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Diseases and arthropods susceptibility of *Vitis vinifera* in the grape growing regions of Quebec, Canada.

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OBJECTIVES and CONTEXT

The proportion of *Vitis vinifera* planted is increasing in Québec, reaching more than 20% of the land under vine for the 2022 vintage (CVQ 2023). The *V. vinifera* species is the most planted winegrape in the world but comes with challenges of high disease susceptibility and poor cold hardiness (Pedneault and Provost 2016; VineAlert 2023). The Québec viticultural regions have been separated into seven main grape-growing regions based on specific topographical and climate features (Figure 1).

To our knowledge, there is no information in the scientific literature on the agronomic properties of *V. vinifera* in the Québec Province. Collecting this information is necessary to understand the growth, diseases and arthropods susceptibility and yield potential of *V. vinifera* cultivars. Additionally, it would allow the establishment of baseline parameters for current and future *V. vinifera* growers.

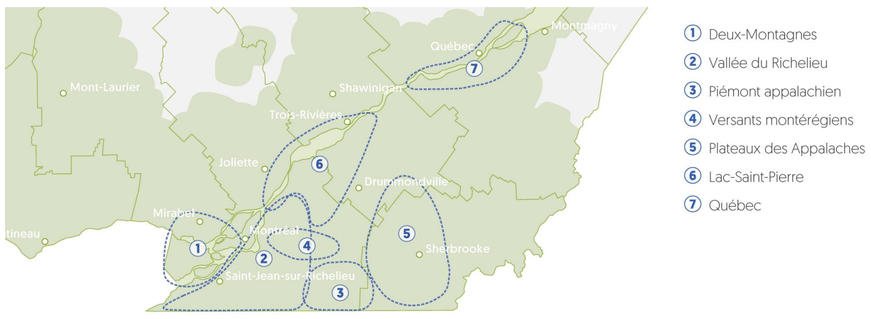

Figure 1: Main grape growing regions of Québec. (Source: Conseil des vins du Québec)

The objective was to characterize the agronomic properties of the main *V. vinifera* cultivars in five viticultural regions of Quebec.

METHODS

General data collection: within each vineyard (Table 1), three blocks of 5 vines were identified in each cultivar. Highly heterogeneous sections and outer rows and panels were avoided. Data was generally collected from all five vines within all blocks.

Diseases: the presence of fungal diseases (e.g. downy mildew, powdery mildew, anthracnose, Botrytis, black rot) was noted once a month using a severity scale (0: 0%, 1: 1-5%, 2: 6-15%, 3: 16-25%, 4: 26-50%, 5: +50%).

Arthropods: the presence of arthropods and their foliage damages (e.g. phylloxera, leafhoppers, flea beetles, Japanese beetle, mites) was noted once a month with the same severity scale.

Data processing: parameters were quantified within a vineyard and reported as the means of the three blocks. Contingency tables were performed to compare the occurrence of diseases and arthropods between vineyards and cultural practices (organic and conventional) for a specific disease or arthropod.

Table 1: Breakdown of the sites and cultivar surveyed. Growing degree-days (GDD) in base 10°C, from April 1st to October 31st are also reported for both years of the study.

Region	Site code	Cultivar	GDD (°C)	
			2021	2022
Deux-Montagnes	A	Cabernet franc, Gamaret, Pinot gris, Pinot noir, Riesling	1524	1383
	B	Gamaret	1497	1378
	C	Cabernet franc, Chardonnay, Gamay	1511	1340
Vallée-du-Richelieu	D	Pinot gris, Pinot noir	1526	-
	E	Cabernet franc, Chardonnay, Gamay, Gewurztraminer, Pinot gris, Pinot noir, Riesling	1517	1439
	F	Chardonnay, Gamay, Pinot gris, Pinot noir	1432	1287
Versants montérégiens	G	Chardonnay, Gamaret, Riesling	1460	1344
Lac St-Pierre	H	Chardonnay, Gamaret, Pinot noir	1384	1183
Québec et les berges	I	Chardonnay, Pinot gris, Riesling	1246	1135
	J	Chardonnay, Pinot noir, Riesling	1123	1135

RESULTS

- Pest susceptibility, whether from fungal pathogens or insects, was highly variable between sites (Tab. 2-4).
- The diseases of importance were powdery mildew, downy mildew, black rot and botrytis (Tab. 2).
- The main insects were leafhoppers, erineum mites and Japanese beetles (Tab. 3).
- Within a site, the cultivars appear similarly susceptible to the pathogens when present on the site (Tab. 2).
- The disease pressure was variable between the years, with more disease symptoms observed in 2022.
- Disease and arthropod incidence differed between conventionally and organically managed vineyards (Tab. 4).
- Powdery mildew and black rot occurrences were higher in conventional vineyards (Tab. 4).
- Mites and leafhoppers were prevalent in organic vineyards and caused higher leaf damage (Tab. 4).

Table 2: Diseases occurrence according to grape variety and vineyard.

	Site	Variety	Powdery mildew		Black rot		Botrytis		Downy mildew		Anthracnose	
			2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Conventional	Site A	Pinot gris	0	0	0	0	0	0	2,1	1,5	0	0
		Pinot noir	0	0	0	0	0	0	2,5	1,5	0,05	0
	Site B	Pinot noir	0	0	1,05	0	0	0	1,35	2,5	0	0
		Riesling	0	0	1,15	0,8	0	0,1	1,1	2,6	0	0
	Site C	Chardonnay	0	1,25	0	0,05	0	0,633	0	0,167	0	0
		Gamaret	0	0	0	0	0	0	0	0	0	0
		Gamay	0	0	0	0	0	0	0	0	0	0
		Riesling	0	0,317	0	0,183	0	0,55	0	0	0	0
	Site D	Cabernet franc	0	0,025	0,45	0,425	0	0,238	0	1,763	0	0
		Chardonnay	0	0,075	0,35	0,3	0,1	0,5	0	1,775	0	0,0125
	Site E	Gamaret	1,85		1,25		0,1		1,25		0	
	Site F	Cabernet franc	0	0	1,25	0	0	0	0	0	0	0
		Chardonnay	0	0	1,05	0	0	3	0	0	0	0
		Gamay	0	0	0	0	0	2	0	5	0	0
		Geisenheim	0	0	0,05	0	1,05	0	0	0	0	
		Pinot gris	0	0	0,65	0	0,1	0	0	2	0	0
		Pinot noir	1,15	0	0	0	0	2	0	2	0	0
		Riesling	0	0	0,65	2	0	3	0	3	0	0
Organic	Site G	Chardonnay	0,1	0	0	0	0,8	2	0	3	0	0
		Pinot gris	0	0	0	0	0,4	0	0	4	0	0
		Pinot noir	0	0	0	0	0,65	0	0	4	0	0
	Site H	Chardonnay	0	0	0	0	0	0	2,5	4	0	0
		Gamaret	0	0	0	0	0	0	2	4	0	0
		Pinot noir	0	0	0	0	0	0	2	2	0	0
	Site I	Chardonnay	0	0	0	0	0	0	0	0	0	0
		Pinot noir	0	0	0	0	0	0	0	0,143	0	0
		Riesling	0	0	0	0	0	0	0	0	0	0
	Site J	Chardonnay	2	0,25	0	0	0,00	0,00	0,00	0,75	0	0
		Pinot gris	0	0,286	0	0	0	0	0	0,429	0	0
		Pinot noir		0		0		0		0		0
		Riesling	0,333	0,444	0	0	0	0	0	0,222	0	0
	p		< 0,0001	< 0,0001	< 0,0001	< 0,0001	< 0,0001	< 0,0001	< 0,0001	< 0,0001	0,7792	0,9881

Table 3: Arthropods occurrence according to grape variety and vineyard

	Site	Variety	Mites		Leafhoppers		Flea beetle		Japanese beetle	
			2021	2022	2021	2022	2021	2022	2021	2022
Conventional	Site A	Pinot gris	1	0	0	0	0	0	0	2
		Pinot noir	0,95	0	0	0	0	0	0,05	2
	Site B	Pinot noir	0	0	0	0	0	0	0	0
		Riesling	0	0	0	0	0	0	0	0
	Site C	Chardonnay	0	0	0	0	0	0	0	1,1
		Gamaret	0	0	0	0	0	0	0	1,3
		Gamay	0	0	0	0	0	0	0	1,5
		Riesling	0	0	0	0	0	0	0	1
	Site D	Cabernet franc	0	0	0,2	0,025	0	0	0	0,125
		Chardonnay	0	0	0,25	0,05	0	0	0	0,113
	Site E	Gamaret	0	0	0,95	0	0	0	0	
	Site F	Cabernet franc	0	0	0,95	0	0,95	0	0	0
		Chardonnay	0	2	0,8	2	0,9	0	0	0
		Gamay	0,15	2	0,95	2	0,7	0	0	0
		Geisenheim	0	0	1,05	0	0,85	0	0	0
		Pinot gris	0	2	0,85	2	0,95	0	0	0
		Pinot noir	0	0	0,6	2	0,7	0	0	0
		Riesling	0	2	0,9	2	0,85	0	0	2
Organic	Site G	Chardonnay	0	0	1	4	0	0	0,65	0
		Pinot gris	0	0	1,1	2	0	0	0,7	0
		Pinot noir	0	0	1,1	2	0	0	0,35	0
	Site H	Chardonnay	0	2	3	4	0	0	0	0
		Gamaret	5	0	4	2	0	0	0	0
		Pinot noir	1	2	2	2	0	0	0	0
	Site I	Chardonnay	0	0	0	0	0	0	0	0
		Pinot noir	0	0	0	0	0	0	0	0
		Riesling	0	0	0	0	0	0	0	0
	Site J	Chardonnay	0	0	0	0	0	0	0	0
		Pinot gris	0	0	0	0	0	0	0	0
		Pinot noir		0		0		0		0
		Riesling	0	0,222	0	0	0	0	0	0
	p		< 0,0001	< 0,0001	< 0,0001	< 0,0001	< 0,0001		< 0,0001	< 0,0001

Table 4: Diseases and arthropods occurrence according to vineyard management.

	Powdery mildew		Black rot		Botrytis		Downy mildew		Anthracnose	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
conventional	0,21	0,26	0,56	0,23	0,10	0,36	0,59	1,06	0,00	0,00
organic	0,06	0,15	0,00	0,00	0,24	0,04	0,84	0,64	0,00	0,00
p	0,0096	0,2489	< 0,0001	0,0237	0,0006	0,0052	< 0,0001	< 0,0001	0,4563	0,7282

	Mites		Leafhoppers		Flea beetle		Japanese beetle	
	2021	2022	2021	2022	2021	2022	2021	2022
conventional	0,15	0,02	0,54	0,04	0,42	0,00	0,00	0,62
organic	0,77	0,13	1,57	0,34	0,00	0,00	0,22	0,00
p	< 0,0001	< 0,0001	< 0,0001	< 0,0001	< 0,0001		< 0,0001	< 0,0001

CONCLUSIONS

- Pest control is ensured by screening, and specific interventions are applied to reduce and limit the spread of diseases and arthropods.
- The first criterion influencing the presence or absence of pests and diseases is the site's history rather than production management.
- The presence of arthropods is often attributed to the properties of the site and its history. It is rarely linked to the susceptibility of the grape varieties.
- Several cultural practices can affect the phytosanitary quality of the vine and the occurrence of diseases, such as leaf removal, training mode, pruning, and topping.

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CANADIAN AGRICULTURAL PARTNERSHIP

LITERATURE CITED

Conseil des vins du Québec. 2023. Rapport Annuel

Pedneault, K., & Provost, C. (2016). Fungus resistant grape varieties as a suitable alternative for organic wine production: Benefits, limits, and challenges. Scientia Horticulturae, 208, 57–77. https://doi.org/10.1016/j.scienta.2016.03.016

VineAlert: grapevine management and monitoring system for cold hardiness and injury. 2023. Cool Climate Oenology and Viticulture Institute at Brock University. https://www.ccovi.ca//vine-alert. Retrieved on February 10th, 2023.