

## Incubation Period of *Helminthosporium papulosum* on Fruit and Bark of Apples

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Journal Paper No. 818 of the College Experiment Station, University of Georgia.

### ABSTRACT

These investigations show that the incubation period of *Helminthosporium papulosum* on apple is 3-6 months on the fruit and 3-10 months on the bark. *Phytopathology* 60:1704-1705.

*Helminthosporium papulosum* Berg causes a black pox on fruit and bark of apple (*Malus sylvestris* Mill.) that has been known since 1934 (1); a leaf spot phase of the disease was reported in 1963 (4). The disease is troublesome throughout the eastern United States and, in some cases, causes severe losses. Although Berg (1) described the causal organism and the bark and fruit symptoms, some phases of his investigations were inconclusive and need elucidating. Many workers have attempted bark infection studies to investigate control measures. Since they were unable to reproduce Berg's work, however, reports were not made. Lewis & Shay (2) provided information on control of the fruit pox and gave an indication of the fruit infection period. Others (3) suggested that nothing is known relative to the incubation period or the temp and moisture requirements of the fungus.

Attempts to repeat Berg's greenhouse inoculation work on development of the bark pox phase of the disease led to the discovery that there was a leaf spot phase (4). Leaves inoculated with a water suspension of spores and mycelium of *H. papulosum* developed tan spots 3-5 mm in diam in 30 days, while noninoculated shoots of the same plant remained disease-free. Leaf symptoms which developed in the greenhouse were similar to natural infections observed under orchard conditions. The fungus was reisolated from such spots in several tests. Although these same plants were maintained on greenhouse benches from April until October, the bark pox failed to develop.

Plants used in the leaf spot studies were planted out in a nursery row to overwinter. During the following growing season, the bark pox developed on stems inoculated over a year earlier, while noninoculated stems remained disease-free. Contrary to Berg's work, this latent bark pox development indicated an extended incubation period and suggested additional studies regarding development of the fruit and bark pox problem.

Field observations and exposure of potted plants to natural inoculum supported preliminary observations of greenhouse inoculations. *Helminthosporium* leaf spot usually developed in orchard trees from May through September, but the first stem and fruit lesions appeared during the latter part of July. Bark platings during

May from symptomless new growth of diseased trees occasionally gave pure cultures of *H. papulosum* showing that the pathogen had become established prior to that time. Platings from developing fruit during the same period also produced pure cultures of the pathogen. Potted Rome Beauty plants placed under diseased orchard trees during April of 1965, then removed to an isolated nursery, developed typical *Helminthosporium* stem pox symptoms in August 1965. This work furnished the basis for further investigations with controlled inoculations to establish the incubation period of *H. papulosum* in bark of apple.

Spore suspensions for inoculations were prepared by submerging 14-day-old potato-dextrose agar cultures in water and brushing the conidiophores with a small camel's-hair brush. The resulting suspensions were diluted to approx 5,000 spores/ml, agitated for 2-3 min in a blender, and sprayed on stems and leaves of actively growing shoots of Rome Beauty apple trees.

During the last week of April 1965, eight potted Rome Beauty trees were inoculated and kept in a moist chamber for 72 hr; then four plants were maintained in the greenhouse and the others were transplanted to an isolated nursery. These inoculations were

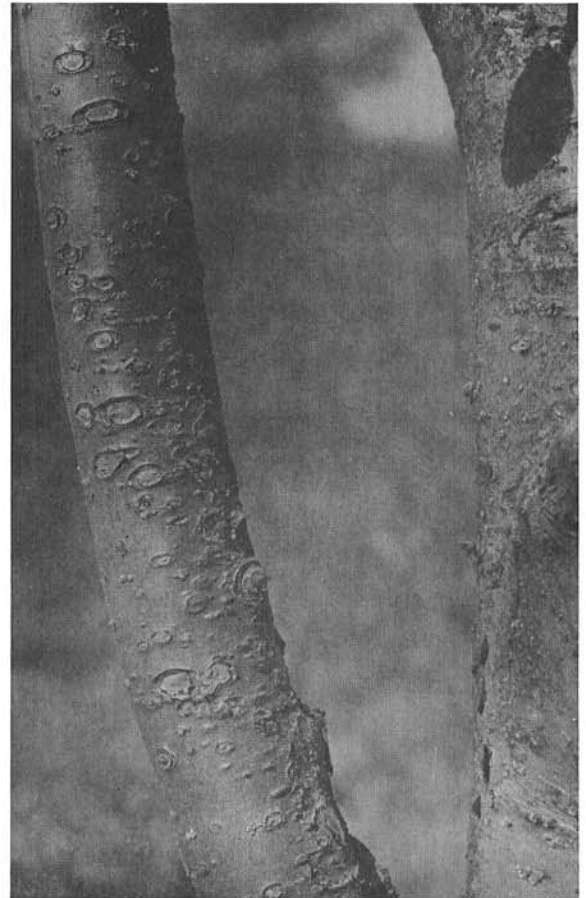


Fig. 1. Black pox on trunk and main limb of Rome Beauty apple tree, source of secondary spread of the disease.

repeated on another lot of trees during 1966. One branch of each plant was protected from inoculum to serve as a control.

Inoculated shoots of plants growing in the nursery developed typical black pox papules during July through October, while those growing in the greenhouse seldom showed symptoms. Noninoculated branches failed to develop symptoms in either case. *Helminthosporium papulosum* was usually reisolated from the pimples that developed in the field on inoculated branches. The fungus was frequently isolated from inoculated, symptomless trees maintained in the greenhouse. Trees inoculated in 1965 and kept on greenhouse benches were transplanted to the nursery during November of that year. Black pox developed on inoculated branches during 1966. Symptoms developed during summer and fall on trees inoculated and planted in a nursery during 1966, but failed to show on those kept in the greenhouse.

From these investigations, the incubation period of *H. papulosum* appears to be 3-10 months and explains Berg's inconclusive results with field investigations. Furthermore, it confirms work of Lewis & Shay (2) regarding spraying experiments for control of the disease on fruit. Although leaf spot develops on inoculated trees in a relatively short period of time, a host growth response is apparently required for development of symptoms on bark and fruit.

The disease is usually introduced into new plantings on infected nursery stock and propagating wood. After it becomes established in the orchard, it spreads to new growth and new trees. The fungus reproduces in old bark lesions (Fig. 1), and spreads to new leaves, fruit, and bark. Infections occur throughout the growing season, enabling the organism to spread to new growth and new trees after the last spray application without showing symptoms until the following season. Propagating wood may be infected without showing symptoms. Therefore, grafting and budding material should be selected from black pox-free orchards. Most fungicides recommended for control of other spring and summer diseases are effective against black pox, but when the disease is established on scaffold limbs and branches as in Fig. 1, it is difficult to control.

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