STUDIES ON POTATO VIRUS X

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C O N T E N T S

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INTRODUCTION

The potato (Solanum tuberosum L.) is an important economic crop in Egypt both for local consumption and for export.

Virus diseases are the major limiting factor of potato production and cause its degeneration.
The depression influence of PVX on potato yield has been proved by several workers in several countries. According to Bawden, et al.(1948) virus X now probably causes more loss of the crop than the virus Y and virus A combined. Bald and Narris (1940) also claimed that the losses from PVX in Austrolia are as serious as the losses from all other viruses combined. In U.A.R. Omar, et al. (1967), found that the yield of the PVX infected plants was 11-30% less than the apparently healthy ones.

The PVX not only decrease the yield of potato crop, but also increase the infleunce caused by other viruses on the plants. Roberts, et al. (1952), estimated the yield reduction caused by the potato virus Y alone by 25%, but the reduction rised to 50 % in case of mixed infection with PVX and PVY. It was also found that even the very mild strains of PVX, causing no leaf symptoms, can reduce the yield (Smith 1943).

The present work was carried out to :

(1) Identify the potato virus X strains that occur in potato fields in U.A.R., According to their modes of transmission, host range, and physical properties. (2) Also experiments of cross protection and cross absorption were carried out to clear their relationship. (3) Effect of PVX strains on the growth and chemical constituents of different potato varieties was recorded.

REVIEW OF LITERATURE

Host range :

Potato virus X was reported to have a wide host range of plants belong to different plant families. The symptoms varied due to the variety, the strain and the enveromintal conditions.

Different investigators (Murphy (1936 , Köhler (1939), Vasudeva, et al. (1945), limassat (1945),Marchionatte (1941), Lorson (1943) and Mai 1947), reported the following potato varieties (Alpha, Up-to-date, Majestic, the Royal Kidney, the green Mountain, Katahdin, Sebago, Chippewa, Duke of york and Arran polat) to be susceptible to PVX infection. Peterson, Hooker (1959), reported that, Towa and Saco potato varieties possess the immune type of resistance to virus X similar to that of S. 41956.

Timian ,et al. (1955), reported that: Aaringspot (XRS) isolate, incited both local and systemic symptoms on a higher percentage of potato plants than did the other isolates. A severe isolate of PVX expressed necrotic symptoms in all susceptible plants tested.

Isolate (X_8), was very mild and incited symptoms on only seedling stages plants. Isolate, (X_5), was very effective in inciting both local and systemic infection. It was the only one that incited visible symptoms in all inoculated plants of a susceptible progeny. The other isolates tested were intermediate between these 2 extremes.

Nicotiana tabacum L. var. white Burley was reported by (Salaman 1933, Karl Lee, Koch (1933), as susceptible host to virus X on which strains of PVX, i.e. (X^a, X^x, and X^y) gave systemic infection. Böhme (1933), Bawden, et al.(1936), Salaman (1938) and Sadasiwan (1940), found that: Tobacco plants inoculated with potato virus X^G, gave systemic mottling. Inoculation with potato virus X^s, cause necrotic local lesions. The medium or X^L strain did not produce local lesions on potato or tobacco, but a yellow mottle, which later develops into a dark tortaise-shell pattern produced on tobacco and a mild mottle on potato.

Salaman(1938)found that,
/ the X^D strain (Bawden foliar necrosis) produced a mild mottle in tobacco. The strain X^N produced a very severe necrotic mottle on tobacco and interveinal necrosis on potato, Similar to that produced by X^s., Salaman (1938) and Whitehead, et al. (1953), reported that, a strain of ringspot of PVX and X^G, incited a severe ringspot when inoculated to tobacco. Suhov [illegible] (1956), found that,

symptoms produced by X_3 different distinctly from those of X_2 in N. tabacum var. (White Burley) plants, none of which showed primary symptoms when infected with X_2, whereas X_3 produced concentric rings on tobacco . Secondary symptoms produced by X_3 were ring mosaic tobacco, whereas X_2 induced individual, mare, chlorotic spots in tobacco. Thomson (1960), found that, strain 3XE-1, produced ringspot lesions on tobacco leaves. Allam, et al. (1967), reported that, a ring spot strain produced clear necrotic rings on leaves of infected tobacco plants.

It was stated by Kohler (1935 & 1937), that Ers 25 differs from all other known X strains in the initial symptoms production on Samsum tobacco leaves of expanding, chlorotic, circular lesions instead of rings. Eight isolates of potato virus X isolated by Roland (1954), from different potato varieties induced very similar reactions in Samsun tobacco. Bercks (1956) stated that, isolates of PVX could be differentiated by symptoms produced on samsun tobacco.

Macclement (1934), Sadaivan (1940) and Bawden et al (1948), reported. Nicotiana glutinosa to be susceptible to PVX. Symptoms incited on this host consist of local necrotic lesions on inoculated leaves and systemic mottling on new leaves. Ladeburg, et al. (1950), stated that N.glutinosa

was most a good host for the differentiation of the 3 types of ringspots strains of the potato virus X, though it was very usefull as a stock-culture plant.

Ladeburg, et al.(1950), reported that, N. rustica varieties, texana, machae, humilis and brasilia plants when inoculated with ringspot strains of PVX, produced different symptoms (chlorotic, clear rings systemic, small irregular and chlorotic areas.) Borges (1962) used this host for the differentiation of three isolates (11 P, 25 P and 324 P) of PVX.

Nicotiana chinensis plants produced glossly local lesions tends to become necrotic when inoculated with ringspot strains of PVX, Ladeburg, et al. (1950).

Asuyama& Kamuro (1951), reported that, N.longiflora was found to be infected by both PVX and PVY.

Köhler (1947) , Bagnall (1961), Moore& Guthrie (1964 & 1965) , stated that N. debineyi and Xanthia tobacco were a susceptible hosts to PVX infection.

Köhler (1951), reported that, Solanum dimissum did not react to the ringspot virus. In 1958 Köhler found, S. dimissum to be a suitable test plant for the quantitative demonstration of PVX, by this test the infectivity curve of PVX,was established with and without the use of carborundum powder.

Döhme(1933)and Bald, et al. (1940), reported that, pepper (Capsicum annum L.) plants were very useful in indexing infected potato tubers. Salaman (1938), stated that the strain designated X^H produced a distinct reaction only on C. annum, while it was masked on all other test plants. David Stoimer(1941), found that, chilli (Capsicum annum) plant presented practical advantages as it seems as an excellent indicator plant for the presence for the PVX. Hoyman (1951); reported that, Capsicum annum is not considered a reliable indicator plant for virus X. Maris, Roland (1956), reported that, the local lesions produced by four strains of PVX, on the Capsicum annum, were predominantly well defined, circular and necrotic.

Döhme (1933), found that, the species Petunia vialacea and P. nyetaginiflor showed individual variations in reactions to the different PVX strains. Ladeburg ,et al. (1950), reported that, Petunia vialacea plants produced small chlorotic lesions when inoculated with ringspot strains of PVX.

Tomato (Lycopersicon esculantum mill var. Pearl Harbar) was reported by Ainsworth,(1934) as a host for PVX. Three strains, designated X^a, X^x and X^y of the virus gave systemic infection when inoculated into tomato, Bawden,et al. (1944). Roberts (1946) and Mai (1947), reported that,

tomato was much more susceptible than potato to infection by virus X. Suhov, et al. (1956), reported that, symptoms produced by X_3 differed distinctly from those of X_2 in tomato plants none of which showed primary symptoms when infected with X_2.

Selman (1946), found that, tree tomatoes (Cyphomandra sp.) inoculated with potato virus X developed a regular mottling.

Although Frank (1948), stated that Physalis floridana is not a satisfactory indicator plant, others (Tein, et al. 1966), Ross (1948), Ladeburg, et al.(1950) and Roberts, et al. (1950) and Roberts, et al. (1952) reported that Physalis ixocarpa, Ph. heterophylla and Ph. acquata produced few small ring lesions, chlorotic mottle, moderate vein clearing and interveinal necrosis when inoculated by the ringspot strains of PVX.

Böhme (1933), reported that Nicandra physaloides was resistant to some but susceptible to other strains of PVX, Nevertheless, Ladeburg , et al. (1950), reported, N. physaloides plants as an indiactor plant for ringspot strains of PVX which produced numerous small ring lesions with chlorotic hole with edge margine becoming slightly necrotic and chlorotic mottle.

Ainsworth (1934), reported, Datura stramonium as susceptible host to virus X. Roland (1950), reported that,

Eight isolates of potato virus X from different potato varieties induced their effects on Datura stramonium were quite divergent, including the development of large, yellowish spots between the veins and of dark green bands along them, generally paller of the leaves with or without a few small, green areas, and green interveinal spots, swellings and scattered Brown dots on the leaves. Suhov, et al.(1956) found that, symptoms produced by X_3 differed distinctly from those of X_2 in datura plants, none of which showed primary symptoms when infected with X_2, whereas X_3 produced irregular necrosis on datura. Secondary symptoms produced by X_3 was veinal necrosis in datura, whereas X_2 induced individual mild mosaic in datura. Datura meteloides and Datura metel were found by Neuton, Edwards (1936) and Bode, et al. (1965) to be susceptible hosts to PVX. Matthews (1949) and Hooker, Benson (1960), found that, D.tatula produced widely differing symptoms ranging from no symptoms to severe necrosis when infected with PVX.

Wilkinson, Roberts (1948) and Sharma (1964), reported that. Gomphrena globosa has opposite leaves, which are similar in appearance and sensitivity, it is well adapted for quantitative work. Gomphrena globosa L. was used by Wilkinson, et al. (1949), as a local lesion test plant. Hutton, Peak. (1951), Roland (1954), Timian, et al.(1955) and Loebensthin (1962), stated that all isolates of virus X