

tion and its degree of fineness, is added to 100 gallons of water for the sprays. Appropriate amounts of insecticides are added for the combined control of disease and insect pests.

Some growers apply sulfur, lime, and insecticides as dusts instead of as sprays. Properly applied, dusts give adequate control of the fungus and can be applied rapidly to large acreages during critical periods. Frequently the light dusting machines can be used when waterlogged soils make it impossible to move the heavy spray machines through the orchards.

In orchards where blossom blight has not been controlled (particularly in humid sections) additional protection against brown rot results from the application of preharvest dusts or sprays. One may use wettable sulfur, 6 pounds to 100 gallons of water; dilute lime-sulfur, 1 gallon to 100 gallons; or sulfur-lime dusts. The application of the fungicide should start about 3 weeks before harvest and should be repeated at intervals of not more than 7 days until the fruit is picked. Dusting is a particularly advantageous procedure for these preharvest applications, as the entire acreage can be treated rapidly and the dust does not leave an objectional deposit on the fruit.

JOHN C. DUNEGAN is a principal pathologist in the division of fruit and nut crops and diseases of the Bureau of Plant Industry, Soils, and Agricultural Engineering. He joined the staff in 1921 and until 1945 was engaged in field investigations of fruit diseases in Georgia and Arkansas. In 1945 he assumed leadership of the deciduous tree fruit disease project at the Plant Industry Station, Beltsville, Md.

The attention of the reader is directed to the section of color photographs, in which appear pictures of peaches infected with brown rot, anthracnose, and bacterial spot. Diseases of apple, pear, citrus fruit, strawberry, grape, and cherry are also illustrated.

Scab or Black Spot on Peach

John C. Dunegan

Peach scab is also called black spot or freckles—apt names because the black spots on a badly infected peach do make it look freckled.

Cladosporium carpophilum, the fungus that causes the disease, occurs throughout the world on peach twigs, leaves, and fruit. In the United States and probably elsewhere fruit trees grown in dry sections are rarely affected, but in more humid sections the fungus is so persistent that growers must undertake control measures every year to protect the fruit. The fungus occasionally attacks plums and cherries but is of little importance on them.

The disease appears on the fruit as small, greenish, circular spots, one-sixteenth to one-eighth inch across, which become visible about the time the fruit is half-grown. The spots usually are most numerous near the stem. At times they cause an excessive dropping of the fruit by killing the stem tissues. The spots slowly increase in size, turning olive green to black and velvety as the result of the mass of dark spores that form on the surface. If the spots are especially numerous, they may coalesce into a crustlike covering over most of the fruit, which interferes with the normal growth of the peach as it matures. Badly infected fruit may crack open to the pit and be destroyed by the brown rot fungus.

On twigs of the current season's growth, the fungus produces many small oval, brown lesions or cankers that

may retard the growth of the twigs. Spores produced in the twig lesions the following spring start anew the cycle of fruit, leaf, and twig infections.

Toward the end of the growing season the scab fungus occasionally develops on the lower surface of the leaves as indefinite pale-green or brownish patches scattered irregularly over the leaf blade, midrib, and stem. The leaf infections are of little economic importance because the area involved is not extensive and only negligible defoliation occurs. The infections give the plant pathologist an easy way to get in pure culture an organism that ordinarily is hard to isolate free from contaminations.

The life cycle of the peach scab fungus is simple enough. It consists merely of a series of superficial spots alternating between the twigs (where the fungus overwinters) and the fruit, twigs, and leaves produced the following season. The process is an endless cycle; the fungus always is present on some part of the peach tree. Its very ubiquity would seem to make it difficult to control, and yet, in truth, it is one of the easiest. So readily can the fungus be controlled that the presence of scab spots on peach fruit is an indication of improper spraying procedures. This is one of the diseases where research has shown the way to uniformly satisfactory control year after year.

The secret of the control of the peach scab fungus lies in the proper timing of the spray application. When bordeaux mixture was the only spray material available, few growers made any effort to control the scab fungus—compared to the injury that generally followed the use of this copper spray, the scab disease was the lesser of two evils. The demonstration in 1907 that a mixture of sulfur and lime could be used safely on peach trees made the control of the scab fungus practical. The demonstration in 1917 by G. W. Keitt that 40 to 60 days elapse from the time the spores first infect the peach until the spots become visible furnished the final clue to the problem. Keitt showed that

the fungicide must be applied within 3 to 4 weeks after the petals have dropped if the fruit is to remain scab free. Since the peaches are then very small and show no evidence of scab infections, it took some time to convince peach growers that the control application must be made early in the season. For years now a single application of sulfur as a spray or dust 3 to 4 weeks after the petals have dropped has been the standard procedure. Sulfur is also used in later sprays to protect the fruit from infections of brown rot. The sprays have little effect on scab infection on the fruit, except on late-maturing varieties, but they do prevent some twig lesions as a comparison of sprayed and unsprayed trees shows.

I have to admit that that control program merely prevents infection on the fruit. It does not eradicate the fungus—the new shoots and branches are infected by the end of the growing season and next year's fruit crop must likewise be protected by sprays. As the standard fungicides applied to peaches for scab and brown rot control do reduce the number of twig lesions, a grower could perhaps eliminate the lesions by additional sprays after the fruit is harvested. But that would not be economical, as it is much less expensive to apply one spray early each season to protect the fruit from scab infections than it would be to apply a series of postharvest sprays to prevent overwintering lesions from developing on the twigs.

THE PEACH SCAB FUNGUS is almost unique in the problem it presents: An ever-present fungus is so efficiently controlled by one application of a sulfur fungicide that it is uneconomical to make any attempts to eradicate the fungus.

JOHN C. DUNEGAN, *principal pathologist in the Bureau of Plant Industry, Soils, and Agricultural Engineering, is in charge of investigations of the control of diseases of deciduous fruit trees. He has studied fruit-disease problems in the United States since 1921*