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PHOMA ROT OF TOMATOES

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WHAT IS PHOMA ROT OF THE TOMATO?

PHOMA ROT of tomato fruits, also known as stem-rot, or black-rot, is a disease caused by a mold, or fungus.¹ This fungus also attacks the leaves and stems of tomato vines, causing the disease known as Phoma leaf-blight or stem-blight.

WHAT IS THE EFFECT OF PHOMA ROT ON THE FRUIT?

Phoma rot makes affected fruit unsalable, or at least lowers its selling price, and often leads to its complete decay.

The fungus attacks both green and ripening fruit. In its earliest stages, Phoma rot of green fruit is marked by minute, slightly sunken spots. As these spots enlarge they develop brown or black borders with slightly lighter centers which become dotted with black pimple-like bodies (pycnidia) in which the seedlike bodies, or spores, of the fungus are borne.

¹This fungus is known as *Phoma destructiva*. A fungus (plural, fungi) is a small, simple plant, which lacks the green color found in more complex plants, such as our orchard, field, and garden crops. Molds, yeast, toadstools, and mushrooms are good examples of fungi. Fungi can not make their own food, as green plants do, and many of them obtain it from living plants or their dead remains. Those fungi which obtain their food and energy from living plants are known as parasites, while the plants upon which they grow and feed are known as their hosts. Such fungi usually cause harmful changes in the structure, composition, and activities of their hosts, which are known as lesions. Such changes constitute disease. Thus, in Phoma rot of tomato fruits the fungus *Phoma destructiva* is the parasite which attacks and feeds upon its host, the tomato, causing spots or lesions, which are manifestations of the disease.

On ripe fruit the earliest stages of the rot are marked by water-soaked concave spots. As these enlarge, their advancing edge remains slightly sunken, slightly discolored, and water-soaked. Their centers become brown to charry black, leathery and firm, and dotted with the black pimplelike fruiting bodies of the fungus. Under moist conditions spores in the form of slimy whitish masses ooze out of these fruiting bodies so abundantly that the fruiting bodies become completely covered and the center of the spot appears whitish and slimy. The spots increase indefinitely and rapidly in size, but remain more or less circular and concave. The underlying affected parts are brown or black and remain firm until the spots become very large or infected with organisms that cause soft rots. The dry crustlike center of the spot often cracks, and a grayish white growth of the fungus may develop in the crevices. Frequently numerous small spots merge to form a large one.

The spots occur most frequently at the stem end of the fruit, where the fungus enters through growth cracks or breaks made when the fruit is picked; they are not confined to the stem end, however, since the fungus may enter the fruit through breaks in the skin made by insects, by cracking, or by other diseases, such as nailhead spot.

WHAT IS THE EFFECT OF PHOMA BLIGHT ON THE PLANT?

Phoma blight consists of spots on the leaves, leaf petioles, and the stems of the vines. (Pl. I.) Spotted leaves dry out and are shed prematurely, thus causing a reduction of leaf surface, which lowers the vigor of the plants and frequently causes heavy loss through decrease in yield. The disease spreads to the fruit from these leaf and stem spots, appearing on the fruit in the field and in transit as the rot previously described.

In the early stages the spots on the leaves are merely small discolored areas, later turning brown or black, which are definite in outline and irregular in shape. These spots do not change color as they become older, but do enlarge, and often several merge into a large blotch of definite outline but irregular shape. They frequently start along the leaf margins. On petioles and stems the diseased areas appear as streaks or blotches. The dead areas on leaves, stems, and petioles dry out and shrivel, and on them appear, singly or in groups, the small black pimplelike fruiting bodies in which the spores of the fungus are borne.

WHERE AND WHEN DO THE ROT AND BLIGHT OCCUR?

Phoma blight and rot occur most frequently in southern winter-grown tomatoes, that is, in the crops of California, Cuba, Florida,



PHOMA ROT OF THE TOMATO.

The disease attacks tomato foliage as well as fruit. Fruits affected with growth cracks, as shown in the tomato just above the basket, are particularly susceptible.



and Mexico. It has also been noted in Texas, Mississippi, Tennessee, and in northern fields.

WHERE AND HOW DOES THE BLIGHT START IN THE FIELD?

The growing plant gets the disease from the soil where the fungus may overwinter, possibly from seed extracted from tomatoes harvested in *Phoma*-infested fields, or possibly from near-by wild or cultivated plants of the potato family infested with the fungus.

WHERE AND HOW DOES THE FUNGUS GET ON THE FRUIT?

As pointed out previously, the spores, or seedlike bodies of the fungus, are produced in the black pimplelike bodies which appear on the diseased spots of affected vines. These spores may be directly carried to the fruit by rain, wind, insects, and man, or they may become lodged in the soil and subsequently spattered on the fruit by rain or carried to it by wind or insects. They probably are also carried to fruit in picking and packing operations.

Fruit which carries these spores on its surface is said to be contaminated, and it is probable that most fruit picked in a diseased field has spores on it, especially if the field is widely and severely affected.

A fruit may carry many spores of this fungus on its surface and still be perfectly sound or healthy and remain so. Before the disease can develop in a contaminated fruit, either in the field or after picking, infection must take place; that is, the spores must sprout, or germinate, and the resulting fungus must enter the tissues of the fruit and establish itself there. Laboratory and field studies indicate that the fungus can not penetrate the uninjured skin of tomato fruits; hence, only tomatoes the skin of which is broken by insects, bruising, natural cracking, or other diseases can become infected. For this reason *Phoma* rot occurs most frequently on the stem end of fruits, either at growth cracks or in the fruit-stem scar. Wounds, however, need not be so large as to be visible in order to permit the entrance of this fungus. It is probable that infection of contaminated fruit is not restricted to the field, but that it also takes place in packing houses and during transit.

WHAT FAVORS THE START AND DEVELOPMENT OF THE FUNGUS?

The fungus can not grow if the temperature is either below 42° or above 90° F., and its spores can not germinate if they are not supplied with moisture. Consequently, the disease can not develop and spread in the field unless dews or rainy weather occur. The fungus grows best when the temperature is about 83° F.

As already stated, the fungus apparently can not penetrate the skin of the tomato. As a consequence, contaminated fruit can not become infected unless its skin is broken, even though temperature and moisture conditions are favorable for the growth of the fungus.

Following infection some time must elapse before visible symptoms of the disease appear. It may happen, therefore, that fruit is packed which looks sound but which has become infected and will develop visible signs of the disease later if temperature and moisture conditions are favorable for the fungus.

Experiments show that at least 4 days must elapse before any signs of the disease become visible in wounded contaminated fruit. After 10 days the spots become distinct, and after 3 weeks the black pimple-like fruiting bodies appear. It was found that at 64° F., in a humid atmosphere, spots may reach a diameter of 1 to 2 inches in 18 days. The spots enlarge more rapidly in ripening than in green fruit. For example, it was found that spots on ripe fruit were one-fifth to three-fifths of an inch in diameter after 10 days, whereas the spots on green fruit kept under the same conditions were only one-fifth as large.

Under the most favorable conditions for the fungus, high humidity and an air temperature of about 80° F., the disease becomes visible on infected leaves in 3 to 5 days as slightly discolored spots. In case of severe infection these spots give the leaves a speckled appearance. About 8 days after infection the spots become black and are about one-tenth to two-fifths of an inch in size.

DOES PHOMA ROT DEVELOP AND SPREAD AFTER THE FRUIT IS PICKED?

Every day's delay in getting infected fruit to the consumer increases the possibility of loss. Fruit picked in an infected field but appearing sound when wrapped, even though actually infected, may show spots in 4 or 5 days. Furthermore, fruit which comes from a disease-free field but which is packed or repacked in places where diseased fruit or fruit from diseased fields is handled is likely to become infected and develop the disease in transit or in the ripening rooms.

WHAT SHOULD BE DONE WITH THE DISEASED FRUIT?

Spotted fruit, even though unsightly, is fit for food provided the diseased parts are cut away. It should be disposed of as soon as possible, however, to avoid greater loss, since the spots enlarge rapidly and also open the way for other organisms of decay, which may rot the fruit completely in a very short time.

HOW CAN THE DISEASE BE CONTROLLED IN THE FIELD AND IN TRANSIT?

No satisfactory effective measures for the control of the disease in the field have been determined. Crop rotation and the planting of disease-free seed probably are advisable.

Since the fungus can enter fruit only through wounds, it is highly desirable that fruit be handled very carefully to avoid breaking the skin.

The only effective way to prevent losses in transit or in the marketing process is to handle only fruit grown in disease-free fields and not packed or repacked in places where *Phoma*-infected fruit is handled.

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