FIRE BLIGHT OF PEAR AND SOME OTHER HOSTS IN NOVA SCOTIA[1]

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Abstract

The bacterium, Erwinia amylovora (Burr.) Winslow et al., has been identified as the cause of an infection on pear and Crataegus species in Nova Scotia. In addition to infections of the current season, older cankers found in pear orchards indicated that scattered infections of fire blight had occurred in the Annapolis Valley prior to 1966. More favorable conditions for infection of pear occurred during 1966 than during the preceeding 4 years.

Introduction

Fire blight, caused by the bacterium Erwinia amylovora (Burr.)Winslow et al., has not previously been positively identified in the Annapolis Valley, of Nova Scotia.

In 1938, Hockey reported that a disease of apple nursery stock collected from Annapolis Royal was caused by the fire blight pathogen, but. subsequent investigation indicated that it may have been caused by Pseudomonas syringae van Hall (5). Following a survey carried out by the Division of Plant Protection, Canada Department of Agriculture, and by J. F. Hockey in 1953 it was concluded that fire blight was not present in Nova Scotia. The disease has been reported from New Brunswick on apple and pear and from Prince Edward Island on apple, pear, Crataegus and Sorbus (5).

On August 2, 1966 a small block of 'pear trees of the varieties 'Clapp's Favorite' and 'Bartlett' were inspected at Falmouth in the Annapolis Valley, Nova Scotia. Most of the 60 trees had twigs, water sprouts, fruit spurs and limbs that showed symptoms similar to those associated with fire blight of pear and apple (1).

Isolations made from cankers on pear wood from the Falmouth orchard yielded a bacterium similar to E. amylovora using Dowson's (3) procedure for identification. The identification of the bacterium was confirmed by one of us (Layne) as a virulent strain of E. amylovora.

This paper is a report of the finding and the extent of the fire blight disease on pear and other hosts in the Annapolis Valley, its probable source of entry and its potential effect on fruit production in Nova Scotia.

A survey for fire blight in Annapolis Valley pear orchards

Seventeen of the pear orchards in commercial production in the Annapolis Valley were examined for symptoms of fire blight infection during August, September and October 1966. A dead twig with leaves or blossoms still attached and often with a small canker formed on the branch beneath it was used as the criterion for determining current season infection. Cankers on limbs and trunks which exhibited one or more successive seasonal advances of infection or had obviously died out were determined to be caused by infection in previous years.

Fire blight infections were found in all of the pear orchards examined in the Annapolis Valley (Table 1). Trees were severelycankered in 3 of the 17 orchards and, in one of these, several trees had died as a result of bacterial infection. In the Falmouth orchard (Table 1, orchard 8) severe twig blight had occurred in 1966 and large cankers were present on the main limbs and trunks of most trees (Figs. 2, 3, 4). In the same orchard infected root sprouts were found with the tips curved in the shape of a shepherd's crook (Fig. 5). Cankers resulting from 1966 infections were found in 8 of the orchards. Cankers which had been formed prior to 1966 were found in another 9 orchards. The 4 orchards which had a moderate number or many cankers were all situated at the east end of the Annapolis Valley near the Minas Basin (Fig. 1).

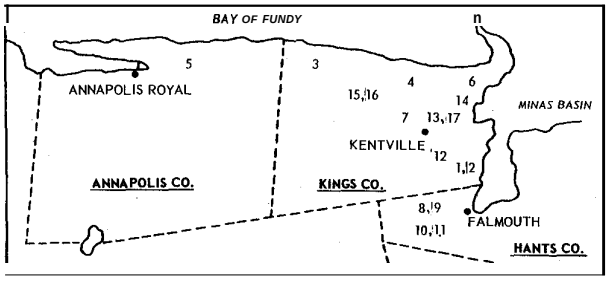

Figure 1. Location of 17 infected pear orchards in the Annapolis Valley of Nova Scotia.

Survey for fire blight on apple and hawthorn

Cankers typical of those formed by E. amylovora were found on apple wood in orchards adjacent to infected pear orchards at locations 2, 3, 6, 7, 9, 11 and 17 (Fig. 1). A few cankers on apple wood at locations 3 and 9 appeared to have been formed in 1966. Cankers were found on hawthorn at locations

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8, 11 and 14 adjacent to infected pear orchards. A few old cankers similar to the one in Fig. 6 were found on a single tree at location 8 and in a hedge row of hawthorn at location 11. A moderate number of cankers were present at location 14 on hawthorn in a hedge row which also contained many wild species of Prunus. A number of these cankers appeared to have been formed in 1966.

Isolation and identification of the bacteria

The isolation procedures were those normally employed for recovering bacterial pathogens from woody tissue. Direct isolations were made from current seasons infections on potato dextrose agar in Petri plates. A small section was excised from the edge of a previous seasons canker and placed in 5 ml of sterile distilled water. After 1 to 3 days a loopfullof the distilled water was streaked on P.D.A. in Petri plates.

Both a white and a yellow colored bacterium were obtained on P.D.A. when isolations were made from wood cankers of apple, pear and hawthorn. The white forms were initially identified by comparing their morphology and growth characteristics on P. D. A. with a known white form of E. amylovora. In a further test to establish the identity of both the white and yellow forms each isolate was inoculated into green pear fruit and succulent pear shoots which are susceptible to E. amylovora and the growing tip of young bean (Phaseolus vulgaris) plants which are susceptible to Pseudomonas syringae. They were inoculated by coating the tip of an inoculating needle with bacteria and inserting the needle about 2 mm into the fruit and into the most succulent part of a shoot or plant.

Dark lesions with watersoaked margins were produced around the point of inoculation on pear fruit inoculated with the white forms of E. amylovora. Pear shoots did not become infected when inoculated with the bacterial isolates probably because succulent wood was past its prime for the season. Infections occurred on bean plants where yellow isolates from cankers collected from two different pear orchards and one from a canker on apple wood were used as inoculum. This indicated the bacterium was probably Ps. syringae.

The white form of E. amylovora was isolated from cankers formed on pear wood at 6 locations in 1966 and from 2 locations where cankers had been formed prior to this date. It was also isolated from wood cankers on apple at locations 2 and 17 and on hawthorn at location 14 in 1966. The bacteria isolated from fire blight cankers may be either a white virulent form or a yellow avirulent form of E. amylovora or a mixture of both forms (2, 4). The yellow form may predominate in host tissue as a result of conditions unfavorable for the white virulent type (2, 4).

Table 1. Extent of fire blight cankers in 17 pear orchards in the Annapolis Valley.

Orchard	Acreage	Canker rating 1966	Canker rating Previous years
1	3	+a*	t
2	1		tta
3	11	ta	t
4	13	-	t
5	10		t
6	3	t	-
7	2		t
8	0.5	ttta	ttt
9	2	tta	ttt
10	1		t
11	1		+a
12	2	ta	t
13	6		+
14	8	tta	ttt
15	3	t	t
16	15	-	t
17	1	-	t

*Cankers were rated as t few, tt moderate in number, ttt many.
[a]E. amylovora isolated (white virulent form).

Discussion and conclusions

Fire blight occurs throughout the North American continent wherever apples and pears are grown, with the exception of a few favored localities which until recently included the Annapolis Valley (1). Agriculturists in Nova Scotia believed that their climatic conditions were not conducive to the development of fire blight on its hosts, It is not understood why fire blight should only now become a problem of economic importance in Nova Scotiabecause the disease is considered indigenous to North America and has been present since before 1900 (1).

Most of the approximately 1000 pear trees brought into the Province annually come from areas that have a history of fire blight and it appears unlikely that their stock has been entirely free of the disease until recent years. Several 2 to 3-year-old pear trees which were cankered by fire blight for a distance of 12 to 14 inches from the tip were found at location 12 (Fig. 1). These cankers were referred to as "die back" by the grower who thought they were the result of an infection following winter injury. Bacterial cankers may have occurred on pear wood in the past and may have been pruned out before they could be recognized as fire blight infections.

During April and May in Nova Scotia temperatures are generally cool and not conducive to the growth of the bacterium or the copious oozing of it

Figures 2 to 6. Fire blight intections on pear and hawthorn hosts. Figure 2–Severe 1966 infection on pear; Figure3–Twig blight of pear with canker formed in 1966; Figure4–Seasonal extension of cankers formed on pear wood priw to 1966; Figure5–Typical shepherds croak effect of pear root sprouts infected in 1966; Figure 6–An old fire blight canker on hawthorn.

from hold-over cankers. Temperatures within the range of 65" F to 85" F are most favorable for the growth of bacteria in hold-over cankers (1). The number of days of consecutive high temperatures exceeding 65" and 75" F during the pear bloom period, May 23 to 31, for the last 5 years in Nova Scotia was as follows:

Year	Consecutive days exceeding 65° F	75° F
1966	8	6
1965	3	0
1964	4	2
1963	5	2
1962	4	3

The number of days of consecutive temperatures exceeding the minimum required for activating hold over cankers was about doubled in 1966 over the 4 preceeding years. The increase in the amount of fire blight in Nova Scotia in 1966 may be a direct result of the effect of temperature which may have increased the amount of the inoculum produced from hold over cankers. Heavy rains which occurred on May 21, 28 and June 1 and 8 provided ideal conditions for the spread of the bacteria and infection of blossoms, young fruits and new growth in 1966.

Now that pear trees in a number of orchards in the Annapolis Valley are severely cankered, the danger of fire blight infection for the next growing season will be greatly increased because more cankers containing living bacteria will be present in the spring of 1967 than in former years. The fact that a number of apple orchards had symptoms of fire blight infection, especially those near infected pear orchards, adds to the potential hazard. From 2 to 10 per cent of the fire blight cankers formed in a season have been reported to contain living bacteria the following spring (1). However, few fire blight infections may occur in Nova Scotia in future years if climatic conditions parallel those recorded for the 4 years preceeding 1966.

This is the first authentic report of fire blight on apple, pear and hawthorn in Nova Scotia. The disease is not expected to be a major problem in Nova Scotia orchards. Growers can prevent a build up of fire blight by pruning out scattered infections which may occur in the orchard, It may be the only control measure necessary to keep fire blight at a minimum during years with normal climatic conditions and may prevent outbreaks from occurring during years when climatic conditions are ideal for infectionand spread of the disease. The destruction of native hosts of E. amylovora in the vicinity of orchards will greatly assist in the control of the disease.

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