

Introduction

Grapevine trunk diseases (GTDs) cause cankers, dieback, and vine decline, leading to reduced yield and shortened vineyard lifespan. These diseases are caused by several different fungi that infect the woody parts of grapevines.

Most GTD fungi enter vines through pruning wounds, where they slowly spread inside the trunk over several years.

Recent research shows that beneficial fungi can slow or stop disease-causing fungi. These fungi may offer a safer and more sustainable way to manage GTDs.

Objective: To evaluate beneficial fungi as potential biological control agents against GTD pathogens found in Ontario vineyards.



Figure 1. Cankers in grapevine wood caused by grapevine trunk diseases.



Figure 2. Greenhouse test showing cankers on grapevine cuttings.

Methods

Fungal isolation: Ten fungi that cause GTDs and 12 beneficial fungi were collected from Ontario vineyards showing GTD symptoms (Table 1).

Testing disease-causing ability: GTD fungi were tested by applying them to grapevine cuttings in a greenhouse. The size of the resulting cankers was measured to confirm which fungi caused disease (Figure 2).

Fungal interaction tests: Each GTD fungus was grown in the lab together with the 12 beneficial fungi to see if the beneficial fungi could reduce pathogen growth.

Measuring control effects: Fungal growth was measured and compared with untreated controls to determine which beneficial fungi were most effective (Figure 3).

Table 1. Pathogenic and biocontrol fungal species tested in dual culture.

Pathogen Species	Biocontrol Species
<i>Cytospora viticola</i>	<i>Beauveria bassiana</i>
<i>Diaporthe ampelina</i>	<i>Clonostachys rosea</i>
<i>Didymosphaeria rubi-ulmifollii</i>	<i>Epicothium nigrum</i>
<i>Didymosphaeria variabile</i>	<i>Gliocladium catenulatum</i>
<i>Neofusicoccum algeriense</i>	<i>Pseudozyma flocculosa</i>
<i>Neofusicoccum ribis</i>	<i>Trichoderma afroharzianum</i>
<i>Neofusicoccum umdonicola</i>	<i>Trichoderma crispatum</i>
<i>Paraeutypella vitis</i>	<i>Trichoderma gamsii</i>
<i>Phaeoacremonium iranimum</i>	<i>Trichoderma hamatum</i>
<i>Phaeomoniella chlamydospora</i>	<i>Trichoderma harzianum</i>
	<i>Trichoderma spirale</i>
	<i>Trichoderma virens</i>

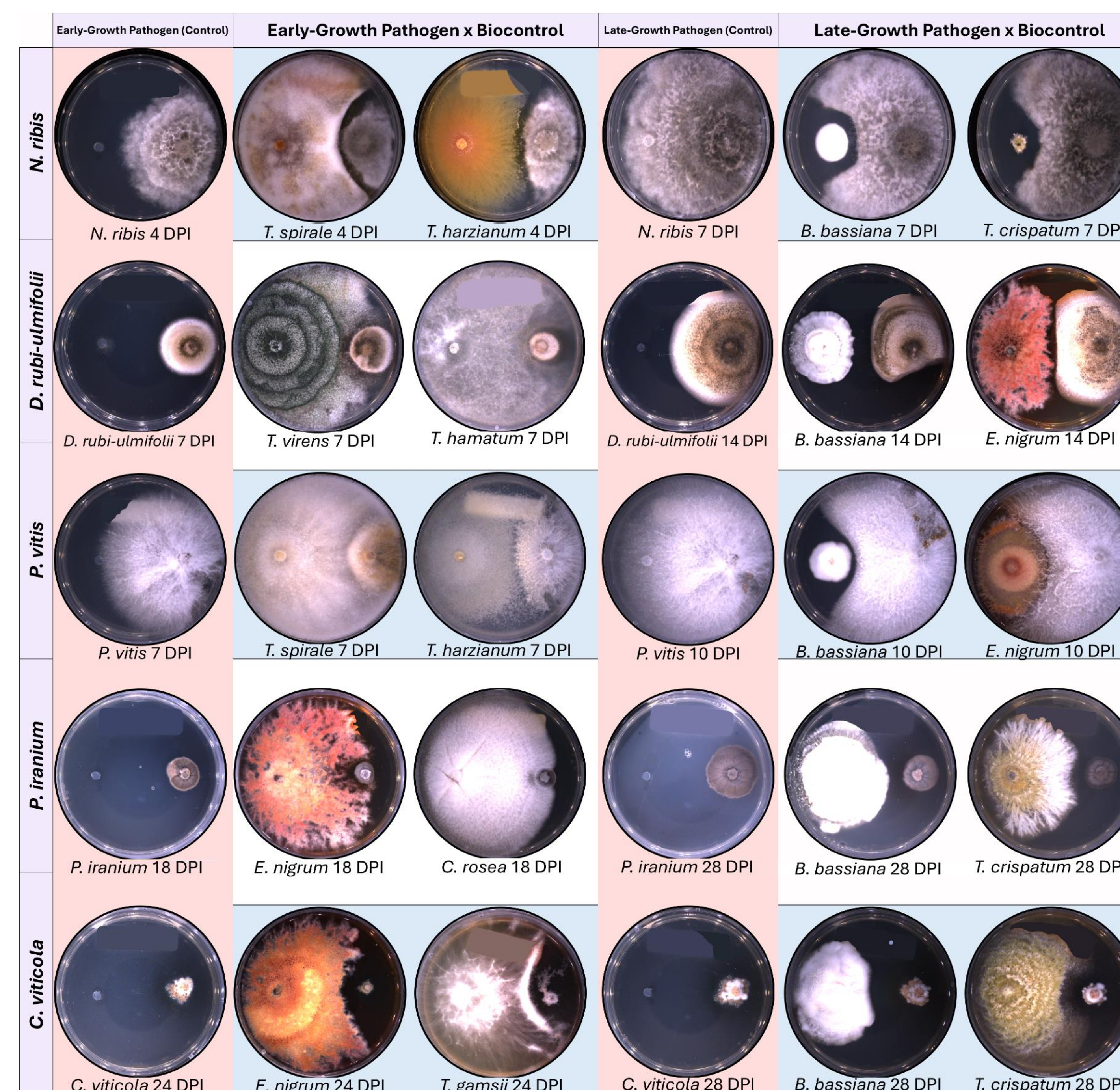


Figure 3. Lab test showing growth of five GTD pathogens with different biocontrol fungi at early and late stages. DPI = days post inoculation.

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Table 2. Percentage of pathogen inhibition (PPI) by biocontrol fungi. Higher PPI values mean stronger inhibition. Green highlights show the top PPI for each pathogen.

	Control	<i>E. nigrum</i>	<i>T. afroharzianum</i>	<i>T. gamsii</i>	<i>T. hamatum</i>	<i>T. harzianum</i>	<i>T. spirale</i>	<i>T. virens</i>
<i>N. ribis</i>	0.00	79.65	25.09	10.73	36.67	43.82	2.02	-3.60
<i>D. rubi-ulmifollii</i>	0.00	8.80	56.63	35.97	64.37	62.16	75.32	45.92
<i>P. vitis</i>	0.00	31.50	60.99	35.66	72.79	67.39	73.46	62.01
<i>P. iranimum</i>	0.00	57.51	-4.54	46.40	23.58	56.99	-3.85	44.57
<i>C. viticola</i>	0.00	26.69	80.62	33.85	68.57	60.13	80.04	80.66

PPI = (A1 – A2) / A1 × 100, with A1 = pathogen area in control and A2 = area with biocontrol.

Results

Several *Trichoderma* species (*T. afroharzianum*, *T. hamatum*, *T. harzianum*, *T. spirale*, and *T. virens*) strongly reduced the growth of all GTD pathogens during early growth (Figure 3).

B. bassiana, *E. nigrum*, *T. crispatum*, and *T. gamsii* showed varying levels of pathogen suppression (Figure 3).

G. catenulatum and *P. flocculosa* showed little or no ability to suppress pathogen growth.

Different beneficial fungi worked best against different GTD pathogens, with *E. nigrum* most effective against *N. ribis* and *P. iranimum*, *T. spirale* against *D. rubi-ulmifollii* and *P. vitis*, and *T. virens* against *C. viticola* (Table 2).

Conclusions

Several beneficial fungi, especially *Trichoderma* species, show strong potential for managing GTDs in Ontario vineyards.

Successful control depends on matching the right beneficial fungus to the right pathogen.

These findings support the use of beneficial fungi as part of an integrated GTD management strategy.

Next Steps

- Test the identified beneficial fungi in field trials on infected vines.
- Determine whether mixtures of beneficial fungi improves efficacy of biologicals.