California Avocado Society 1958 Yearbook 42: 86-89

THE SUN-BLOTCH DISEASE OF AVOCADOS

J. M. Wallace
Plant Pathologist, Citrus Experiment Station, University of California, Riverside, California.

The Sun-Blotch Disease of Avocados by Dr. J. M. Wallace, Citrus Experiment Station, Riverside, California, published in the 1958 Journal of the Rio Grande Valley Horticultural Society of Texas, is reprinted with their permission.

Unlike most economic plants, the avocado (**Persea americana** Mill.) has been found to be subject to only one virus disease. Prior to the demonstration of the virus nature of this disease (Horne and Parker 1931), the name sun-blotch was given to the disorder because the effects or symptoms on the trees resembled sunburn (Coit 1928). In his early description of the disorder, Coit expressed the opinion that the striped appearance of the shoots arose from the effects of the sun. The work of Horne and Parker disproved this but the name sun-blotch was retained for the disease.

The most detailed account of avocado sun-blotch yet published (Whitsell 1952) appeared in the 1952 Yearbook of the California Avocado Society. This present paper will review some of the information reported by Whitsell, but it will cover primarily the developments in the studies of sun-blotch since 1952, with particular emphasis being given to methods of control or prevention of the disease.

SYMPTOMS OF THE DISEASE

The most consistent symptom of sun-blotch and the only symptom of much value in diagnosis is the streaking and spotting of the bark of twigs and limbs. Usually the streaks are yellow in color but at times, especially on young trees, the streaks may be whitish or almost colorless. On some plants experimentally infected as small seedlings, the streaks are pink or red. The streaks usually arise in line with the leaf petiole and extend in narrow bands for varying distances below. On occasions the first symptoms, particularly those developing on young budded trees, are in the form of a few small yellow spots scattered at random. The streaked areas are sometimes depressed and some vigorously growing shoots on field trees may have many depressed streaks paralleling each other so as to present a fluted appearance.

Sun-blotch-infected trees sometimes produce clusters of leaves showing marked white or pink mottle or variegation (Figure 1). The fruits of some affected trees quite commonly have depressed streaks, usually extending onto the fruit from the stem end. These streaks may be few or many. In some instances the fruits are badly marked and are small and misshaped. The number of affected fruits on diseased trees may vary

from none or very few on some trees to many on others. The absence of fruit and/or leaf symptoms is thus not proof that a tree is not infected. Furthermore, as will be discussed later, it has been established that avocado trees are sometimes carriers of the sun-blotch virus without displaying any of the known symptoms of the disease.

ECONOMIC IMPORTANCE OF SUN-BLOTCH

There are actually no data available regarding the economic importance of this disease. It is known, however, that infected trees generally are less productive than healthy trees. Diseased trees frequently grow into a low, flattened shape with the limbs bending toward the ground. This type of growth increases exposure and injury from sunburn. Some infected trees commonly set fewer fruits, thus reducing the yield. The streaking of fruits further reduces the marketable yield. An important loss from sun-blotch is sometimes sustained by nurserymen when sizable numbers of avocado trees grown for sale are found to be diseased. Further losses are experienced by avocado growers who purchase trees for planting and have the added expense of their care for a period of years before learning that the trees are infected.

Symptoms of avocado sun-blotch disease. Slight stem streaks indicated by arrows; fruit showing depressed streaks and some mature leaves with distortion and variegated patterns.

MEANS OF SPREAD OF THE VIRUS

Limited experimental studies and field observations indicate that there is no important amount of natural spread of sun-blotch virus from diseased to healthy trees. If there is any spread by insects this has not been detected. Healthy trees can become infected as a result of a naturally-occurring root graft with an adjacent diseased tree, but nothing is

known as to how frequently this takes place.

The use of diseased propagative material is responsible for most of the sun-blotch in avocado trees. The use of budwood from diseased trees results in diseased progeny trees. In some instances, too, infection comes from the rootstock seedlings as a result of seed transmission of the virus (Wallace and Drake 1953). Recent studies have revealed that certain avocado trees are symptomless carriers of the virus and that all or nearly all of their seedling progeny are likewise symptomless carriers of the virus. If grown as seedlings, these trees will never show symptoms of sun-blotch but when used as rootstocks and worked to sun-blotch-free scion varieties the resulting budlings will develop severe symptoms of the disease.

It is not known how common such symptomless carriers, which produce sun-blotch-infected seedling progeny, are. Three trees have been located in California which have been demonstrated to be of this type. Past experiences of avocado nurserymen in the State indicate that, at least occasionally, such trees have been used as sources of seed for the production of rootstock seedlings. In a number of instances, budwood from sun-blotch-free sources resulted in healthy trees when used on one rootstock source but on another rootstock source most of the resulting trees developed sun-blotch symptoms. Such reactions clearly demonstrate that the infection came from the rootstock seedlings.

Experimental studies have established that an occasional avocado seedling will express sun-blotch symptoms within 3 months or longer after germination. This reaction is accepted as seed transmission of the virus and is the type known for several plant viruses. Actually, this type of seed transmission of the sun-blotch virus occurs very rarely. Numerous experiments have been completed in which seeds were harvested from many different trees showing severe diseased symptoms and with many of the seed originating from fruits with severe symptoms. Less than 1 per cent of these seedlings have developed symptoms.

Thus, there are two types of virus transmission through seeds of avocado. One of these is the rare instance of transmission, as known for other viruses, in which the virus invades the growing seedling and causes expression of symptoms with perhaps more than 99 per cent of the seedlings from the same parent source being virus-free and symptomless. The second kind of seed transmission, as already mentioned, is that in which 100 per cent of the seedlings grown from an infected but symptomless parent source will likewise be symptomless carriers of the virus. If grown as seedlings, they remain symptomless and do not develop symptoms even when repeatedly reinoculated. However, by indexing the seedlings to other test seedlings it can be shown that they carry a low concentration of the virus. When a healthy scion bud is grown on these infected seedlings, the scion growth eventually develops sun-blotch from the virus which moves up from the rootstock.

PREVENTION OF SUN-BLOTCH

Control of sun-blotch is strictly a matter of prevention. To have healthy trees one must plant healthy trees. The propagator of avocado trees therefore must know that both the

scion variety parent source and the rootstock parent are free of sun-blotch. Accurate diagnosis for the disease can be made only by indexing. This involves inoculation or transmission tests which unfortunately require several months to complete. There is no short-time test as in the case of many plant viruses. After inoculation or infection with the virus, an avocado test seedling requires from 3 months to 2 years to express symptoms of sun-blotch.

To test for sun-blotch in a tree selected as a bud source, it is recommended that buds or scions from the candidate tree be grafted to at least 10 avocado seedlings which are preferably about 3 to 5 months from germination (Wallace 1950). Decapitate the seedlings, leaving two or three buds above the inoculum. Observe the new growth for 6 months and again remove most of the top to force new growth. If, after an additional 6 months, none of the inoculated seedlings have developed sun-blotch symptoms, the chances are very good that the candidate tree is not a carrier of sun-blotch virus.

With the exception of the variety Zutano, which appears to be slow in developing symptoms, there appears to be no particular difference between avocado varieties in susceptibility to sun-blotch. Mexican varieties appear to be as susceptible as the Guatemalan varieties, but our observations indicate that the latter varieties generally develop symptoms somewhat earlier after experimental inoculation.

It has already been emphasized in this paper that avocado trees may be symptomless carriers of the sun-blotch virus and that some of these symptomless carriers produce seedling progeny, all of which may be infected and are undesirable for use as rootstocks. A candidate rootstock parent tree can be indexed for sun-blotch in two ways. The first of these is as described for budwood parent trees, i.e., indexing on healthy avocado seedlings. The second test involves the budding of a known sun-blotch-free scion variety on 25 seedlings from the rootstock candidate source and observing the budlings for symptoms for a period of 1 year. This test can be done in the greenhouse or in the field. A method of speeding up this test is to grow the seedlings in pots in the greenhouse, budding with the healthy scion variety while the seedlings are young (pencil-size or smaller) and transplanting later to nursery rows in the field. This test can be completed in the greenhouse but growth is usually better if transplanted to the nursery.

A nurseryman can make this test himself entirely under field or commercial conditions if he desires to do so. Seedlings of the candidate rootstock parent can be lined out and budded in the field. However, there are two requisites for accurate diagnosis. First, the budwood used must come from a source known to be free of sun-blotch. Second, the operator must know how to read the early symptoms of sun-blotch or have the services of a person trained to identify the symptoms. When infection results from virus that is carried by the rootstock seedling, the first symptoms usually appear as very small yellow spots close to but above the bud union. These spots gradually enlarge and increase in number and later the more typical streaks will begin to appear on the growth higher up on the tree. The trunks of budling trees grown for this indexing under field conditions must be shaded from direct sun by tree wraps or burlap in order to prevent sunburning, which masks the early-appearing yellowish spots caused by the sun-blotch virus.

SUMMARY AND CONCLUSIONS

Sun-blotch is the only known virus disease affecting avocados. No appreciable difference in susceptibility between varieties has become apparent. There is a suggestion that the variety Zutano may be somewhat more resistant than other varieties, but this may be largely a matter of time required for symptom expression. Observations on varietal reaction indicate that the Guatemalan varieties as a group express symptoms somewhat earlier after inoculation than the Mexican varieties, but the total percentage of infection and severity of symptoms do not differ between the two groups.

Stem streaking and spotting are the only consistently reliable symptoms for diagnosis of the disease. Some trees are symptomless carriers of the sun-blotch virus. The absence of symptoms on field trees is no certain proof of their freedom from infection.

There is no known natural spread of the sun-blotch virus other than possible root grafting between diseased and healthy trees.

Sun-blotch infection results from the use of either diseased budwood or rootstock parent trees for propagation of young trees. Seed transmission of the virus may be of two kinds. One of these is the rarely-occurring transmission of the virus which results in typical symptoms developing on a seedling grown from seeds from an obviously diseased tree. Other seedlings from the same source will be symptomless and virus-free. The second type of seed transmission is that known in three specific cases and suspected in several other instances in which the seedling progeny from infected but symptomless trees is infected to the extent of 100 per cent. Such seedlings never express symptoms but if used as rootstocks will cause sun-blotch to develop on the scion growth of the variety worked on them.

Control of sun-blotch is a matter of prevention. The propagation of diseased trees can be avoided if both budwood and rootstock source trees are determined to be free of the causal virus. This can be done by proper indexing procedures which can be made easily but which require approximately 1 year to complete.

LITERATURE CITED

Coit, J. Eliot. 1928. Sun-blotch of the avocado. Calif. Avocado Assn. Yearbook, p. 28.

Horne, W. T., and Parker, E. R. 1931. The avocado disease called sun-blotch. Phytopathology 21: 235-238.

Wallace, J. M. 1950. Prevention of sun-blotch disease of avocados in new plantings. Calif. Avocado Soc. Yearbook, pp. 97-100.

Wallace, J. M., and Drake, R. J. 1953. Seed transmission of the avocado sun-blotch virus. Citrus Leaves 33(12): 18-20.

Whitsell, Robert. 1952. Sun-blotch disease of avocados. Calif. Avocado Soc. Yearbook, pp. 217-240.