Heat-Stable Strains of Potato Leaf Roll Virus

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ABSTRACT

Potato leaf roll virus (PLRV) and potato virus S were eradicated from potato (*Solanum tuberosum*) by growing infected plants at 33-36 C for 4-14 weeks, then excising axillary buds for nutrient culture. Retention of PLRV in three cultivars ranged from 0-16% of the plantlets. Size of bud excised influenced ease of eradication of the heat-tolerant PLRV. Of plantlets developed from buds 0.3-0.5 mm long, 3-6% were infected; from those 0.8-1.2 mm long, 33-41% were infected. Duration of heat treatment had no apparent influence on virus eradication. Phytopathology 61:246-247.

Potato leaf roll virus (PLRV) is reported to be one of the most heat-labile of the viruses infecting potato (*Solanum tuberosum* L.). This virus has been eradicated from whole tubers by relatively moderate heat treatment. The ease of eradication was first reported by Kassanis (2), who found that infected tubers surviving an air temp of 37.5 C for 25 days or longer were free from PLRV, whereas the same conditions for up to 40 days failed to eliminate potato virus X (PVX). Similarly, Rozendaal (5) reported that heat treating tubers infected with PLRV, PVX, potato virus Y, and potato virus A eradicated only PLRV. He found no difference in heat stability among the various PLRV isolates that he treated. Fernow et al. (1) also reported eradication of PLRV from the majority of infected tubers subjected to 36 C for 33 days or more, although the treatment had no effect on PVX.

Three potato selections infected with PLRV were among the cultivars treated for virus eradication during a program to develop virus-free nuclear stocks (4). They were (i) Green Mountain; (ii) Pontiac; and (iii) USDA seedling 41956. Each was also infected with potato virus S (PVS), which is one of the most heat-tolerant of potato viruses (6). The comparative survival of PLRV and PVS in each of these three clones is our subject.

Treatment for virus eradication consisted of nutrient culture of axillary buds excised from infected plants after heat treatment of 4-14 weeks. Plants for heat treatment were grown from tip cuttings or from small, one-eye tuber pieces. When growth started, the young plants were subjected to an air temp which alternated daily from 33 to 36 C, under fluorescent lights which provided a 16-hr photoperiod. At intervals during treatment, shoots were removed from the infected plants and axillary buds 0.3-1.2 mm long were excised from them for nutrient culture (6). Plantlets that developed in culture were transplanted to soil and, when established, were indexed for virus survival. Potato leaf roll virus was detected by aphid transmission to seedlings of *Physalis floridana* Rydb. (3). Potato virus S was detected serologically (6).

TABLE 1. Comparative survival of potato leaf roll virus (PLRV) and potato virus S (PVS) in plantlets developed from each of three heat-treated cultivars

Source plant	Plantlets developed	PLVR-infected	PVS-infected
	no.	%	%
Pontiac[a]	23	0	65
Green Mountain[a]	92	16	7
USDA seedling 41956[a]	64	5	9
USDA seedling 41956[b]	126	16	47

[a] Source plants grown from tip cuttings.
[b] Source plants grown from tuber pieces.

There was a marked difference in ease of eradication of PLRV between Pontiac and Green Mountain (Table 1). The strain of PLRV that infected Pontiac behaved in the manner anticipated from published results (1, 2, 5). Leaf roll virus was completely eradicated while an unusually large proportion of the plantlets were still infected with PVS. The strain of PLRV that infected Green Mountain was far more difficult to eradicate, and survived in many plantlets from which PVS had been eradicated. The strain of PLRV in USDA seedling 41956 was also relatively heat-stable, but was more readily eradicated than the accompanying strain of PVS.

Size of buds excised influenced the survival of heat-tolerant PLRV. The size of buds excised from USDA seedling 41956 differed according to the origin of the treated plant. Plants developed from tuber pieces were more robust than those from tip cuttings, with large leafy axillary buds which, even after dissection, probably weighed at least twice as much as buds of similar length excised from tip cuttings. The difference in bud mass was reflected in ease of eradication of both viruses, although the effect was less marked for PLRV than for PVS (Table 1).

The influence of bud size on survival of PLRV was further shown by comparison of plantlets within each of two clones (Table 2). When length of the excised buds was 0.3-0.5 mm, few plantlets of either Green Mountain or USDA seedling 41956 were infected with PLRV. With increasing bud size, the proportion of infected plantlets increased sharply.

TABLE 2. Influence of length of excised bud on survival of potato leaf roll virus (PLRV) in plantlets developed from each of three heat-treated cultivars

Source plant	Length of bud	Plantlets developed	PLRV-infected
	mm	*no.*	%
Green Mountain[a]	0.3-0.5	32	3
	0.6-0.7	38	13
	0.8-1.2	22	41
USDA seedling 41956[b]	0.3-0.5	67	6
	0.6-0.7	35	23
	0.8-1.0	24	33

[a] Source plants grown from tip cuttings.
[b] Source plants grown from tuber pieces.

No relationship between treatment period and virus survival was apparent from the limited data presented here. From the two source plants in which there was an appreciable survival of PLRV, some of the plantlets from each treatment period were infected, but there was no consistent pattern of eradication.

Variability in heat tolerance between isolates of the same virus from different sources has been reported for PVX and PVS (4). For lack of a better word, we used "strain" to designate virus isolates showing marked differences in heat stability. The results reported here clearly show that PLRV also exists as heat-stable and heat-labile strains, and that the heat-stable strains are not easily eradicated by heat treatment.

LITERATURE CITED

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