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Epidemiology of Potato Virus S in the San Luis Valley

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Summary:

580 weed and potato leaf samples were collected from five potato fields during August of 1990. Weeds collected included Nightshade, Lambsquarter, Pigweed, Kochia and Purslane. All samples were assayed serologically for PVS using ELISA. Suspect positives were inoculated to bioassay plants for further verification. The bioassay plants did not perform as expected and we were unable to obtain verification of PVS infection in all but one case, a potato sample. Information obtained from the ELISA testing showed that each field sampled had weeds which tested positive for PVS. Two fields had only one positive each, a pigweed sample and a kochia sample. The other three fields had percentages ranging from 5% to 30% positive. However, generally the percentage of weeds positive was lower than the actual percentage of potatoes found to be positive. This follows closely the results obtained in 1989. Additional verification is needed before we can conclusively say that PVS is harbored in weeds in the San Luis Valley.

Materials & Methods: Weed samples were collected from various potato fields and placed into zip-lock bags. Leaf samples for each plant type were combined into a single bag and indicated as 'bag #' in Table 1. The bags were kept cool and out of the direct sunlight. A total of 580 leaf samples were collected.

Each individual plant leaf was assayed serologically using ELISA. The PVS (+) sap samples were used to inoculate healthy Russet Burbank microplants in the greenhouse. After allowing a suitable time for virus replication and systemic infection, microplants were assayed using ELISA.

Green peach aphid colonies from three local sources were established. Individual aphids were removed from the host plant, starved for 3-5 hours and then placed on potato plants infected with PVS. They were allowed to feed overnight and then removed and placed on virus free Russet Burbank microplants. They fed on these plants for 48 hours and were killed with insecticide. The microplants were transplanted to the greenhouse and allowed to grow for 60 days. Ten microplants were used per aphid colony with 3-5 potentially viruliferous aphids placed on each plant. Each plant was individually assayed serologically with ELISA for the presence of PVS.

Results: Data in Table 1 shows only 1 sap sample (#24+2) resulted in an infected microplant. This indicates infectious PVS was present in the one sap sample. All plants were re-assayed at a later date to give microplants additional time to develop detectable PVS titer. However, at the time of re-assay, all plants were negative, including #24+2.

Results indicate that the conditions for inoculation and/or plant growth were questionable, at best. In the case where we had a reasonable certainty that PVS was present and should have been detected by bioassay, only 25% of the plants developed symptoms for bag# 24 (Scidmore-potato). The bioassay data becomes even more inconclusive when we consider the fact that 41 infected potato plants were actually tested via bioassay (for all fields combined) and only one developed a detectable titer. Re-assay of this infected plant failed to detect PVS.

Test results on the microplants which were used to test the potential of aphid vectors to spread PVS were negative for the presence of PVS. Further work will be done in 1991 on this part of the project.

Discussion: We still have no firm, conclusive evidence that weeds in the San Luis Valley can act as hosts for PVS. Certainly the initial evidence derived from the serological testing would suggest that this is the case, but without a confirmed, accurate bioassay followup, there is no way to verify this. Further work will need to be done on this project to corroborate these results. One important point that does come out in this project relates to PVS testing of both the potatoes and the weeds within a given field. In all but two cases over two years, the amount of PVS detected in the weeds was lower than that detected in the potatoes. If indeed weeds are PVS hosts, they should not be of serious concern until the potatoes are relatively free of the virus. The exception relates to PVS free plants such as nuclear stocks in the seed program exposed to infected weeds. In this case, a grower should take appropriate precautions.

TABLE 1. Potato Virus 'S' survey results for the San Luis Valley. All foliar samples were collected during August 1990. G.D. Franc & R.D. Davidson, Center, CO 1991.

BAG NO.	ELISA SAMPLE NO.	FIELD NAME	PLANT TYPE	PERCENT PVS (+)	GHSE BIOASSAY ¹	
					#TESTED:	#PVS (+)
1	1-3	WORLEY	NIGHTSHADE	0%	0	N/A
2	4-25	WORLEY	LAMBSQUARTER	0%	0	N/A
3	26-45	WORLEY	PIGWEED	5%	0	N/A
4	46-60	WORLEY	KOCHIA	0%	0	N/A
5	61-80	WORLEY	PURSLANE	0%	0	N/A
6	81-100	WORLEY	POTATO	0%	0	N/A
7	101-200	KEHLER	NIGHTSHADE	0%	0	N/A
8	121-130	KEHLER	LAMBSQUARTER	0%	0	N/A
9	131-155	KEHLER	PIGWEED	0%	0	N/A
10	156-165	KEHLER	PURSLANE	0%	0	N/A
11	166-185	KEHLER	KOCHIA	5%	1	0
12	186-210	KEHLER	POTATO	85%	17	0
13	211-245	SCIDMORE	LAMBSQUARTER	17%	6	0
14	246-265	SCIDMORE	PIGWEED	30%	6	0
15	266-275	SCIDMORE	PURSLANE	15%	3	0
16	276-295	SCIDMORE	KOCHIA	5%	1	0
17	296-325	SCIDMORE	POTATO	20%	6	0
18	ZERO	SCIDMORE	NIGHTSHADE	N/A	N/A	N/A
19	326-355	SCIDMORE	LAMBSQUARTER	17%	5	0
20	356-390	SCIDMORE	PIGWEED	0%	0	N/A
21	391-410	SCIDMORE	PURSLANE	10%	2	0
22	411-420	SCIDMORE	KOCHIA	10%	1	0
23	421-430	SCIDMORE	NIGHTSHADE	30%	0	N/A
24	431-460	SCIDMORE	POTATO	13%	4	1
25	461-480	MIX	LAMBSQUARTER	0%	0	N/A
26	481-500	MIX	POTATO	20%	4	0
27	501-520	MIX	NIGHTSHADE	0%	0	N/A
28	521-540	MIX	PURSLANE	10%	2	0
29	541-555	MIX	KOCHIA	13%	2	0
30	556-580	MIX	PIGWEED	8%	2	0

¹ The '#TESTED' column indicates the number of PVS (+) sap samples (based on ELISA) used to inoculate healthy potato (R. Burbank) microplants in the greenhouse. The '#PVS (+)' column indicates the number of microplants becoming infected after mechanical inoculation.