VIRUS DISEASES OF STRAWBERRIES IN EASTERN CANADA[1]

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Introduction

During 1961 and 1962 a survey was made of the viruses occurring in strawberries in eastern Canada. Strawberry plants were collected from fields in Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island. Most of these plants were collected from fields where certified virus-tested stock had not been used.

The strawberry plants were tested for virus content by grafting to the East Malling strain of Fragaria vesca, to seedlings of Alpine F. vesca and to Miller's F. vesca.

The results of the survey are described in this paper.

Materials

Strawberry plants were collected at random in fields (Fig. 1), placed in plastic bags, and mailed to the laboratory. They were then planted in pots and allowed to become well established. Four leaves from each plant were grafted to the East Malling strain of Fragaria vesca. Leaves were also grafted to seedlings of Alpine F. vesca and to Miller's latent free F. vesca.

The commercial variety Empire was used for determining the presence of veinbanding virus. In all cases symptoms showed on the indicator plants during the fifth week after grafting and these were read after seven weeks.

The descriptions of symptoms of virus diseases by Mellor and Fitzpatrick (4) were used in identifying most of the viruses found during the survey.

Survey Results

Plants from Ontario included the varieties Premier, Valentine, Sparkle, Louise, Mackenzie, and Senator Dunlap. The varieties Senator Dunlap and Sparkle were collected in Quebec, New Brunswick, Nova Scotia, and Prince Edward Island.

All Senator Dunlap plants collected in Quebec, New Brunswick, Nova Scotia, and Prince Edward Island produced typical mottle symptoms on the indicator plants. Twelve of 22 plants of this variety from Ontario were infected with mottle virus. These 12 plants were from 4 locations scattered throughout the province. Of the 10 plants collected in Ontario that did not have mottle, 9 were infected with veinbanding and 3 with a veinbanding-latent C complex.

One hundred and twenty Sparkle plants taken from 36 locations in the five provinces contained latent A virus. Thirty-two, representing 3 locations in Prince Edward Island, 2 locations in Nova Scotia, 1 location in New Brunswick, 1 location in Quebec, and 7 locations in Ontario were infected with mottle virus. Of the 88 plants remaining, 70 from 18 locations in Ontario and 8 from 2 locations in Nova Scotia caused symptoms of the veinbanding-latent C complex. Ten plants, representing 5 locations in Ontario, were infected with veinbanding.

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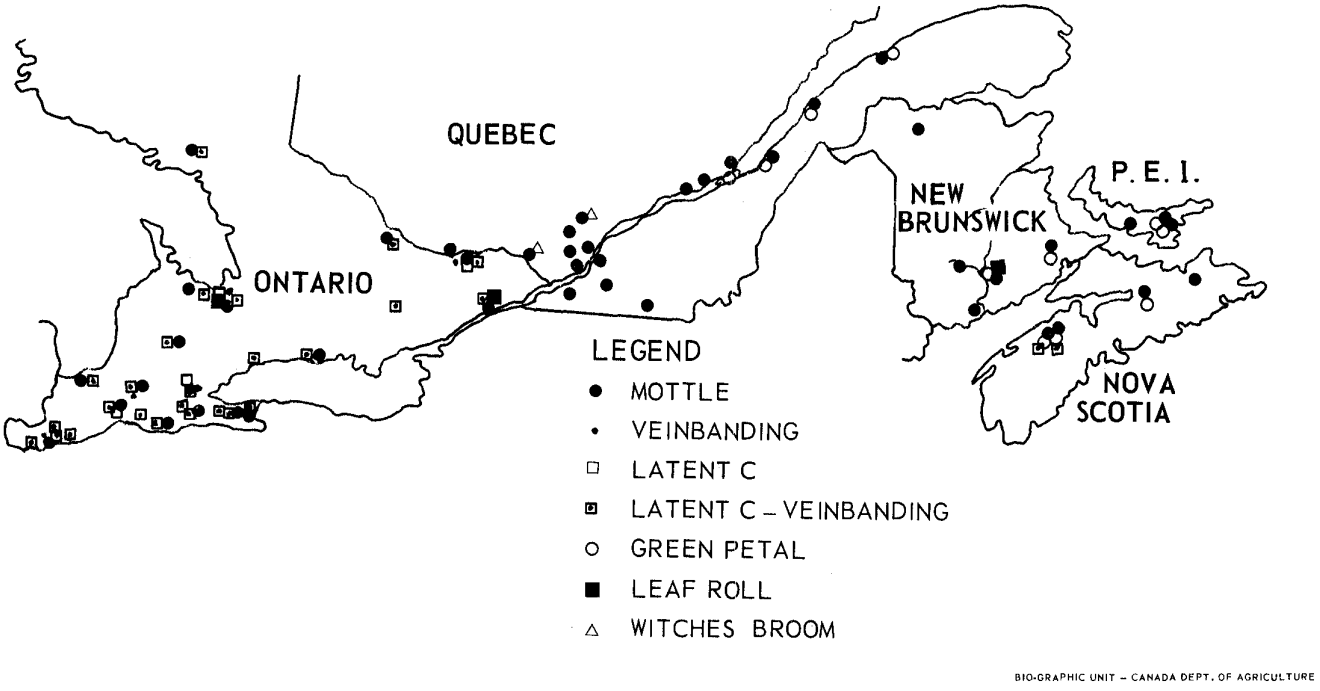

Figure 1. Map showing location of strawberry plant collections and the virus diseases occurring on them.

All plants of the Premier variety collected in Ontario caused symptoms of virus disease. Seventy-two per cent of the plants were infected with the veinbanding-latent C complex. Twelve per cent contained mottle as well as the veinbanding-latent C complex, 10 per cent contained veinbanding alone, and 6 per cent latent C alone.

Valentine collected from 5 locations in Ontario was infected with mottle, veinbanding, and latent C combined while Mackenzie plants from 3 locations in Ontario were infected by the veinbanding-latent C complex.

Symptom Expression

Although most of the viruses present in the affected plants were identified as mottle, veinbanding, latent C, or a combination of these, there were cases when the indicators exhibited atypical symptoms.

Mottle

East Malling F. vesca was used for comparing mottle symptoms in all varieties. All plants containing mottle virus caused similar symptoms on the indicator with the exception of Sparkle taken from one locality in New Brunswick. These plants caused a very severe distortion of the leaves as well as the typical mottling symptoms resulting in a condition similar to curly-dwarf mottle

described by Frazier and Posnette (3). Proliferation of the crown was accompanied by both upward and downward curling and twisting of the leaves (Fig. 2). In addition, several necrotic spots were observed at an early stage of infection. These symptoms appeared 21 days after grafting. Since the plants failed to produce symptoms on the indicators after a heat treatment of 100°F for 24 days, it was concluded that they had been infected by a severe strain of the mottle-latent A complex.

Veinbanding and latent C

Infection by the veinbanding virus was widespread in Ontario in all strawberry varieties, and usually occurred in combination with latent C virus. Veinbanding was found on Sparkle plants in Nova Scotia, but was not encountered in Prince Edward Island, New Brunswick or Quebec. Symptoms of veinbanding virus alone occurred on East Malling F. vesca as more or less continuous yellow streaks along the veins, especially along the midrib, accompanied by moderate downcurling of the leaflets (Fig. 3). Where veinbanding occurred alone in the plants, there was no observable variation in symptoms expressed by different varieties from different localities.

Veinbanding in association with latent C was found in the majority of plants from Ontario. Symptoms produced on East Malling F. vesca by these plants were similar to those produced by veinbanding alone. In the commercial varieties Empire and Redcoat containing latent A, however, the symptoms were considerably more severe than those caused by veinbanding. The veinbanding - latent C complex from Premier, in which it produced no symptoms, produced a much more severe condition in these two commercial varieties. Leaf distortion and epinasty were greatly increased, and petioles and runners became necrotic within a short time (Fig. 4 and Fig. 5). Most of the infected Empire plants died within two months of the appearance of symptoms. The effect on the runner plants was also much more pronounced (Fig. 6).

Latent C alone was encountered in a few of the Premier plants examined. Early symptoms produced by this virus alone on East Malling F. vesca consisted of severe epinasty of the newly formed leaves and petioles (Fig. 7). Symptoms became much more severe as the disease reached chronic proportions causing dwarfing of the leaves and proliferation of the crown. In plants that did not contain latent A, no definite symptoms appeared.

Green Petal

Green petal was observed in all fruiting commercial plantations visited in Prince Edward Island and Nova Scotia. A small amount of infection by this virus was observed in New Brunswick and eastern Quebec. The disease was not observed in western Quebec nor in Ontario. The virus was readily transmitted by grafting to both indicator plants and commercial varieties. In the absence of floral structures, the disease was indistinguishable from witches' broom.

Witches' Broom

Plants showing witches' broom symptoms were found in all five provinces. The disease was severe in two plantations of Senator Dunlap in Quebec and in one plantation of Premier in eastern Ontario. The disease was transmitted by grafting to indicator plants and commercial varieties. Symptoms consisted, in all cases, of dwarfing of the leaves and proliferation of the crown.

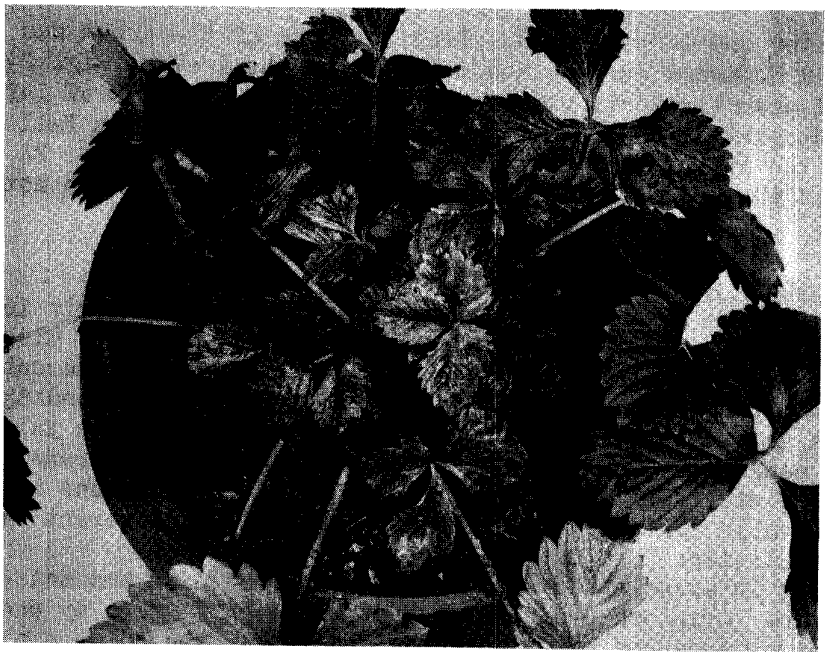

Figure 2. Mottle symptoms obtained after grafting Sparkle from N.B. to East Malling *F. vesca*.

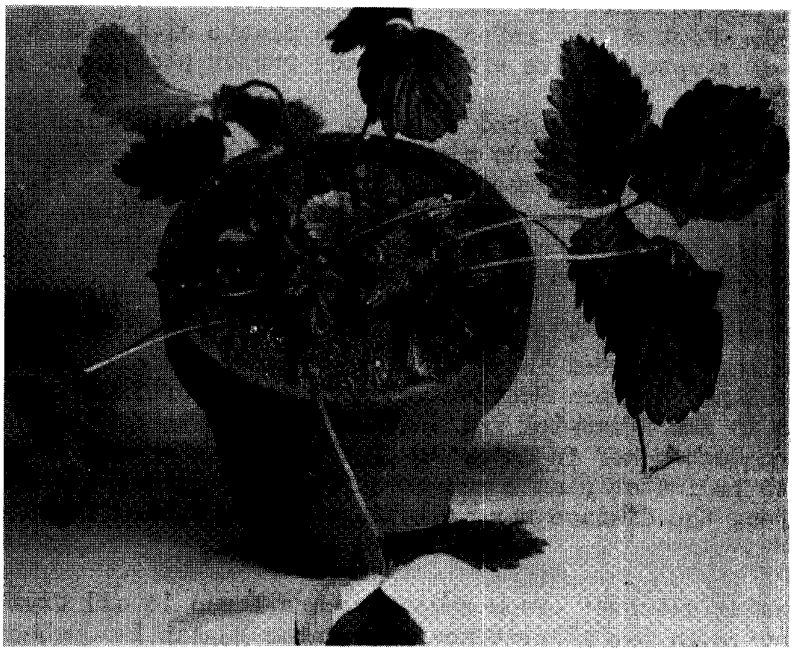

Figure 3. Veinbanding virus symptoms on East Malling *F. vesca*.

Figure 4. Veinbanding – latent C virus symptoms on the variety Redcoat.

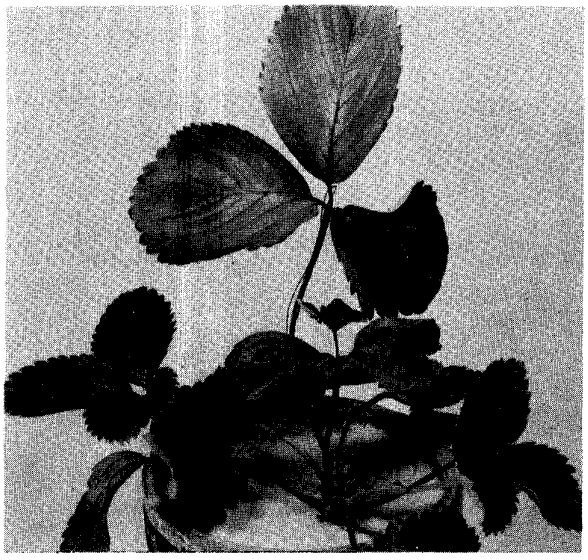

Figure 5. Veinbanding – latent C symptoms on the variety Empire.

Figure 6. Veinbanding – latent C symptoms on runner plants of Redcoat.

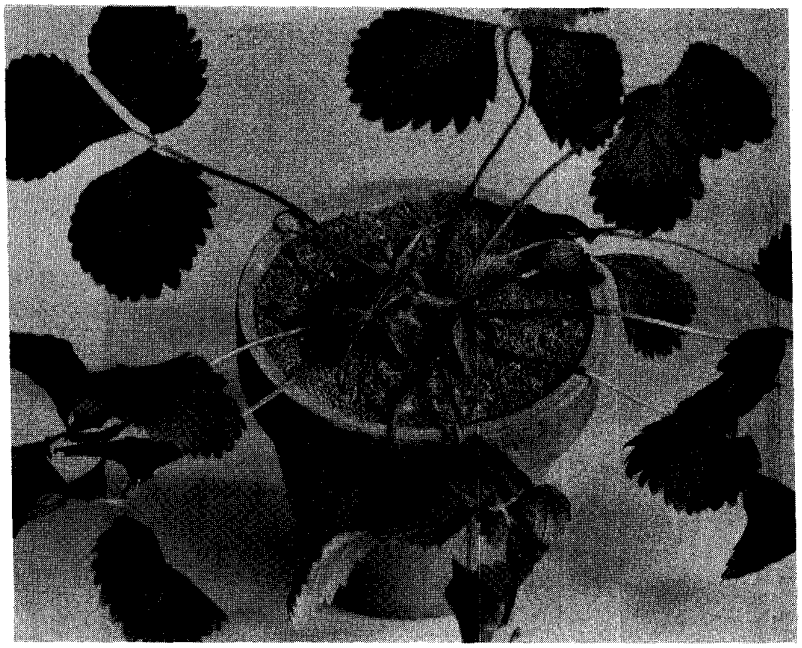

Figure 7. Latent C symptoms on East Malling *F. Vesca.*

Figure 8. Symptoms of strawberry leaf roll on the variety Sparkle.

Leaf Roll

Typical leaf roll symptoms were found in two plantations in Ontario and at one location in New Brunswick. The disease was severe in the Ontario plantations, and no fruit developed. The plants were dwarfed and the leaves severely rolled downward. Chlorotic streaks and powder-fine specks were present on the leaves (Fig. 8). The virus was transmitted to several commercial varieties by grafting, and typical symptoms appeared on all plants in 15-20 days.

Discussion

The important virus diseases occurring on strawberries in eastern Canada are veinbanding, mottle, latent C, and green petal.

Veinbanding, although symptomless on Premier and Senator Dunlap, produced severe symptoms in the presence of latent A on most other commercial varieties, especially Redcoat and Empire. In the presence of both latent A and latent C infection with veinbanding can be lethal. Because of this, it is preferable to use latent A-free plants for setting out new plantations. In several cases within the last five years, symptoms of the latent A-veinbanding complex have been observed on Sparkle, Redcoat, Empire, and Guardsman in Ontario. Yields of such infected plants have been reduced by as much as 50%. Veinbanding on Redcoat and Guardsman, in the absence of latent A, had very little effect on vigor and yield in greenhouse experiments.

Latent C virus occurring in the absence of veinbanding, but in the presence of latent A, did not appear to reduce vigor in commercial varieties. This virus does, however, increase the symptom expression of the veinbanding-latent A complex. The combination of veinbanding and latent C in the absence of latent A, as it occurs in most Premier plants in Ontario, has a marked effect on the general vigor. This reduction in vigor is most pronounced under conditions adverse for plant growth. The Premier plants which proved to contain latent C alone were collected from plantations showing exceptional vigor, and it was apparent that the virus had little effect on this variety. Redcoat and Guardsman, artificially infected with latent C in the absence of other viruses, showed no loss of vigor. When latent C was transmitted from these plants to latent A-free F. vesca no symptoms were produced. However, when leaves from East Malling F. vesca were grafted onto these latent C-infected F. vesca plants, symptoms appeared which were typical of those described by Mellor and Fitzpatrick (4) for the latent C-latent A complex, and by Demaree and Marcus (2) for type 2 virus.

From the results of this survey and preliminary greenhouse investigations, it appears that the veinbanding-latent A or veinbanding-latent C-latent A complexes are of major concern in Ontario.

Green petal virus is of great importance to strawberry growers in Nova Scotia, Prince Edward Island, New Brunswick, and eastern Quebec. The disease was not observed on strawberries west of Quebec City. This distribution agrees with that given by Chiykowski (1) for the strawberry green petal virus causing phyllody of clover.

Crinkle virus, described by Zeller and Vaughan (6) in Oregon and by Prentice (5) in Great Britain, was not encountered in the survey. There was no evidence that any of the components of yellows virus disease, as described by Mellor and Fitzpatrick (4) in British Columbia, are present on strawberries in eastern Canada.

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