NATURAL INFECTION OF TOMATO FOLIAGE BY PLEOSPORA HERBARUM [1]

C.O. Gourley

Abstract

A severe foliage infection of tomato plants caused by Stemphylium botryosum Wallr. was found in a greenhouse in Nova Scotia. The symptoms of the disease were similar to those described on field tomatoes in Israel. The Nova Scotia isolate produced only sterile perithecia; however, based on its morphological similarity to an ascospore producing isolate from strawberry and on the perithecial primordia which formed in cultures, it was identified as the asexual form of Pleospora herbarum (Fr.) Rabh.

Introduction

In the fall of 1969 the foliage of tomato plants, cultivar Eurocross BB, became severely blighted in a greenhouse at Greenwich, Kings County, Nova Scotia. The disease was first thought to be early blight, caused by the fungus Alternaria solani (Ell. & Mart.) Jones & Grout. However, a Stemphylium species sporulated on leaf lesions in moist chambers, and it was the only fungus isolated from diseased leaves. Because of the perithecial primordia produced in cultures it was thought to be Stemphylium botryosum (Fr.) Rabh.

S. botryosum was reported by Rotem et al. (4) as the cause of a foliage disease of field tomatoes in Israel. Because the fungus attacked only tomato foliage they considered it a separate forma specialis, which they designated S. botryosum f. sp. lycopersici. Samuel (5) reported S. botryosum as the cause of leaf blight and fruit spot of tomatoes in greenhouses in South Australia. In Nova Scotia the disease occurred on the foliage but not on the fruit of tomato plants in the greenhouse.

A brief account of the symptoms of the disease, the conditions conducive to infection, and the isolation and identification of the fungus is reported.

Observations

Symptom development

The tomato plants were grown in a plastic-covered greenhouse in which centrally suspended ventilator fans forced air toward the end of the house. Leaf lesions appeared to have occurred first on plants beneath the fans and gradually spread outward in the direction of the forced air. At the time the plants were examined approximately 75% and 25% of the foliage was destroyed at the center and at the ends, respectively, of the central bed. Occasionally infected leaves were found on plants in the two side beds. It was not possible to determine the source of the initial inoculum.

Leaf lesions first appeared in the older, lower leaves as small chlorotic spots in which the centers soon became necrotic. Many such spots occurred in a single leaf and these often coalesced to form extended areas of infection (Fig. 1). As the lesions increased in size, they became concentrically ringed, and the brown, necrotic tissue became dry and often cracked. Individual lesions varied from 2 to 10 mm in diameter. Severely infected leaves turned brown and dropped. Foliage injury was most severe during the harvest period. No infections were found on the fruit.

Isolation and Identification of the Asexual Stage of the Fungus

Infected tissue was surface sterilized in 1:1000 $HgCl_2$ solution, rinsed in two changes of sterile water and plated on potato-dextrose agar (PDA). Severel surface sterilized diseased leaves were placed in large petri plate moist chambers.

All the isolations made from infected tissue yielded pure cultures of a fungus that developed conidia of the Stemphylium type. A pinkish color, characteristic of some isolates of S. botryosum (2), developed in the mycelium of the colonies growing on PDA. Cultures incubated on the laboratory bench sporulated concentrically. There were no differences in the morphology or the size (38-64 x 14-25 u) of conidia produced on leaf lesions in moist chambers and those produced on PDA. The swollen apices of the

[1] Contribution No. 1429, Research Station, Canada Department of Agriculture, Kentville, Nova Scotia.

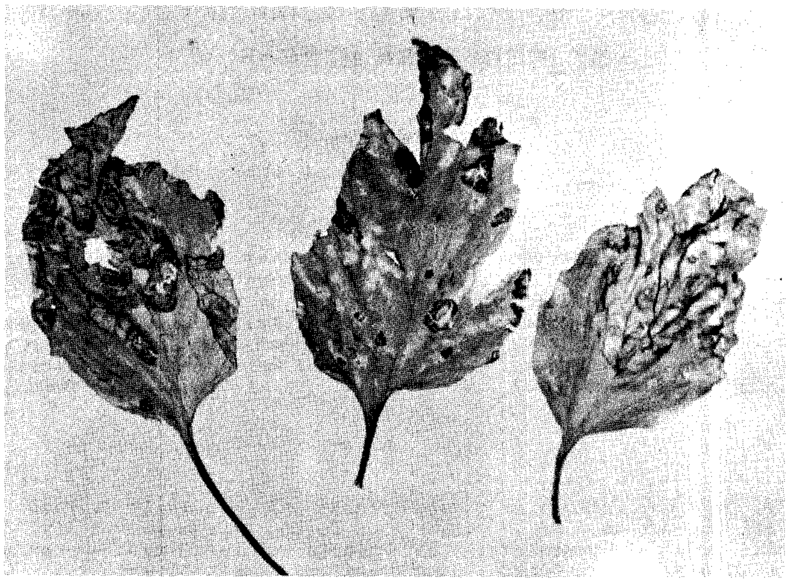

Figure 1. Lesions on tomato leaves caused bv natural infection with Stemphylium botryosum. DAOM No. 137773.

sporophores, the conidia, and the perithecial primordia which formed in PDA cultures indicate that the fungus is S. botryosum (2, 6).

Sexual Stage

Numerous sterile perithecia formed in all PDA cultures of S. botryosum. Rotem et al. (4) showed that the perithecia which formed in cultures held for 2-weeks at 10, 15, or 20 C produced ascospores when exposed for an additional 14 days to 15, 20, and 25 C, respectively. However, with the Nova Scotia tomato isolate biweekly alterations of either upward or downward temperature shifts failed to induce the maturation of perithecia and the production of ascospores. Similarly an isolate of S. botryosum from strawberry, included for comparison, failed to produce ascospores. Neither constant temperatures nor various temperature shifts induced maturation of the sterile perithecia for either of these isolates in PDA cultures. When cultures containing immature perithecia were exposed to constant light, diffused daylight, alternate artificial light and dark periods, and constant darkness, no asci or ascospores were produced by either the tomato or strawberry isolates.

Sterile seedlings of three tomato cultivars, Eurocross BB, Stokesdale, and Viscount, were grown in test tubes as recommended by Neergaard (3), and eight seedlings of each cultivar were inoculated with each of the tomato and the strawberry isolates. Both isolates were pathogenic and perithecial primordia formed on the roots of all seedlings. These necrotic seedlings were held at 18 C and observed periodically. After 8 months, mature perithecia and ascospores of the strawberry isolate were found on the 'Stokesdale' and 'Viscount' seedlings. The tomato isolate did not

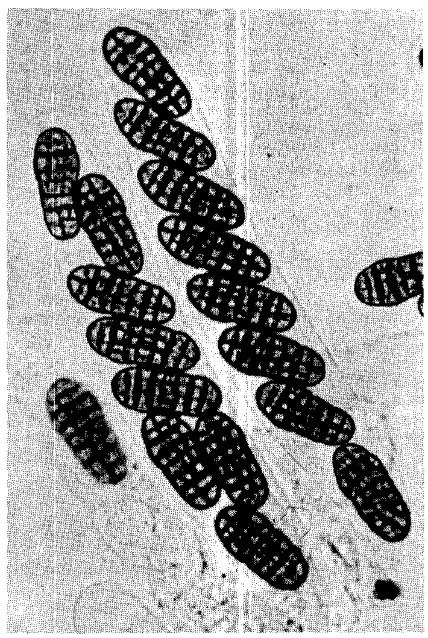

Figure 2. Ascospores of Pleospora herbarum produced by an isolate from strawberry, X 400. DAOM No. 137380.

produce mature perithecia on any of the seedlings. The ascospores of the strawberry isolate (Fig. 2) were typical of those described for Pleospora herbarum (Fr.) Rabh., and their size, 37.3 x 15.9 u, was within the range given for this species (2).

Discussion and conclusions

In Nova Scotia the symptoms of naturally infected tomato foliage in the greenhouse were similar to those of naturally infected tomato foliage in the field in Israel (4). S. botryosum is a weak, faculative parasite found ubiquitously on dead or weakened Plant material. In Nova Scotia foliage infections were most severe during the harvest season. At this time plants are more vulnerable to weak parasites than at earlier growth stages. Rotem et al. (4) did not indicate the growth stage at which tomato plants were the most susceptible to natural infection under field conditions.

The morphology of S. botryosum isolates from tomato and strawberry were similar, and not unlike the isolates described as pathogenic on tomato foliage in Israel (4).

Rotem et al. (4) found that cultures of Stemphylium pathogenic on tomato produced sterile perithecia on nutrient media at constant temperatures between 5 and 30 C. They reported that a few isolates parasitic on tomato never produced perithecia, and that these were identical with the perithecia-producing isolates in their morphology and conidial dimensions. They did not find perithecia on naturally or artifically infected plants nor on their debris, regardless of the kind of treatment employed to stimulate their formation. Here the isolate of S. botryosum from diseased foliage of greenhouse grown tomatoes produced only sterile perithecia in culture and on artifically inoculated tomato seedlings. The morphologically similar isolate of S. botryosum from strawberry produced mature perithecia and ascospores of P. herbarum on tomato seedlings, but only after a long incubation period. Thus it is concluded that the tomato isolate is P. herbarum.

As far as the author is aware, P. herbarum has not heretofore been reported as the cause of a foliage disease of greenhouse grown tomatoes in Canada (1). The disease is not considered to be economically important because it occurred only on the foliage and its manifestation at a late stage of plant growth would have little effect on crop production.

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