

VEGETABLE CROPS

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DISEASES OF POTATO Virus Diseases

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Virus and Viroid Diseases of Potato

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Potatoes are a vegetatively propagated crop, and many disease organisms including several viruses and a viroid are disseminated in tubers. The important role that tubers play in virus spread is recognized by the strict requirements for foundation or certified seed production. For example, all four classes of New York foundation seed shall not show a total in excess of 1/2 percent of mosaic, leafroll, or spindle tuber viroid based upon a winter test performed in Florida. Seven viruses and spindle tuber viroid are recognized as important in the state from either a production or a seed certification standpoint. The viruses include potato leafroll virus, potato viruses Y, X, A, S, M, and alfalfa mosaic virus, with the first three being the most important.

Major Potato Viruses

Potato leafroll virus (PLRV) causes an important disease of potatoes affecting the quantity and quality of produc-

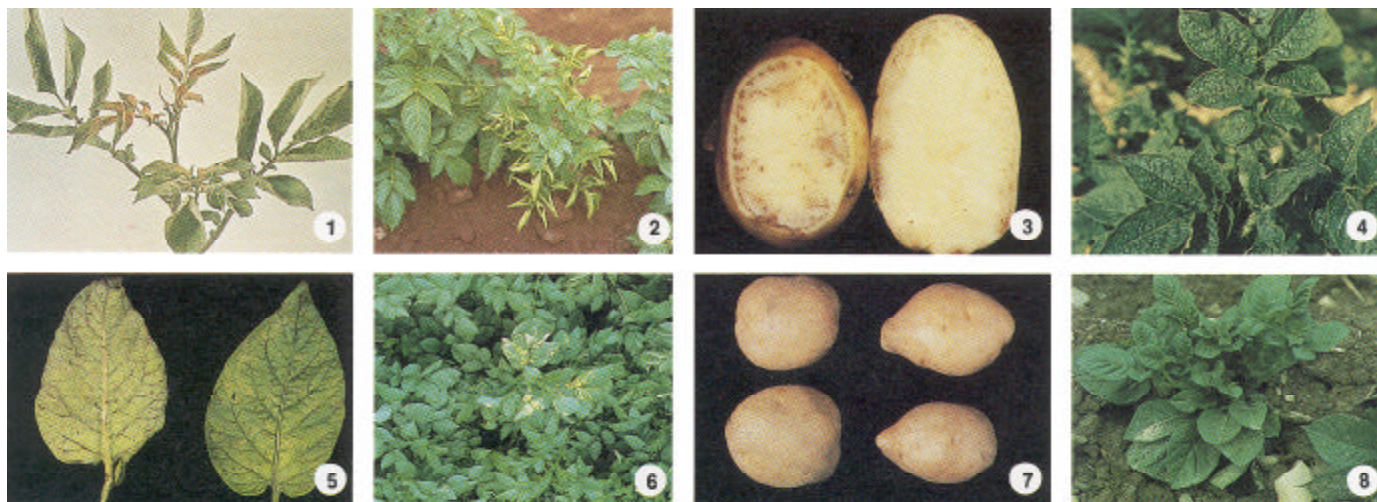
tion and may cause a crop to be ineligible for certification. Foliar symptoms of PLRV can be divided into primary and secondary infections. Primary infection results when an initially healthy plant is inoculated via aphids during the current season. Symptoms first appear where inoculation occurs. The upper leaves become pale, upright, and rolled and show some reddening of the tissue around the leaf edges (fig. 1). The lower leaves may or may not have symptoms. Secondary infection occurs when an infected tuber is planted, giving rise to an infected plant. The lower leaves are severely rolled and leathery to the touch (fig. 2). The plant frequently has an overall stunted, upright, chlorotic appearance. The oldest leaves may show reddening on the margins or chlorosis. The upper leaves may not have obvious symptoms. Some varieties such as Russet Burbank are very susceptible to PLRV and to tuber symptoms of internal net necrosis (fig. 3). Many varieties grown in the Northeast are not subject to net necrosis. PLRV can be difficult to detect because foliar symptoms are not always obvious. Thus infected tubers or tubers with net necrosis may result from plants without visual symptoms.

PLRV is transmitted in a persistent manner by several aphid species, the most important being the green peach aphid (*Myzus persicae*). In addition to

infecting potato, the virus infects other solanaceous crops and weeds (tomato, tobacco, jimsonweed, etc.). Control consists of suppressing aphid populations with systemic and (or) foliar insecticides and planting certified seed.

Potato virus Y (PVY) is one of the most important viruses infecting potatoes. It is readily spread by aphids in a nonpersistent manner as well as mechanically by human activity and may result in severely depressed yields. PVY is tuberborne and can interact with other viruses such as PVX and PVA to result in heavier losses. Symptoms caused by PVY infection can vary depending upon the strain and potato variety grown. A rugose mosaic symptom (fig. 4) is characteristic for some strains, but is most commonly ascribed to a mixture of PVY and PVX. Other strains produce a general mosaic or a hypersensitive (severe necrotic) reaction (fig. 5). Necrosis may progress to total leaf collapse, with the dead leaflet clinging to the stem. Some varieties with a strong hypersensitivity reaction display field resistance, and the progeny from such plants may be healthy. Besides infecting potato, PVY affects other solanaceous crops (tomato, pepper) and weeds (nightshade, groundcherry).

Control depends on the use of disease-free seed, insecticides to reduce aphid populations, and mineral oil



sprays to interfere with the aphid transmission process.

Potato virus X (PVX) is one of the most widely distributed viruses of potatoes. Because no symptoms develop in some varieties (latent mosaic), the full extent of damage with PVX is not recognized. Mixed infections of PVX with other viruses like PVY and PVA cause more damage than PVX alone. PVX is tuberborne and is readily mechanically transmitted by human activities. Tobacco, pepper, and tomato are additional hosts for this virus.

Minor Potato Viruses and Spindle Tuber Viroid

Potato virus A (PVA), which causes mild mosaic, has a number of characteristics in common with PVY and belongs to the same virus group. Symptom severity will depend upon the strain, potato variety, and environmental factors. Many varieties (Katahdin, Kennebec, Sebago) reportedly react to infection with hypersensitivity (field resistance) as mentioned under PVY. Control of this aphid-transmitted virus disease is

through the use of disease-free seed, insecticides, and resistant varieties.

Potato viruses S and M (PVS and PVM) occur in New York, but their importance in yield loss is uncertain. Both are aphid transmitted in a nonpersistent manner and are tuberborne. PVS is symptomless in most potato varieties, and many varieties express mature plant resistance. PVM may induce symptoms referred to as paracrinkle. These viruses may be most important when found as mixed infections with other viruses.

Alfalfa mosaic virus (AMV) occurs worldwide in potato, but is considered to be of little economic importance. Because AMV infections produce characteristic calico symptoms on the foliage, it is commonly referred to as "calico mosaic" (fig. 6). Aphids bring virus from reservoir hosts such as alfalfa and clover.

Potato spindle tuber viroid (PSTV) can cause a destructive disease of potato and receives particular attention for certified seed production. It is often transmitted through breeders' progenies mechanically, as well as through pollen and true seed. PSTV consists of a small

RNA molecule lacking the protein coat of viruses.

Evidence suggests that chewing insects may be responsible for spread in nature, but humans and their activities serve as the principal disseminator. As the name implies, infected tubers may be spindle or oblong shaped or tend to be more rounded instead of the normal shape for a given variety (fig. 7). Prominent eyebrows are another important characteristic. Foliar symptoms on infected plants are not easily contrasted, making this one of the more difficult diseases to diagnose. The leaflets may be smaller and curve inwardly, giving a stiff upward growth habit (fig. 8). Sensitive tests (i.e., molecular hybridization) are now available to screen true seed and progenies to eliminate the viroid. Use of these tests and the selection of certified seed are important steps in eliminating this disease from potato stocks.

Acknowledgment

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