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Pests and Diseases - Latest Developments in Avocado Disease Control

Wm. T. Horne
Associate Professor of Plant Pathology University of California, Riverside

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It seemed best in preparing this brief paper to give our present ideas on a few important, or supposedly important, diseases rather than to discuss all of the rather numerous items which have forced themselves on our attention. I propose to discuss: (1) **Anthracnose,** (2) **Ring-Neck,** (3) **Tip-burn,** (4) **Sun-blotch,** (5) **Dothiorella rot,** (6) **Canker of trunks and twigs.**

ANTHRACNOSE OR WITHER TIP

When I came to the Citrus Experiment Station some three years ago and devoted a considerable amount of my time to the study of avocado diseases there was a widespread concern about anthracnose. Doctor Fawcett had observed cases in which the disease was apparently doing considerable harm in the orchard and there was much fear that losses might increase.

As an early step in this work a program of spraying, based on Florida recommendations, was prepared with Doctor Fawcett's help and this was given out for use in case the situation seemed to warrant.

In addition to the publication mentioned, two reliable growers at my request put on an experimental spray program. The result of these sprayings was significant in that it showed the possibility of the treatment. No harm was done by the bordeaux mixture to the avocado trees. However, the treatment was not necessary as no anthracnose developed in the orchards in question nor in other orchards which I saw.

No clear case of anthracnose as a general disease affecting fruits in the orchard has come to my attention until this season. Two cases of anthracnose on fruits came to me, one from Riverside and the other from Escondido. Definite spots on Mexican fruits hanging on the tree were abundantly infected by the anthracnose or wither-tip fungus. On examining my notes I found that the dates when these cases were studied followed the November freeze—in fact the Riverside fruit at least was giving trouble because when picked it failed to soften. It was also recalled that there had been a severe hail-storm in Riverside early in the autumn and the injuries suggested a possible initial hail mark.

The wither tip fungus undoubtedly is one of those which cause spoilage of soft fruit, although usually it is less abundant and less destructive than several other fungi. We believe it safe for the present to conclude that wither tip anthracnose of the avocado in California is an unusual disease of fruit in the orchard, and that it probably follows injuries of some sort such as wounds, excessive cold or wet, or senility of fruit.

This situation would seem to exactly parallel that in the orange, which is set forth in Fawcett and Lee's book on "Citrus Diseases of the World."

Some confusion may arise from the way pathologists use words. The anthracnose of avocado in Peru described by Mr. Abbott in the Avocado Association Yearbook for 1929 is not caused by the wither tip fungus. Mr. Abbott's fungus doubtless occurs in California but if present in the avocado it evidently is not common. I should not have called this disease anthracnose; it is not caused by the wither tip fungus.

RING-NECK

Ring-Neck is one of the avocado diseases named by Doctor Coit in the Avocado Association Yearbook for 1928. It is familiar to most of you as blemishes on the fruit stem or pedicel in the form of superficial areas of dead dried tissue more or less separated from the living tissue of the pedicel below. It is particularly liable to affect the thickened segment of the pedicel next to the fruit. Sometimes a complete ring of surface tissue dies, separates from the pedicel and peels off, leaving a scar.

It is possible that some deeply scarred pedicels break more easily than normal pedicels but I have not observed evidence of this. In fruits which have attained full size I have not succeeded in observing ring-neck in stages of active development, although there have been doubtful cases, especially following the cold spells of the present winter.

We do not know exactly what happens in the development of ring-neck nor when the lesion is formed. Young and partly grown fruits are shed from the tree in great numbers. Often this shedding continues to a late stage and may take the whole crop. In the shedding or abscission the fruit pedicel often breaks down in a number of ways. The pedicel segment next to the fruit is most commonly involved and is frequently found completely withered and blackened, while the fruit and the rest of the pedicel is green. It seems possible that ring-neck may be a small lesion of the same sort as that which occurs with shedding of young fruit.

In some cases lesions like ring-neck in large and small spots are extensively developed over the surface of the fruit and give it a grotesque appearance from the curling up scales.

Evidently ring-neck needs no treatment on fully grown fruit, but it is highly desirable that it should be studied further.

TIP-BURN

Tip-burn has continued to appear in about the usual amount. There appears to be no reasonable doubt as to the fundamental correctness of the work of our Doctor Haas,

briefly presented in the Avocado Association Yearbook for 1928. The processes which go on in the leaf are probably similar in all cases of tip-burn. However, the conditions of the environment and of the tree which cause these processes to go on are probably exceedingly various. To such an extent is this true that for the practical orchardist tip-burn is little more than a symptom, warning him that something is wrong and needs correcting. He is particularly warned that something is probably wrong under ground and that he must make sure he is not using water with an excess of alkaline salts.

As mentioned elsewhere trees heavily sprayed with bordeaux mixture had very little tip-burn. If it should prove possible to secure the same result regularly the fact should be suggestive for scientific studies and perhaps of direct practical use.

Tip-burned leaves often are heavily infested with the Dothiorella fungus and must be a source for infecting the fruit. Bordeaux spraying has not destroyed the Dothiorella fungus in the tip-burned areas and we doubt whether it will prevent infection of the leaves, though it might if applied early enough.

SUN-BLOTCH

Sun-blotch is one of the most interesting plant diseases known to me, and it is capable of being a serious matter to the industry if it should develop in severe form and extensively. Fortunately it frequently develops only very slightly and apparently does not spread actively. The disease was described and named by Doctor Coit in the California Avocado Association Yearbook for 1928, and more recently the writer and Doctor Parker have a paper on it in the Monthly Bulletin of the State Department of Agriculture, Sacramento, for July, 1931.

See latest article on Sun-blotch by E. R. Parker and Wm. T. Horne, Page 50.

DOTHIORELLA ROT

Dothiorella rot of the fruit has already been described* and it has been discussed in a preliminary way at various meetings of growers. It is a rot of softening fruit, though very rarely it may start in injured fruits on the tree. It is by no means the most destructive rot of soft fruit and it is said to give serious trouble in the market only in fruit from the vicinity of the coast. Nevertheless it has probably caused more trouble than any other one kind of rot in the market. No sign of it appears on the hard fruit, but when this begins to break (soften) small dark specks appear. Specks are at first somewhat watery and not so clearly outlined nor so dark as the so-called "speckles" which are common on Fuertes from any locality as the season advances. The small spots spread rapidly as the fruit softens and if they are numerous the whole surface may be involved a little while after the fruit is ready to use. The surface is, in part at least, not very dark and has a soft decayed aspect; if scraped with the finger nail the outer skin breaks easily. The decay is not very deep at first but appearance is much impaired and a rancid odor develops in the skin and outer flesh.

The rot is caused by a fungus which is propagated in the dead areas of tip-burned leaves and in the bark of dead twigs in the tree. Spore-producing bodies show as tiny

dark pimples in the surface of dead twigs, leaves, and spoiled fruits.

When the nature of the rot was first recognized various treatments were tried on the fruit while still hard, in cooperation with the Calavo Growers, but no preventative was discovered.

During the past season a spraying experiment was planned and executed by San Diego County through their Farm Bureau and Agricultural Commission. The Calavo Growers cooperated and the writer carried on the mycological studies.

Persons familiar with such experiments will understand the difficulties involved and the dangers of a too optimistic conclusion. However the work was well executed and it appears safe to say that results are encouraging. Repeated spraying with bordeaux mixture evidently very materially restrains the development of Dothiorella rot. It was not observed that a single spraying was very effective and bordeaux dust is not promising. The questions which now remain are: When are the important times for spraying, and will a spray schedule, which it would be practicable for a grower to apply, give satisfactory results. A new spray program is being put on to try to answer these questions.

Several points came out in the work which should be mentioned. (1) Individual trees varied widely in the amount of rot which their fruit developed. (2) Heavy bordeaux spraying has apparently very much reduced the amount of tip-burn. (3) In going over the fruit at the Calavo House it was impressed on my attention that there were very different types of fruit from the same tree and that Mr. Newton had learned from experience that on some of these types the Dothiorella rot developed much more rapidly than on others. In fact, certain types of fruit may carry a few small spots of Dothiorella rot and still be utilized with little loss. These fruit types need to be studied on the tree especially to find out whether the old fruits are the ones which go down badly.

The problem of controlling Dothiorella rot is not finished, but we believe progress has been made. We believe that growers who have the problem should make some studies for themselves. For example: The off-bloom fruits now on the trees—can these be distinguished next August? Next November? Next February? Of the regular crop can you distinguish the early fruit from the later? Do fruits of the same age all behave alike? A little tag attached to the stem of the fruit and with the date and size recorded might tell a great deal next fall. I am putting on some tags myself but the University can not take up this study in a thorough way now. In one of our sprayed plots we hope we may have the early fruit picked out from the later by the spray material.

In the experimental orchards dead twigs have been so well removed that no effect was noted of removing them but it seems clear they must be an important source of infection and should be removed.

**See the Calavo News for March, 1931, page 11; also California Avocado Association Yearbook for 1931, page 85.*

CANKERS OF GREEN STEMS AND TRUNKS

In the second Report of the California Avocado Association (1916) Doctor Fawcett

describes a canker of avocado trees from which he isolated a fungus similar to the fungus of lemon gum disease and brown rot. This fungus placed below the bark of an avocado tree killed the bark and produced a canker again.

Following this work it was assumed that any large canker of the avocado in which bark turns dark and dies, with the accumulation of whitish-sugary material on the surface, is caused by the lemon brown rot fungus.

I have been much interested in the study of cankers such as those mentioned, both on avocado and on walnut.

The amount of time which I have been able to give to the study of avocado cankers has not been very great, but I am now inclined to believe 'that the mast common avocado cankers are not caused by fungi. Black areas of various sizes on green stems are not rare but mostly they do not have the characteristics we should expect in spots caused by the Pythiacystis and Phytophthora fungi. Spots are usually superficial and do not extend into the wood. They are rather dry and appear to begin below the outer bark layer. On the trunk or large limbs often the whole darkened bark can be scraped off, leaving good bark below. In severe cases the whole tree is sickly. Sometimes the affected tree has the aspect of a tree suffering from too much water in the soil. In one case where injury probably came from salt in the soil or water, striking cankers formed on the green stems.

We may conclude for the present, then, that parasitic cankers as described by Doctor Fawcett do occur. However, it is probable that not all cankers are of this sort.

The significance to the grower of this idea would be that cankers should be treated so far as possible, since it is often difficult to distinguish one sort of canker from another, but that this operation should not be relied on to solve the problem. Other unfavorable circumstances should be looked for. With the avocado the first thing to do is to examine the roots for possible injury from excess water in the soil.

Where diseased outer bark is scraped away and the surface disinfected, as in treating early-stage scaly bark of oranges, it has been reported that results appear favorable. It seems probable that this should be so, even if the canker is not due to a local parasite, but the effort to discover the unfavorable condition should not be relaxed.

A diseased tree in a young avocado orchard. Prof. Wm. T. Horne, Pathologist of the Experiment Station, Riverside, is examining the patient.