Short Communication

POTATO CARLAVIRUS S (PVS) RESISTANCE OF POTATO CLONE B6603-12

Robert W. Goth* and E. W. Goins*

Abstract

The potato (Solanum tuberosum L. tuberosum) breeding line B6603-12 was shown to be resistant to Potato Carlavirus S (PVS) on the basis of non detection of PVS by ELISA in plants that were: 1) either graft or mechanically inoculated with composite isolates of PVS; and 2) interplanted among PVS infected cultivars in fields for twelve growing seasons.

Introduction

Potato virus S (PVS) is a flexuous rod in the Carlavirus group (Wetter, 1971). It was described in potato in 1951 (De Bruyn 1952) and since then has been found wherever potatoes (Solanum tuberosum L.) are grown (De Bokx, 1972). Several factors are responsible for the widespread distribution and high percentage of potato plants infected with this virus: 1) it is readily transmitted mechanically (De Bokx, 1972); 2) infected plants produce many small tubers and their use as seed pieces selectively enhanced its propagation and distribution (Hunnius, 1969; Rozendaal and Brust, 1955); 3) roguing as an eradication measure in seed fields is ineffective because PVS is symptomless in many cultivars (De Bokx, 1972); and 4) because serological methods and bioassay plants are the two primary methods for detection of this virus, the number of samples that can be adequately processed is a limiting factor (De Bokx, 1967 and 1972).

Host resistance is a desirable approach for management of virus diseases of potato. PVS resistance in the cv Saco was described by Alfieri and Stouffer, (1957) and Bagnall (1965). Resistance to PVS was also reported in the polish cvs Narew and Uran (Kapsa et al., 1983) and in the german cv Adretta Ross, (1986). In 1984, we used ELISA to screen 138 cultivars and advanced breeding lines in the USDA cultivar collection for the presence of PVS. Only the resistant cv Saco and breeding clone B6603-12, (Goth and Webb, 1985) derived from a cross of B04063 x B5141-6 were identified as not being infected with PVS.

This paper reports on further testing of clone B6603-12 for PVS resistance.

*Research Plant Pathologist and Biological Science Technician, USDA/ARS, Vegetable Laboratory, Beltsville, MD 20705, Telephone 301 504 5953 FAX 301 504 555, E-mail: rgoth@asrr.arsusda.gov. Accepted for publication May 24, 1997.

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ELISA Testing

PATHOSCREEN (Agdia Inc., Mishawaka, IN), an enzyme-linked-immunosorbent-assay (ELISA) system (Voller et al., 1976), that uses a peroxidase conjugate was selected for this study. A Titertek Multiskan ELISA plate reader (Flow Laboratories, McLean, VA) measured absorbance at 492 nm. Macerates of potato leaf tissue individually infected with Potato virus S (PVS), Potato virus M (PVM) and Potato virus X (PVX) were the virus references in each microplate. Macerates of composite leaf samples from virus tested stem cuttings (Stace-Smith and Mellor, 1963) were used for the “healthy” tissue background readings. A control without enzyme conjugate was used as an assay for possible interference from naturally occurring plant peroxidases. Reactions were rated positive when the mean absorbance of a sample exceeded the mean absorbance of the healthy controls by four standard deviations.

Mechanical Transmission and Graft Study

The experiments were performed in a greenhouse where ambient air temperatures ranged from 19-24°C and 1) daylight supplemented with sodium vapor lights with intensities of 8,600-10,700 lux to provide a 16 hr light period.

Tubers were from the USDA varietal collection maintained at Aroostook State Farm Presque Isle, ME. Tubers were numbered and tissue samples from the apical end of each tuber were assayed for PVS with ELISA (De Bokx et al., 1980). The tubers were sprouted on a greenhouse bench and sprouts 1.5 to 2.0 cm long were assayed with ELISA. Following sprout evaluations, tubers were cut into seed pieces and used in greenhouse and field studies. Seed pieces used in the greenhouse studies were planted in 20-cm plastic pots containing Jiffy Mix. After plant emergence, each pot was fertilized with 10 ml of a 5% solution of soluble 20N-20P-20K at fourteen-day intervals.

For mechanical studies, leaves of 20-to-30 cm tall plants were dusted with 600-mesh silicon carbide and rubbed with either a composite macerate of PVS-infected leaves or distilled water. Titers of the PVS infected leaf macerates ranged from 0.890 to 1.680 and were composites of equal weights of leaf tissue from: 1) commercially grown, naturally infected, cvs Atlantic and Katahdin collected in Aroostook County, ME; 2) breeding line B0220-14 infected with the DeBruyn PVS strain #3 maintained in S41956 in the USDA Virus Collection at Aroostook State Farm, Presque Isle, ME (Webb, 1958); and 3) cv Russet Burbank from tubers of PVS infected plants from Idaho and grown in a greenhouse in Beltsville, MD. Immediately after inoculation, the leaves, they were rinsed with sterilized distilled water. The experimental design was a randomized, complete block with three replications of four plants. Sixty days after inoculation a composite sample of three leaves from each plant was assayed for PVS with ELISA.