BLOSSOM AND POD BLIGHT - AN UNUSUAL DISORDER OF THE PEA[1]

V. R. Wallen and M. D, Sutton[2]

Abstract

A sporadically occurring blossom and pod disease of garden pea was found in epiphytotic proportions in 1957 and in trace amounts in 1958 and 1961. Only plants of short-stemmed varieties growing in sandy soil were affected, Infected blossoms all contained sand crystals that had been propelled into the blossoms by means of severe hard-driving rain or hail. Alternaria tenuis and two unidentified species of bacteria were isoiated from diseased blossoms and pods. Under specific conditions described in the text the Alternaria reproduced the disease, The occurrence of the disease is dependent upon a sequence of events that must occur during blossom and early pod formation..

Introduction

During the summer of 1957, particularly in the month of June, a characteristic symptom unlike those of any of the common pea diseases appeared on the blossoms and young pods of peas of the garden variety Improved Laxton's Progress growing in sandy soil. In 1958, in an adjacent plot, a few blossoms of the variety Profusion were noted with similar symptoms, In 1961, the disease was noted on a few plants of the variety Improved Laxton's Progress in the same area as in 1957. These observations, together with one record in 1931 (1) of a "blossom blight" caused by a species of Alternaria constitute the only records of a distinct blossom disorder of peas in Canada. Unfortunately the 1931 record did not give any description of symptoms or other pertinent information; it is therefore impossible to determine if the sequence of events that brought about the disease described below was similar to that recorded in 1931.

Symptomatology

When the disease was first observed in the field, blossoms in all stages of development were affected, A few small pods emerging from the affected blossoms were also diseased.

Depending on the stage of blossom development when attacked,' symptoms ranged from a slight water-soaked appearance to complete necrosis of the petals with subsequent petal fall and death of the young flowers (Figure 1). Slightly affected flowers formed pods, but in the majority of cases the pods failed to develop and did not set seed. Pod infection caused a necrotic, water-soaked appearance at the stem end of the pod that gradually spread over most of the pod. Severely affected pods shrivelled and died shortly after emergence from

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[1] Contribution No. 176 from the Plant Research Institute, Research Branch, Canada Department of Agriculture, Central Experimental Farm, Ottawa.

[2] Plant Pathologists.

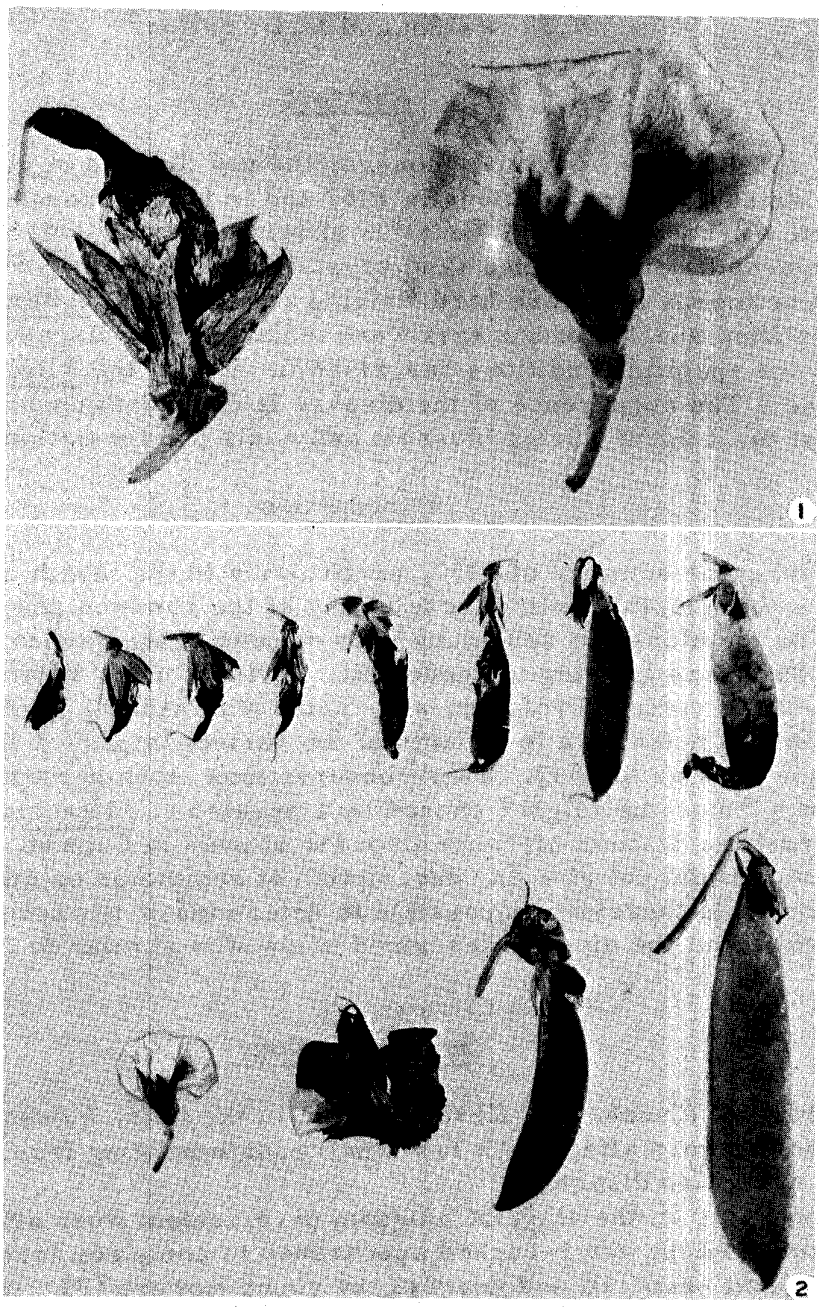

FIGURE 1. LEFT, APEA BLOSSOM AFFECTED WITH BLOSSOM BLIGHT. RIGHT, A HEALTHY PEA BLOSSOM OF SIMILAR AGE.

FIGURE 2. UPPER SERIES, EIGHT PODS IN VARIOUS STAGES OF DEVELOPMENT SHOWING SYMPTOMS OF POD BLIGHT. LOWER SERIES, TWO HEALTHY BLOSSOMS AND TWO HEALTHY PODS.

the flower (Figure 2). In many cases the petiole turned dark-brown to purple and broke off, leaving only a short stump attached to the pod.

Materials and Methods

To detect pathogenic microorganisms, petals and pods from affected blossoms were surface-sterilized for 2 minutes in 2 per cent chlorine solution (Javex standardized to 2 per cent available chlorine as sodium hypochlorite), washed in sterile distilled water, and plated on pea and yeast beef agars. The pea agar plates were-incubated for 10 days at room temperature and examined for fungi. The yeast beef agar plates were incubated at 28°C for 96 hours and examined for bacteria. In addition, smears were prepared, stained and examined.

For inoculation studies, pea seedlings, variety Improved Laxton's Progress, were grown in pots in the greenhouse until flowering. Bacterial and fungal spore suspensions were prepared from affected tissues in water, nutrient broth and distilled water respectively. In replicated tests, blossoms were atomized with suspensions of the isolated organisms separately and removed to four growth chambers held at 15°, 20°, 25° and 30°C. The chambers provided sufficient light for growth (1000 foot candles) and a high R.H. of approximately 90 per cent, Other lots of flowering pea plants were treated similarly and removed to a greenhouse held between 18" and 22°C. The R.H. was maintained close to saturation.

In a second test the blossoms of seedlings of similar age were treated as before with the exception that the young blossoms were blasted with fine sand delivered by means of a small haad-operated duster used for dusting fungicides on foliage. The blossoms were subjected to the sand blast for 10 seconds, Following treatment, the seedlings were inoculated with suspensions of the test organisms and removed to the growth chambers and greenhouse.

In both growth room and greenhouse tests, suitable controls were provided.

Results and Observations

An Alternaria of the tenuis type was isolated and maintained on pea agar. Two gram-negative bacterial species frequently found in leguminous plant tissues were isolated and demonstrated by smearing and staining. Both species grew well at 28-32°C on yeast beef agar. The most prevalent organism found in the tissues was a small coccal bacillus which, on isolation, produced a small, white, circular, convex, smooth, entire, opaque colony on yeast beef agar, On the same medium the other bacterial species isolatedwas a long rod that produced a yellow colony with similar characteristics.

Where the blossoms had not been sand blasted no infection was obtained in any of the tests in growth chambers or in the greenhouse following inoculation with the two species of.bacteria and with the Alternaria However, in the 20°C chamber, on blossoms subjected to the sand blast followed by inoculation with the Alternaria isolate, 7 of 25 blossoms showed characteristic symptoms of blossom blight (Table 1). No infection occurred at 15°C. At 25°C and 30°C an almost complete collapse of all plants occurred followed by complete over-growth by Botrytis cinerea.

Table 1. Effect of sand blasting blossoms of healthy pea seedlings maintained in a growth room at 20°C and inoculated with two species of bacteria and a species of Alternaria.

Organism	Treatment	No. healthy blogsoms	No. diseased blossoms
Contro1		25	0
White bacterium	Untreated	25	0
White bacterium	Sand blasted	25	0
Yellow bacterium	Untreated	25	0
Yellow bacterium	Sand blasted	25	0
Alternaria sp.	Untreated	25	0
Alternaria sp,	Sand blasted	18	7

Several diseased blossoms, collected from the original plots in 1957, were examined microscopically. In all cases, sand crystals were present in the blossoms. Healthy blossoms, examined at that time, revealed only a trace of or complete absence of sand. It was also observed that only blossoms borne close to the ground on the short-stemmed varieties, Improved Laxton's Progress and Profusion, showed symptoms of disease; taller vine types, grown in the sar area, were disease-free,

Records obtained from the Agrometeorology Unit, Plant Research Institute, revealed that severe weather conditions prevailed during flowering time in 1957. During the last week in June, a total of four inches of rain fell in the area where the peas were grown; 1.68 inches of rain fell on June 23 together with sporadic hail showers. The remainder of the four inches fell as heavy, hard-driving rain storms on June 24, 28, 29 and 30.

Discussion

Blossom blight was found only in one section of a field where the soil was composed primarily of sand and in short-stemmed varieties where the flowers were close to the ground level. The fact that sand crystals were found in the diseased blossoms from this section and that no infection took place in growth room or greenhouse tests where sand was not used prior to inoculation indicates that sand or some other abrasive material is important in establishing infection courts for the initiation of this disease. The presence of sand in the blossoms, particularly in 1957, was the result of hard-driving rain and hail that propelled the sand into the blossoms. The absence of disease in tall pea varieties may be explained by the height of the blossoms from ground level.

In this particular test, the Alternaria isolate produced typical symptoms under certain growth room conditions, It is quite possible that other saprophytic fungi might produce this disease under favorable conditions. It is not the purpose of this paper to state that the disease is caused by this particular Alternaria isolate but more to a sequence of events that is dependent upon the initial establishment of infection courts through wounds.

Literature Cited

1. ANON, 1931. Tenth Ann, Rept. Can. Plant Disease Survey. 1930. p.44.