

OBJECTIVES and CONTEXT

- Grapevine trunk diseases (GTD) are a significant threat to vineyard sustainability worldwide.
- These diseases, caused by various fungi, attack the vine's perennial organs, leading to plant death.
- GTD can impact both young and old vineyards.
- In Québec, GTD prevalence is rising as vineyards are ageing and land under vine is growing yet the distribution is unknown.
- Climate change exacerbates GTD spread, with factors like higher temperatures and increased rainfall.
- Understanding GTD's causes and spread is crucial for developing effective control methods.
- Knowledge of infection times and management strategies, like 'replacement surgery' and fungicide application, is essential for controlling GTD in vineyards (Bertsch et al. 2013; Gramaje et al. 2018).

The objective was to survey vineyards of various grape cultivars, cultural practices and age to acquire knowledge on the distribution and possible causes of grapevine trunk diseases in Québec, Canada

METHODS

Project was divided into two parts:

- 1) Assessing the presence and distribution of GTD across Québec
- 2) Characterizing the microbiome related to the distribution of GTD.

The GTD targeted were:

- *Esca* (*Phaeoemoniella chlamydospora*, *Phaeoacremonium* sp.)
- *Botryosphaeria dieback* (*Botryosphaeriaceae* sp., *Diplodia* sp., *Neofusicoccum* sp.)
- *Excoriosis* (*Diaporthe ampelina*)
- *Eutypa dieback* (*Eutypa lata*)

A total of 79 samples from 46 Québec vineyards were collected, sampling three parts of the plants when possible: 1) part of a lignified arm, 2) a shoot of the year, and 3) part of the bark of the trunk with canker.

Samples were classified based on the following parameters:

Cultivar	Age of vineyard (young vs. mature)	Organic or conventional	Part of the vine
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Genomic DNA samples extracted from vine samples subjected to vine wood disease detection tests were used to portray the vine microbiome. The composition of microbial communities was determined by PCR amplicon sequencing targeting the 16S rRNA of bacteria. The profile of microbial communities was linked to the distribution of *D. seriata* and *E. lata*.

RESULTS

Quick facts about the survey

203 samples from 56 blocks in 46 vineyards

30 different cultivars

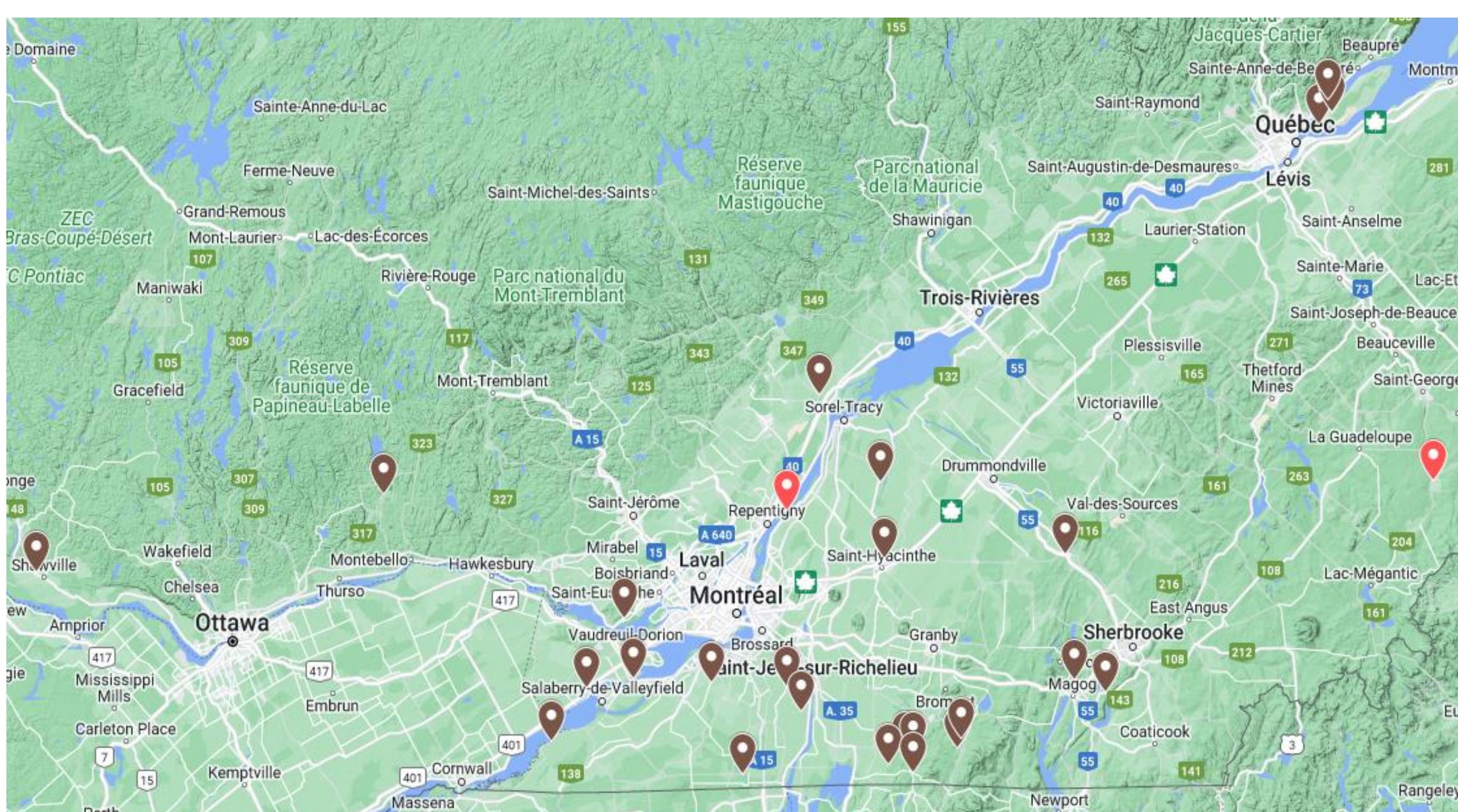
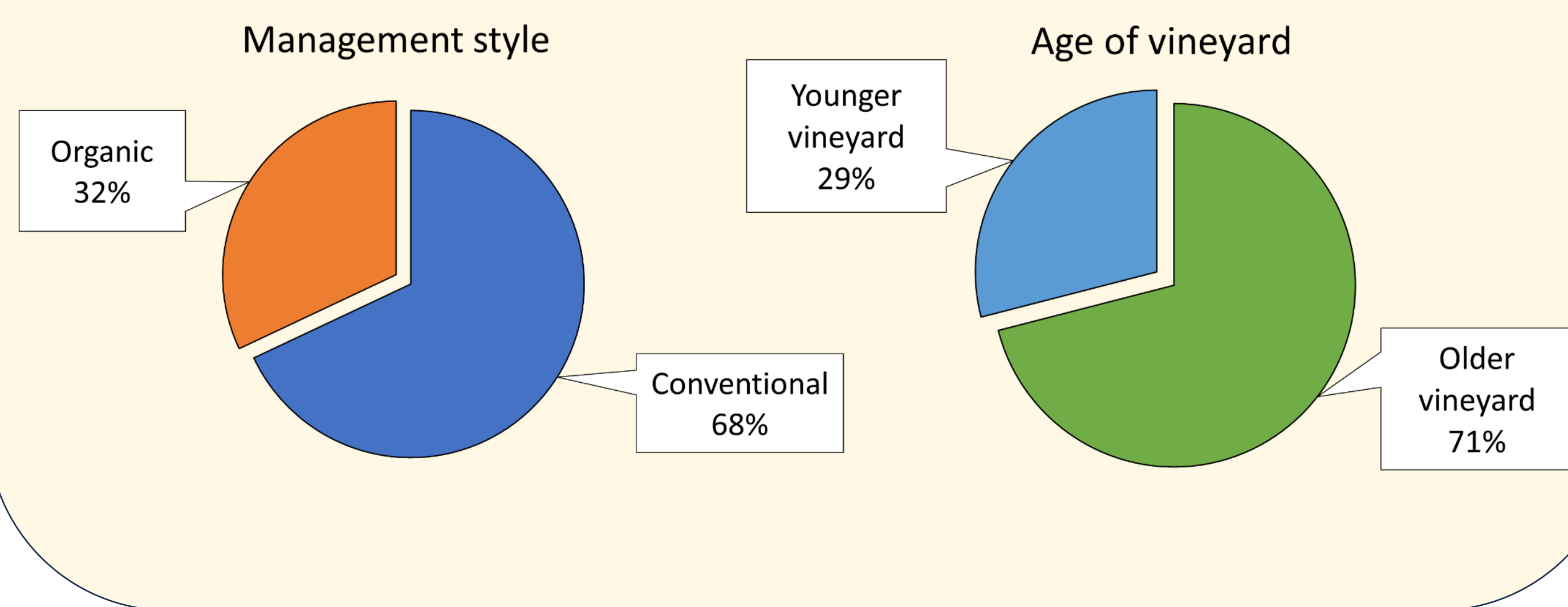


Figure 1: Distribution of Esca in Québec vineyards (*P. chlamydospora* (pink), *P. aleophilum* (brown)).

- **GTD are present in all main grape growing regions in Québec**
 - Esca is the most widespread and present in all regions (Figure 1);
 - *Botryosphaeria dieback* is found everywhere but in the newly developed Outaouais region;
 - It was common to find more than one *Botryosphaeria dieback* fungus on the same site;
 - At least one GTD was detected in 81% of the samples showing signs of decline.
- **Three to four GTD were detected in the *Vitis vinifera* samples which was a higher rate than interspecific hybrids like Frontenac, Ste-Croix, St-Pépin and Marquette**
- **Management strategies did not have an impact on the presence of GTD (Table 1)**
- **Both young and mature vines are affected by GTD (Table 1)**
 - The most prevalent in young vine are Esca (*P. aleophilum*) and *Botryosphaeria dieback* (*D. seriata*)
 - In older vines, they are *Botryosphaeria dieback* (*D. seriata* and *B. dothidae*), Esca (*P. aleophilum*), and *Eutypa dieback* (*E. lata*)
- **Detection of GTD was similar in different parts of the vine.**

Table 1: Distribution of samples infected by different vine fungi.

Disease	Fungi	Organic		Conventional	
		< 8 years old	> 9 years old	< 8 years old	> 9 years old
Botryosphaeria dieback	<i>Botryosphaeria dothidae</i>	0	1	4	10
	<i>Diplodia seriata</i>	7	5	7	18
	<i>Neofusicoccum parvum</i>	1	0	1	9
Eutypa dieback	<i>Eutypa lata</i>	4	9	5	19
Esca	<i>Phaeoacremonium aleophilum</i>	8	6	11	26
	<i>Phaeoemoniella chlamydospora</i>	1	0	0	1
Excoriosis	<i>Diaporthe ampelina</i>	1	4	5	7
Total number of plots tested positive		10	13	15	41
Total number of positive vineyards		6	10	10	28

CONCLUSIONS

- This portrait allows us to confirm that GTD are indeed present in Québec grape-growing territory and must be considered in the context of cultural practices.
- The presence and distribution of GTD in vineyards demonstrate that their presence is linked to sources external to the vineyard.
- Possible solutions have also been raised in connection with the vine microbiome and must be explored.

REFERENCES

- Bertsch, C., Ramirez-Suero, M., Magnin-Robert et al. (2013). Grapevine trunk diseases: complex and still poorly understood. *Plant Pathology*, 62(2), 243-265.
- Gramaje, D., Urbez-Torres, J. R., & Sosnowski, M. R. (2018). Managing grapevine trunk diseases with respect to etiology and epidemiology: current strategies and future prospects. *Plant disease*, 102(1), 12-39.

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