IV. VIRUSES ISOLATED FROM POTATO VARIETIES IN CULTIVATION IN CANADA - 1940[1]

by

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Katahdin and Chippewa material from Prince Edward Island, Nova Scotia, and New Brunswick were found carrying, without symptoms, a weak strain of Solanum Virus 1, corresponding to that described by Dr. R. N. Salaman, F.R.S., as Strain G[2]. Plants so affected were tested by graft and sap inoculation against the necrotic S and N strains of Solanum Virus 1 and were found to be immune to these necrotic strains. The stocks carrying the G strain of Solanum Virus 1 do not seem to be affected by the presence of the virus. The G strain of Solanum Virus 1 is common in commercial stocks of Green Mountain, Bliss Triumph, Irish Cobbler, and Spaulding Rose, in which it is also carried without symptoms.

A mild type of mosaic caused by a strain of Solanum Virus 1 was found in Katahdin material from Prince Edward Island, Nova Scotia, New Brunswick, and Saskatchewan. The mottle produced is of a fine diffuse interveinal type, accompanied by a slight unevenness of the leaf blade. This mottle became less evident as the plant matured. The virus was identified as the mottling strain L of Solanum Virus 1. The effect on the yield is slight.

A severe mosaic caused by a strong strain of Solanum Virus 1 was found in Katahdin material from Prince Edward Island, New Brunswick, and Saskatchewan. The mottle produced is of a diffuse interveinal type accompanied by a marked unevenness of the leaf blade and a waviness of the margin. In addition, there are on the younger leaves, a few scattered necrotic spots, which usually do not enlarge or coalesce and seem to cause no serious change. The mottle persisted while the foliage remained green. This virus was also found combined with Solanum Virus 2 in Green Mountain and Irish Cobbler material from Prince Edward Island and New Brunswick. The combination of viruses caused a severe rugose mosaic and a foliar streak. This virus also caused a severe mosaic and a foliar streak in a number of potato seedlings grown in the open air at Fredericton. When tested on standard differentials, the virus was found to correspond to that described by Dr. Salaman, as Strain S,

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1/ A similar section was prepared in 1939 by Mr. MacLeod (P.D.S. 19:69-74).

2/ Philosophical Trans. Royal Society of London, Ser. B. No. 559, p. 143. 1938.

Solanum Virus 1[3]. The reduction in yield is estimated to be from 15 to 20%.

A necrotic disease of virus origin was found in Chippewa material from Saskatchewan and New Brunswick. When the sap from infected plants was inoculated by the rubbing method into Chippewa and Arran Victory, local lesions ranging from 1 to 3 mm. in diameter developed on the inoculated leaves in 15 days. In 24 days, a blotchy interveinal mosaic appeared on the younger leaves which was soon followed by the development of fine necrotic lesions between and following the course of the smaller veins. These lesions enlarged, coalesced and in some instances involved the greater part of the leaf blade, causing a destructive foliar streak which resulted in the death of the leaves so affected. The destruction of the leaves progressed acropetally. In some cases only the apical leaves remained unaffected. The destroyed leaves remained hanging from 7 to 10 days. In a few plants, new leaves were formed which developed similar symptoms later in the season. The yield was materially reduced, only two or three small tubers being produced. The plants produced from these tubers in the second year developed a destructive foliar necrosis and were severely dwarfed. Most of these plants died after reaching a height of from 3 to 8 inches. The virus gave the typical reaction of the necrotic N Strain of Solanum Virus 1[4] on Datura Stramonium, Nicotiana Tabacum, Lycopersicon esculentum, Capsicum annuum, but differed from the type strain by producing a severe etching on the leaves of Solanum nodiflorum.

The conclusion arrived at in connection with the mosaics and streaks found in the Chippewa and Katahdin varieties is that these varieties are not resistant to Solanum Virus 1 and are gradually acquiring different strains of this virus under field conditions. The stocks which first acquired the weak symptomless strains do not seem to be affected by these viruses and are protected by them against the necrotic S and N strains. It would appear that the stocks which are not so protected will gradually be eliminated when attacked by the necrotic strains.

A severe rugose mosaic and leaf drop streak was found in the Earlaine variety. The disease was found to be due to a combination of strain S, Solanum Virus 1 and a strong strain of Solanum Virus 2. This variety is apparently not resistant to these viruses under field conditions. Two per cent of the plants in the field were so affected.

3/ Philosophical Transactions Royal Society of London, Series B, No. 559, p. 149. 1938.

4/ Philosophical Transactions Royal Society of London, Series B, No. 559, p. 153. 1938.

Worthy of mention in this connection is the fact that the aphid, Myzus persicae, was found causing injury in potato seedlings and some commercial varieties which resembled the necrosis present in the collenchyma of the stem and larger veins as well as the rugosity of the leaves produced by strong strains of Solanum Virus 2. In severely injured plants, there was also a leaf drop streak produced, resembling another characteristic symptom of Solanum Virus 2. In a few instances a top necrosis was produced in potato seedlings characteristic of that caused in some varieties by Solanum Virus 1 and Solanum Virus 3. These findings were also established by critical tests conducted under cage and greenhouse conditions.

A disease of virus origin was found in a number of potato seedlings grown under open air conditions. It is characterized by the development of numerous fine necrotic lesions occurring between and following the course of the smaller veins, culminating in a destructive foliar streak. Thereupon the margins of the top leaves become necrotic and rolled upwards, and the lower and middle leaves rolled downwards and showed a slight unevenness of the leaf blade. In extreme cases the necroses extended to the larger veins, midrib and the petiole. In the severest cases the necrotic tissue dropped out producing a shredded shot-hole effect. The necrotic areas were more evident on the upper surfaces of the leaves. Severely affected leaves collapsed and dropped off the plant. The virus was transmitted by grafting to a virus-free seedling and the Arran Victory variety in which typical symptoms were reproduced. Attempts to transmit the virus by the aphid, Myzus persicae, and sap inoculation to Nicotiana Tabacum, Nicotiana rustica, Nicotiana glutinosa, Datura Stramonium, Lycopersicon esculentum, Capsicum annuum, Solanum nodiflorum, Lycium chinense and the President and Arran Victory varieties were unsuccessful. The disease caused some damage to plants in the field. The virus appears to spread under field conditions.

An unusual disease of virus origin was found in potato seedlings grown in one of the testing greenhouses. The leaves of affected plants developed a superficial rusty necrosis which extended over most of the leaf blade, causing it to curl upwards and later to collapse. The dead leaves usually remained hanging on the plant. The destruction of the leaves progressed acropetally and in most cases only the apical leaves remained unaffected at the end of the season. The affected leaves have the appearance of being scorched by fire. There was no mottle. The virus was transmitted by grafting to a virus-free seedling and to the Arran Victory variety in which typical symptoms were reproduced. Attempts to transmit the virus by sap inoculation to Nicotiana Tabacum, Nicotiana rustica, Nicotiana glutinosa, Datura Stramonium, Lycopersicon esculentum, Capsicum annuum, Solanum nodiflorum, Lycium chinense and the President and Arran Victory varieties were unsuccessful. The disease caused considerable damage to a number of plants in the greenhouse in which it was discovered.

A severe phloem necrosis was found in the Green Mountain, Katahdin, Chippewa and Up-to-Date varieties. From 40 to 50% of the tubers in some of the laboratory plots planted with certified seed were severely affected early in October. The necrosis in most cases was confined to the stem end and the adjacent third of the tuber. In a few tubers, the entire phloem network was involved. Plants grown from Green Mountain tubers showing extreme phloem necrosis developed the following symptoms: The lower leaves showed a slight upward rolling while the middle ones developed a more definite rolling, accompanied by a slight rugosity and waviness of the leaf blade and margin. The top leaves were rosetted, severely puckered and upwardly cupped. All the leaves showed a diffuse interveinal mottle which was more intensified towards the top of the plant. A few of the plants, when from 2 to 4 inches in height, showed a definite downward rolling of the top leaves which later changed to the symptoms mentioned above. The leaves of affected plants were light green in colour and lacked the soft texture of normal foliage. Most of the plants had a staring upright appearance caused by the sharp angles between the leaf petioles and the stem.

A disease described as "purple top" in the 1939 report, page 74, was again observed in Chippewa, Katahdin and Green Mountain sources in commercial fields. The rate of infection was estimated at from a trace to 1%. Tubers from affected plants collected in 1939 with the exception of one case, produced normal plants the following year. In the single instance, tubers from a Chippewa plant which had purple top in 1939 produced plants which developed a downward rolling of the leaves and a waviness of the leaf blade and margin, accompanied by the production of purplish pigment chiefly along the margins of the top leaves. The upper leaves were rosetted and upwardly cupped. There were no tuber symptoms at harvesting time. A scion from an infected plant was grafted to Arran Victory. No symptoms appeared in the Arran Victory during the course of the growing season.

Three Green Mountain tubers brought from the Argentine by Mr. G. C. Cunningham were examined for their virus content. These tubers showed diffuse, brownish, necrotic areas ranging from 2 to 4 mm. scattered throughout the flesh. In one tuber there were disconnected necrotic streaks in the vascular system. Plants which grew from these tubers developed symptoms corresponding to that described in the 1939 report, pages 72-73. A virus was isolated from these potatoes which proved to be a varient of Lycopersicum Virus 3 (spotted wilt). The virus differed from the type virus by giving a much weaker reaction on tomato. The bronze ring-like secondary lesions were faint and almost entirely lacking. There appeared to be no symptoms on the fruit.