

Is the soil microbiome related to the risk of cavity spot on carrots?

INTRODUCTION

Cavity spot (Fig. 1) is an economically important disease of carrots with a worldwide distribution. The disease can be caused by several species of *Pythium*. Management recommendations are limited to avoiding fields with a history of cavity spot and applying fungicides prior to or during seeding. There are no diagnostic tools to identify high-risk fields. Many studies have shown that the risk of disease is not related to the total quantity of *Pythium* species in soil. The hypothesis is that some aspects of the soil microbiome, along with pathogen presence, influence the development of cavity spot.

Objective

To determine if there is a relationship between the soil microbiome, soil chemical properties, and the risk of cavity spot

MATERIALS AND METHODS

- Carrot fields were identified as having low or high-risk of cavity spot in Ontario based on disease history and harvest assessment. Cavity spot severity in low-risk and high-risk fields in 2021 was 15–21% and 38–55%, respectively.
- All fields had high organic matter soils (>54 %) and carrots-onions in rotation.
- Soil was collected (Fig. 2) from 6 fields in 2021 and 12 fields in 2022 just before or at carrot seeding. A comparative metagenomic analysis of soil samples was conducted by Harvest Genomics, Quebec.



Fig. 1. Cavity spot: Sunken, elongated lesions



Fig. 2. Soil sampling (~ 15 cm)

RESULTS

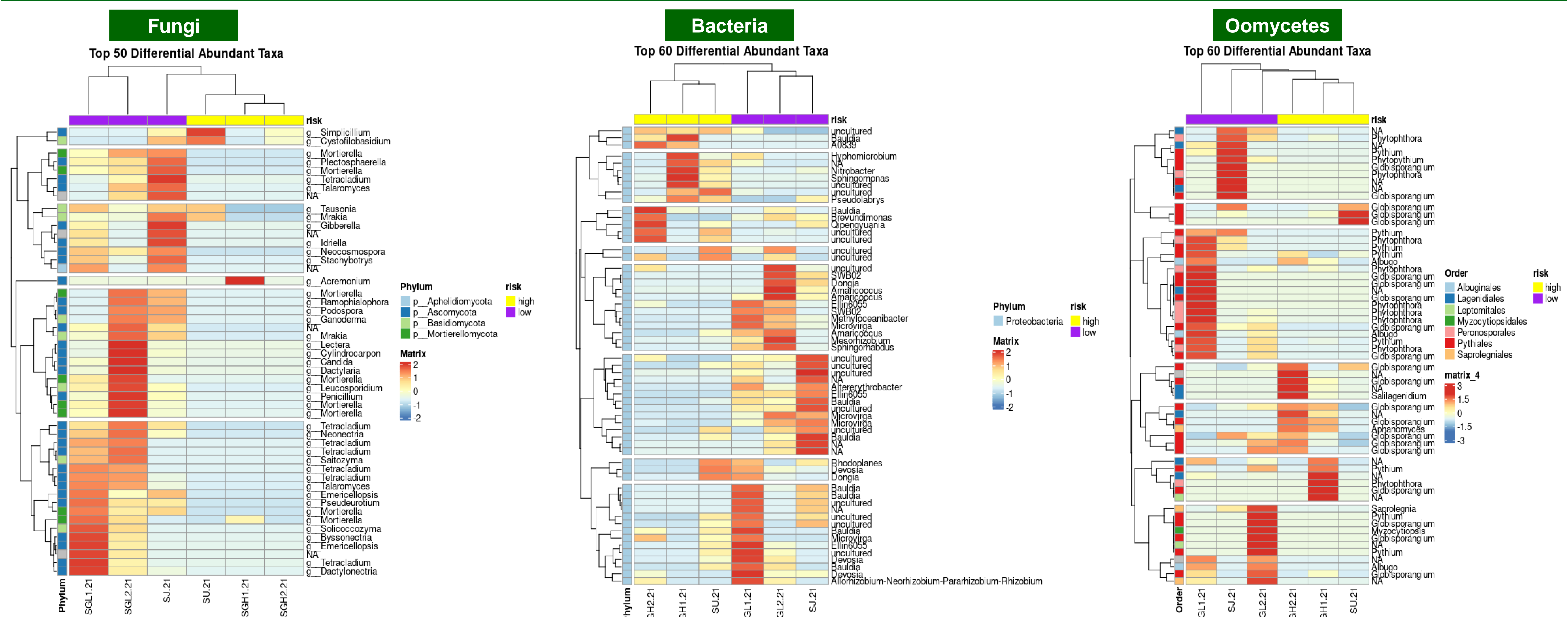


Fig. 3. Metagenomic analysis of six soil samples collected in 2021

The relative abundance of the following microbes was lower in high-risk soils vs low-risk soils: fungi *Mortierella*, *Tetracadium*, *Penicillium*, and *Fusarium*; bacteria *Bauldia* and *Rhizobium*; and oomycetes *Phytophthora*, *Albugo* and *Peronosporales* (Fig. 3). The analysis of samples collected in 2022 is in progress.

Table 1. Association of soil properties with risk of cavity spot

Risk		Soil characteristics				
		OM (%)	pH	Ca (ppm)	CEC (MEQ/100g)	BSCa (%)
2021	Low	60 a*	7.0 a	8400 a	48 a	87 a
	High	76 a	5.8 b	3800 b	28 b	68 b
2022	Low	54 b	6.4 a	4100 a	26 a	77 a
	High	66 a	6.0 a	3000 b	23 b	68 a

- Low-risk soils had a higher average soil pH of ~6.7 and soil calcium content of 4100 - 8,400 ppm compared to high-risk soils that had an average pH of ~5.9 and calcium content of 3000 - 3,800 ppm (Table 1).
- High (>80%) calcium base saturation may be associated with low risk of cavity spot.
- There were no significant associations of other soil nutrient concentrations with cavity spot risk.

OM: organic matter, Ca: Calcium, CEC: cation exchange capacity, BSCa: base saturation calcium.
*Numbers in a column followed by the same letter are not significantly different, Tukey's test (P-value >0.05)

CONCLUSIONS

Initial results suggest that the taxa identified, along with soil pH and calcium content, could be used as indicators of cavity spot risk. Studies are continuing.

A method to assess the risk of cavity spot in fields before seeding would be very useful for growers.