a wound parasite of avocado trees, is shown by these tests. The fungus was isolated from two different specimens, was grown in pure cultures, was introduced into avocado trunks at two different seasons and produced effects similar to those on the trees from which it was isolated. It was twice recovered in cultures from the inoculated trees, in one case six weeks and in another three months after the inoculation.

The same preventive and control measures as used for *Pythiacystis* Gummosis of Citrus will probably apply to this disease, though few experiments of this kind have as yet been tried out.