

Spongospora subterranea f. sp. *subterranea* (Sss) affects plant susceptibility to subsequent pathogen infections under controlled environment conditions



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Link to the article
 in *Plant Disease*:



INTRODUCTION

- Sss is responsible for tuber scabs, root galls, reduced root water uptake and vectoring Potato Mop-Top Virus.
- Susceptibilities of potato varieties against tuber scabs, root galls and root hair colonization are not always correlated.
- While the asymptomatic Sss infections have been previously reported, variety susceptibilities and the extent of these infections into disease spread are currently unknown.
- Effects of Sss on subsequent pathogen infections above ground have not been previously reported.

OBJECTIVES

Investigating the effects of Sss on disease symptom development and susceptibility to subsequent pathogen infections on six potato varieties with economic importance to American potato industry.

MATERIALS & METHODS

- Six potato varieties; Atlantic (ATL), Dark Red Norland (DRN), Gold Rush (GDR), Lamoka (LMK), Silverton (SLV) and Snowden (SNO), were used to test susceptibility levels to Sss in three independent greenhouse assays.
- Assessment of Sss-induced disease severity was carried out by quantifying root galls, scabby tuber numbers and total tuber weights at 12 weeks post inoculation (wpi).
- Root and asymptomatic tuber colonization were determined by quantifying Sss genomic DNA with qPCR.
- Detached leaf assays were utilized to determine susceptibilities of Sss-infected plants to subsequent attacks of *Sclerotinia sclerotiorum* (white mold) and *Phytophthora infestans* (late blight).

RESULTS

- LMK and SNO were most susceptible to powdery scab development (36% and 31%), followed by DRN (26%) (Figure 1-a).
- Sss was detected most frequently in asymptomatic LMK (91.6%), GDR (77.7%) and DRN (76.9%) tubers (Figure 1-b).
- Asymptomatic Sss detection frequency and Sss biomass on asymptomatic tuber skins were not correlated (Figure 1-c).

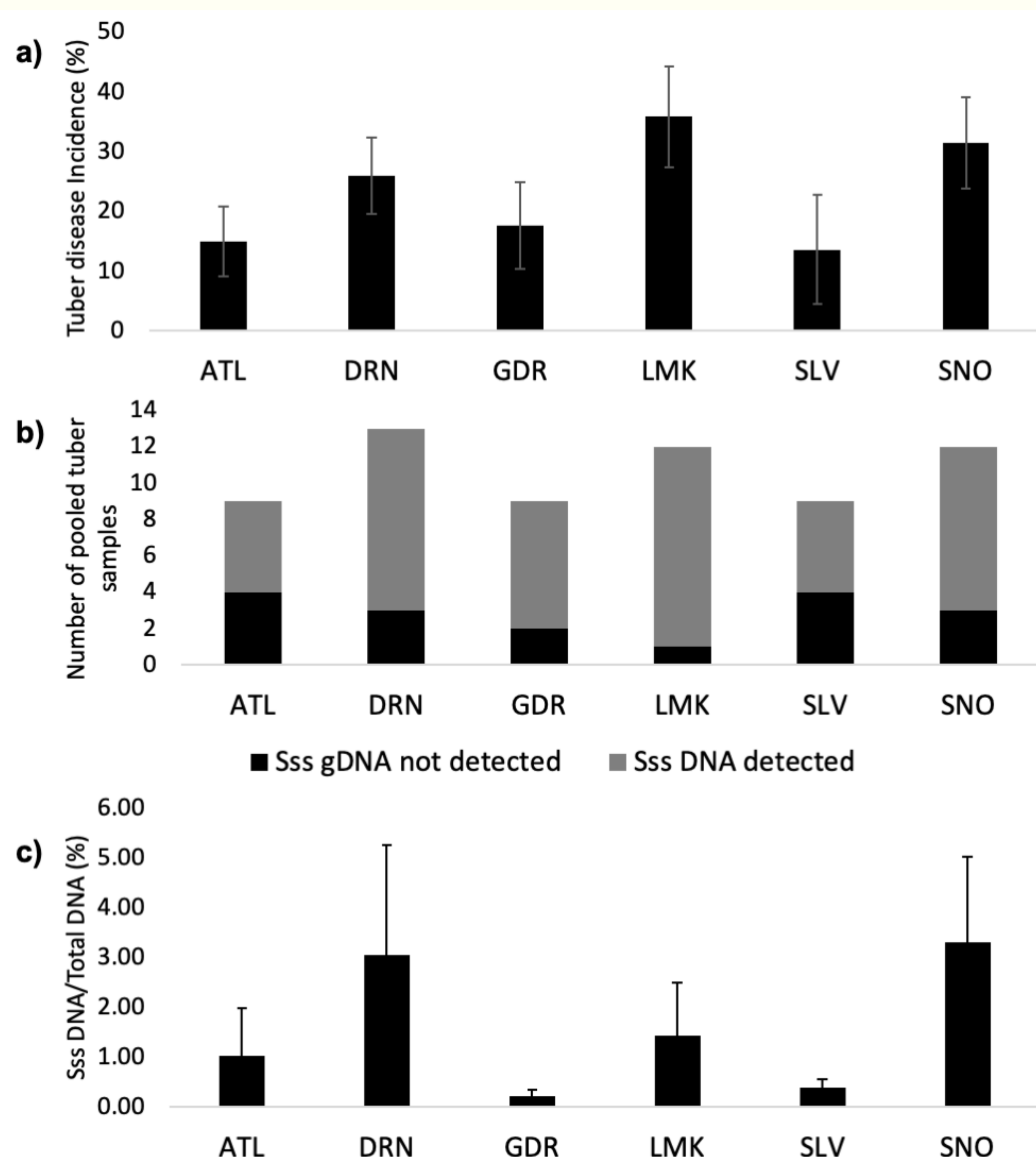


Figure 1. Detection of Sss on the tubers. a) Powdery scab incidence. b) Frequency of Sss colonization in asymptomatic tubers. c) Sss gDNA levels on asymptomatic, Sss-positive tubers.

RESULTS

- No association was found between root gall numbers and root colonization across the varieties (Figure 2).
- Sss-infected SLV plants had 20.6% larger late blight lesions on leaves than Sss-free SLV plants (Table 1).
- Sss-infected GDR and ATL plants had 26.2% and 15.8% larger white mold lesions on leaves than Sss-free plants, respectively (Table 1).
- On the contrary, Sss-infected SLV plants had 28.7% smaller white mold lesions on leaves than Sss-free SLV plants (Table 1).

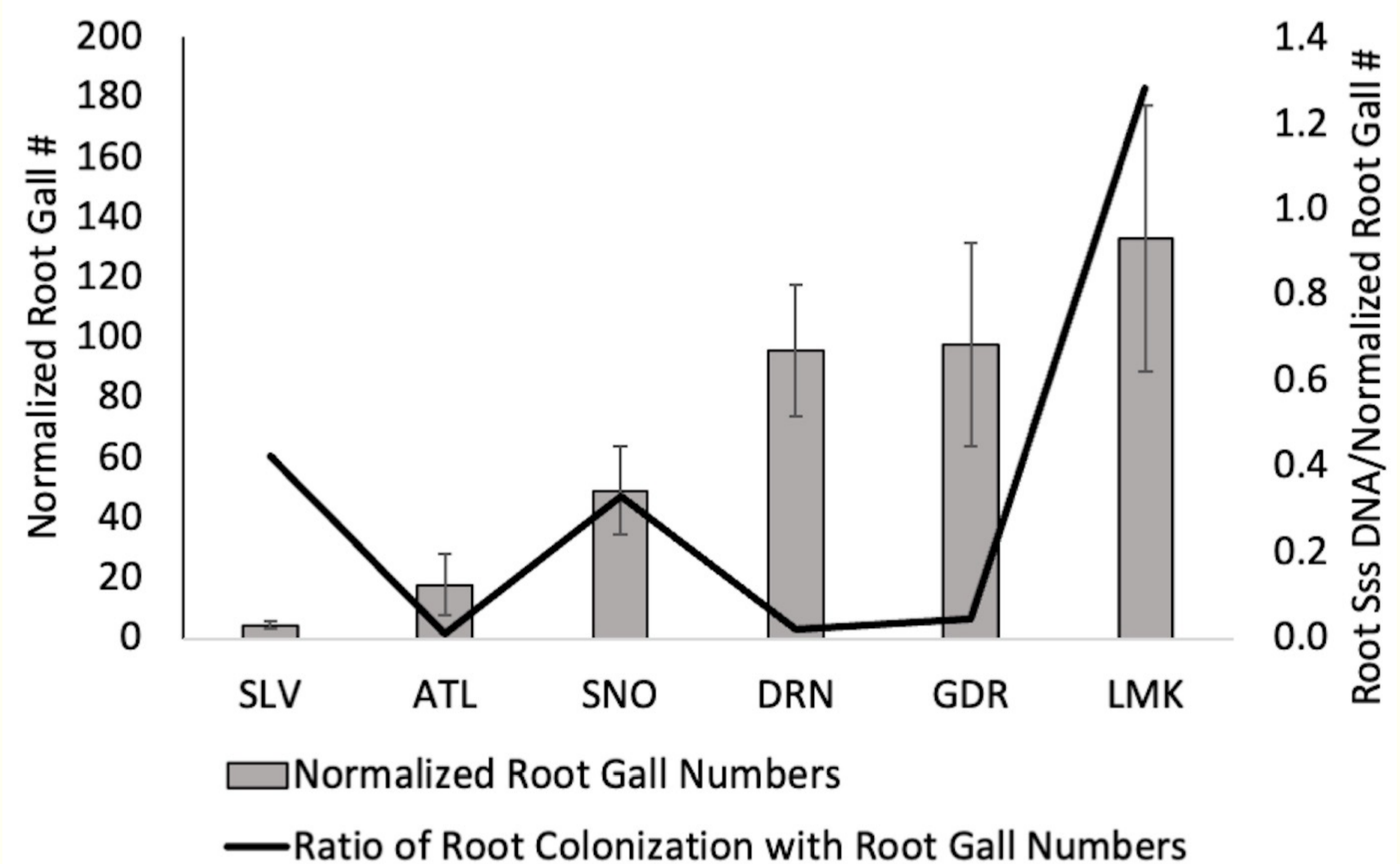


Figure 2. Root gall and root colonization associations of the six potato varieties upon Sss infection. Normalized root gall numbers are the number of root galls per gram of dry root tissue.

	<i>P. Infestans</i> -4 dai	<i>S. sclerotiorum</i> -2 dai	<i>S. sclerotiorum</i> -3 dai
ATL-C	0.47 ± 0.03	0.47 ± 0.15	1.65 ± 0.48
ATL-Sss	0.42 ± 0.08	0.81 ± 0.15	1.96 ± 0.35*
DRN-C	0.57 ± 0.02	0.68 ± 0.18	1.79 ± 0.40
DRN-Sss	0.49 ± 0.08	0.60 ± 0.15	1.82 ± 0.37
GDR-C	0.46 ± 0.09	0.97 ± 0.20	2.54 ± 0.34
GDR-Sss	0.38 ± 0.05	1.35 ± 0.13	3.35 ± 0.30*
LMK-C	0.52 ± 0.03	0.80 ± 0.21	1.86 ± 0.39
LMK-Sss	0.51 ± 0.06	0.78 ± 0.15	1.94 ± 0.33
SLV-C	0.34 ± 0.02	1.08 ± 0.31	2.19 ± 0.50
SLV-Sss	0.41 ± 0.05*	0.77 ± 0.22*	1.68 ± 0.41
SNO-C	0.40 ± 0.03	0.71 ± 0.14	1.57 ± 0.29
SNO-Sss	0.41 ± 0.03	0.62 ± 0.12	1.65 ± 0.36

Table 1. Detached leaf assay lesion sizes of the leaves collected from the six potato varieties with or without Sss infection at 12 wpi. (N=1242 for *P. infestans* and N=573 for *S. sclerotiorum*). *p<0.05 (Tukey–Kramer HSD test)

DISCUSSION & CONCLUSIONS

- Sss influences susceptibilities to subsequent pathogen infections in a variety and pathogen lifestyle-dependent manner.
- Majority of the asymptomatic tubers were found to contain Sss, however, further research is required to understand the extent of such infections in pathogen spread.
- These findings gives precedence that the lack of disease expression does not indicate resistance of a variety to Sss.

ACKNOWLEDGEMENT

This project was funded by a Wisconsin Potato and Vegetable Growers Association base funding.