Investigating the prevalence and identifying the species of aphids most commonly present in cranberries in the Lower Mainland of British Columbia

Final report to:
British Columbia Cranberry Marketing Commission and Lower Mainland Horticulture Improvement Association

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Executive Summary

Aphids are an important agricultural pest in British Columbia (BC). Although considered a minor pest in cranberries, there is concern about their potential to damage crops if present in sufficient numbers. Aphids can cause damaged by directly feeding on plant tissue, as well as serving as a vector for viruses (Polashock *et al.* 2017). Blueberry scorch virus in blueberries is causing major crop damage and yield losses in BC. The effect of this virus in BC cranberries is unclear, but possible symptoms have been observed and the virus has been detected in American Cranberries (*Vaccinium macrocarpon*) (Wegener *et al.* 2004).

The two main objects for this project were to:

1. Document the prevalence of aphids in cranberries in the Lower Mainland of BC.
2. Identify the species of aphids most found in cranberries in the Lower Mainland of BC.

For 10 weeks from June to August 2022, 16 fields from a variety of regions were sampled weekly. The regions sampled were Richmond, Surrey, Pitt Meadow/Maple Ridge, Langley, Delta, and Abbotsford. Samples were collected and uprights were inspected for aphids under a microscope. The number and type of aphids (regular/apterous, winged, parasitized) on 30 uprights per field were recorded. The highest levels of aphids were observed in Richmond and the lowest in Abbotsford. Aphid populations peaked in late-June to early-July, declining into August. The most common type of aphid was the regular (apterous) aphid, with low levels of winged and parasitized aphids found.

Four collection events for species identification occurred in July and August within the same fields used for the prevalence data. Aphids were divided into 70% and 95% ethanol vials and kept in a -20°C degree freezer. In total 66 sets of vials were collected and sent to Ottawa for species identification by Agriculture and Agri-food Canada. Preliminary results using morphological identification keys indicated the presence of *Ericaphis frimbiata/scamelli.*

There is an opportunity to increase the number of fields sampled in the future to improve regional perspective on aphid distribution in the Lower Mainland. Increasing the time frame for data collection is also another area where this project could be expanded to capture more of the growing season. Although aphids are not considered a major cranberry pest, they are present in all growing regions and can increase risk of virus transmission, so it is important to continue to monitor and track their levels over time.

Introduction

Aphids are an important pest to the agricultural industry in British Columbia (BC) and are prevalent in many crops. They can cause direct damage due to their feeding and serve as a virus vector (Polashock *et al.* 2017). Aphids are considered a minor pest to cranberries in BC but there is concern about virus transmission. One of the known species commonly found in cranberry fields in BC is *Ericaphis fimbriata* (Fitzpatrick *et al.* 2016).

Aphids can cause damage to crops both directly and indirectly via feeding on plant tissue. Using their sucking mouthparts, they extract sap from developing tissues in the plant, which causes weakening of the plant and damages the tissues. This feeding also causes aphids to excrete honeydew, which in turn can attract other pests and creates a favorable environment for disease development (Polashock *et al.* 2017). Past studies have shown that direct feeding damage due to aphid presence is minor in cranberries in BC (Fitzpatrick *et al.* 2017), however with aphid levels potentially increasing in cranberry fields, their impact could change.

Another role aphids can play is as a vector for virus transmission. Aphids are a proven vector for viruses such as blueberry scorch virus and blueberry shoestring virus among many others (Polashock *et al.* 2017). Concerns around blueberry scorch virus in blueberries are increasing in BC as this virus is causing major crop damage and yield losses. The extent of these viruses and their effects in BC cranberries is unclear, but possible symptoms have been observed in some plantings (E.S. Cropconsult Ltd., field observation). Blueberry scorch virus has been detected in American cranberries (*Vaccinium macrocarpon*) and in Canada raising questions about the potential impacts of aphids and blueberry scorch virus to the cranberry industry locally (Wegener *et al.* 2004).

Understanding the species of aphids present and their prevalence is a first step in understanding these impacts, with the overall goal to assist the cranberry industry in mitigating insect pressure and the risk of virus transmission in the field. The objectives of this project were to:

1. Document the prevalence of aphids in cranberries in the Lower Mainland of BC.
2. Identify the species of aphids most found in cranberries in the Lower Mainland of BC.

Methods

Location and field selection

There were 16 sites surveyed for this project across various regions of the Lower Mainland, British Columbia (Figs. 1a and 1b). These fields were in Richmond (five sites), Delta (two sites), Pitt Meadows (five sites), Abbotsford (one site), Surrey (two sites), and Maple Ridge (one site). Fields were selected across multiple regions to get a regional perspective on aphid populations.

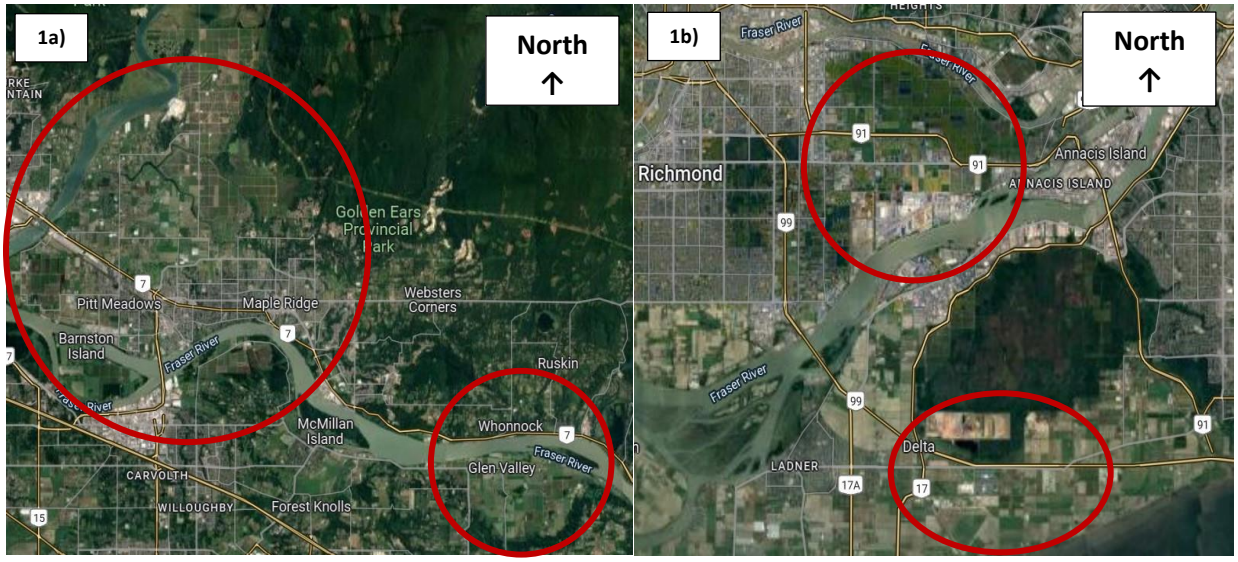


Figure 1a & b. Cranberry field sites located in Pitt Meadows, Maple Ridge, Surrey, and Abbotsford (1a), and Delta and Richmond (1b), BC where aphids were collected during the 2022 growing season. Areas with red circles indicate field locations; specific locations are not provided to maintain grower confidentiality.

Aphid Prevalence

Aphid prevalence data were collected weekly, starting June 13th and ending August 21st at all 16 sites for a total of 10 weeks to track levels over time. Per site, three samples, each consisting of 10 uprights (for a total of 30 uprights per field), were collected and GPS coordinates recorded. Samples were analyzed under a microscope so that aphids could be more easily observed. The number and type of aphids observed were recorded. The types were divided into three groups: regular (apterous), winged, and parasitized aphids.

Missing data points are due to weeks when fields could not be entered due to chemical application. When this occurred, data collection for that field was skipped for that week and resumed the following week.

Aphid Collection and Identification

Four collection events took place during the growing season. These events occurred during the weeks of July 4th, July 29th, August 16th, and August 29th. Collections during the weeks of July 29th and August 16th were limited due to a shortage of available vials. While observing the aphids under the microscope, aphids were collected using a fine brush and placed into vials. If aphids looked morphologically similar, they were split evenly between two vials that contained ethanol at two concentrations, 70% and 95%. If there were obvious variations in the aphids collected (e.g., colour differences) the type of aphid that composed the majority was put into to 95% vial, with the rest placed in the 70% vial. At each collection event, the aim was to collect aphids from every region, but this was not always possible if no aphids were present in the samples. Once collected, aphids were stored at -20°C until they could be delivered to Agriculture and Agri-food Canada in Ottawa for species identification. Aphid species in the 70% vials were evaluated using morphological identification keys and presented in this report. Aphids from the 95% vials will be identified using molecular characterizations. These data will be available in spring 2023.

Results and Discussion

Aphid Prevalence

The highest average levels of aphids were recorded in the Richmond region while the lowest average levels of aphids were recorded in the Abbotsford field (Fig. 2). Most fields had aphid levels peak around late June and early July. After mid-July and during the month of August, there was a noticeable decrease in aphid levels.

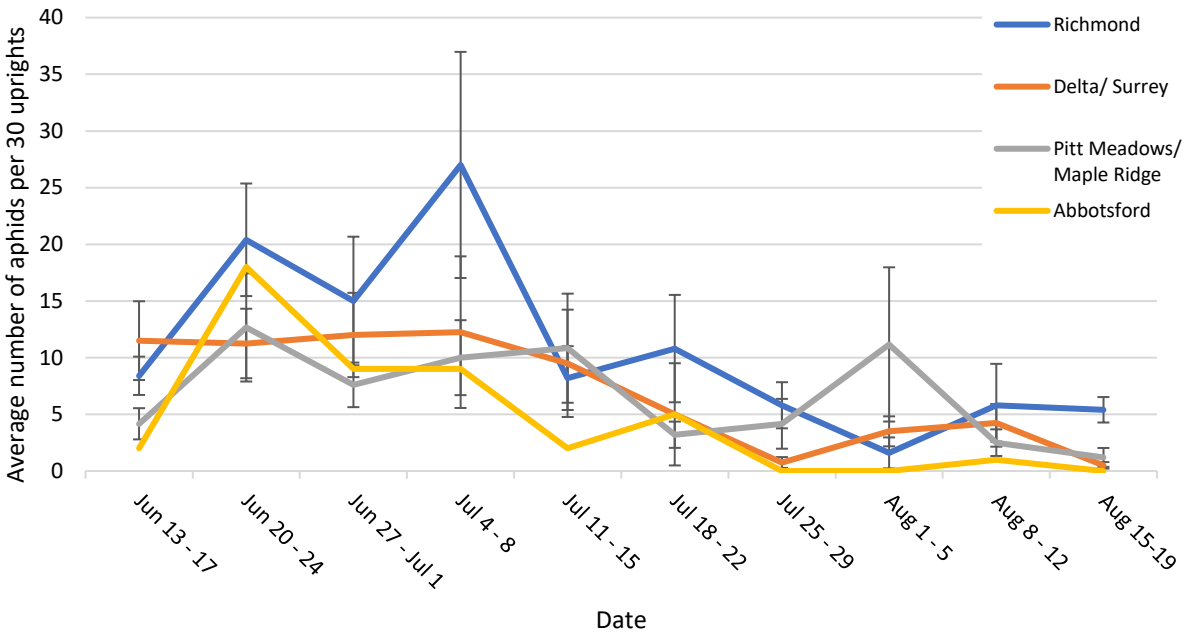
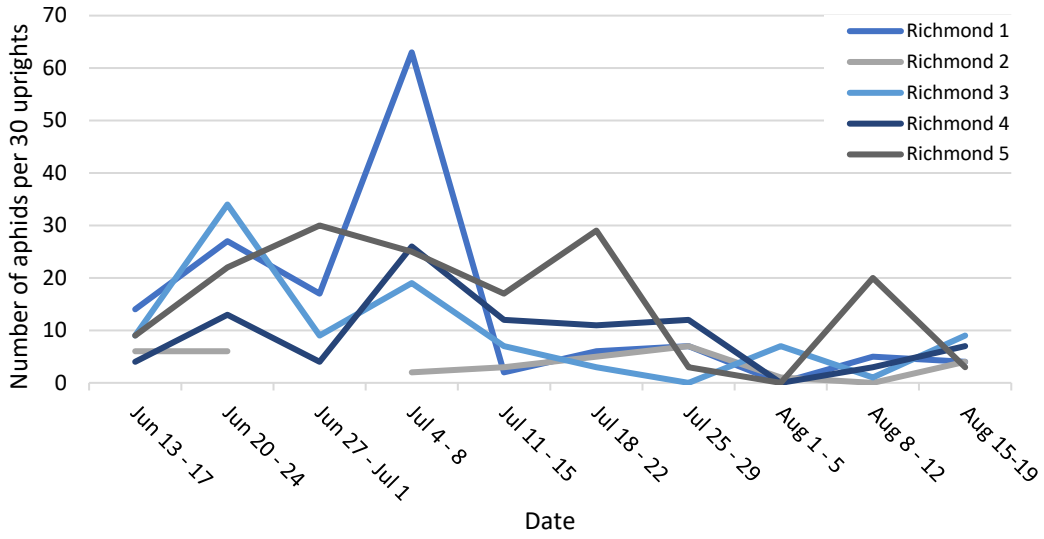


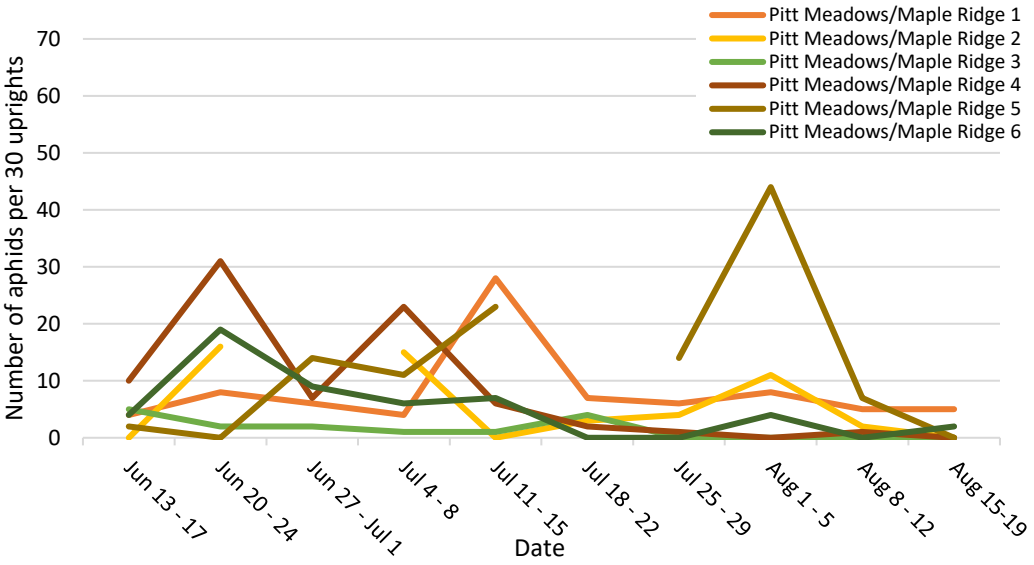
Figure 2. The average (±s.e.m.) number of aphids (regular and winged combined) observed per 30 uprights in four broad regions over the course of 10 weeks of sampling during the 2022 season. Some regions were combined and the number of fields for each were as follows: Richmond (five), Delta/Surrey (four), Pitt Meadows/Maple Ridge (six), and Abbotsford (one).

When looking at individual fields, the highest number of aphids found was during the week of July 4th, 2022, with 63 aphids per 30 uprights, in a Richmond field (Fig. 3a). The highest levels of aphids recorded in the Pitt Meadows/Maple Ridge region was during the week of August 1st with 44 aphids recorded per 30 uprights (Fig. 3b). The field in the Abbotsford region had levels peak during the week of June 20th with 18 aphids per 30 uprights (Fig. 3c) and the Surrey fields saw a peak of 23 aphids per 30 uprights during the week of June 27th (Fig. 3c). The highest number of aphids recorded in Delta was during the week of July 4th with 32 aphids recorded (Fig. 3c).

a)


Number of aphids per 30 uprights
70
60
50
40
30
20
10
0
Jun 13 - 17
Jun 20 - 24
Jun 27 - Jul 1
Jul 4 - 8
Jul 11 - 15
Jul 18 - 22
Jul 25 - 29
Aug 1 - 5
Aug 8 - 12
Aug 15-19
Date
Richmond 1
Richmond 2
Richmond 3
Richmond 4
Richmond 5

b)


Number of aphids per 30 uprights
70
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Jun 20 - 24
Jun 27 - Jul 1
Jul 4 - 8
Jul 11 - 15
Jul 18 - 22
Jul 25 - 29
Aug 1 - 5
Aug 8 - 12
Aug 15-19
Date
Pitt Meadows/Maple Ridge 1
Pitt Meadows/Maple Ridge 2
Pitt Meadows/Maple Ridge 3
Pitt Meadows/Maple Ridge 4
Pitt Meadows/Maple Ridge 5
Pitt Meadows/Maple Ridge 6

c)

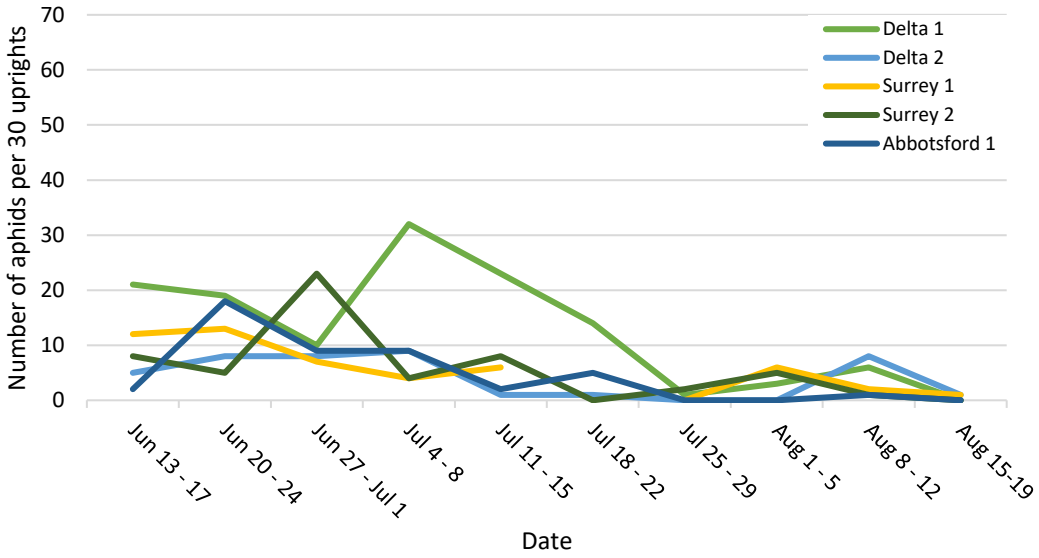

Figure 3a, b, & c. The number of aphids (regular and winged combined) recorded per 30 uprights over the course of 10 weeks of sampling during 2022 in 16 fields across the Fraser Valley. Richmond (3a) had five fields, Pitt Meadows/Maple Ridge (3b) had five fields; Delta had two fields, Surrey had two fields, and Abbotsford had one field (all in 3c).

Since fewer fields were sampled from Delta, Surrey, and Abbotsford, the data from these regions may be less representative of the entire region. Further the 16 field sites sampled in this study represent less than 5% of the total cranberry acreage in the Fraser Valley so a higher sample number may be needed to improve the clarity of the data.

Three fields (Pitt Meadows 2, 3 and 5) in this study were treated with Movento on July 29th to control cranberry tipworm populations. Aphids were not the target pest of these sprays, but they are listed on the label for this insecticide and were likely impacted. However, it is interesting to note that Pitt Meadows 5 saw an observational increase in aphid numbers following the Movento application.

The most common type of aphid recorded out of the categories (regular, winged, and parasitized) were regular (apterous) aphids. There were only a small number of winged aphids found and they were not found in every region (Table 1). A small number of parasitized aphids were found as well signifying there is some activity of beneficial insects on aphid populations in cranberries (Table 1).

Table 1. The total number of winged and parasitized aphids observed over 10 weeks of sampling in five regions of the Fraser Valley.

Region	Number of Winged Aphids	Number of Parasitized Aphids
Richmond	0	16
Delta	0	12
Pitt Meadows/Maple Ridge	4	8
Abbotsford	0	4
Surrey	1	4

Aphid Collection and Identification

During the four collection events, a total of 66 pairs (70% and/or 95% ethanol) of vials were filled with samples. Most aphids were collected during the first event and from fields in Richmond (Table 2). From the 66 pairs of vials, 48 of them had aphids collected into the 70% ethanol with a total of 108 aphids, 15 of which were adult females and able to be identified using morphological identification keys. These 15 specimens were identified as *Ericaphis frimbiata/scamelli.*

Table 2. The number of vials sets filled across the different regions during each aphid collection event in the 2022 season.

Week of collection event	Number of vial pairs filled				
	Richmond	Pitt Meadows/ Maple Ridge	Surrey/ Delta	Abbotsford	Total
July 4th	13	14	9	3	39
July 29th	6	4	1	0	11
August 16th	4	1	1	0	6
August 29th	9	1	0	0	10
Total	**32**	**20**	**11**	**3**	**66**

Conclusions and Recommendations

The two objectives of this project were to document the prevalence of aphids in cranberries and to identify the species of aphids most found in cranberries in the Lower Mainland of British Columbia (BC). The project was undertaken with the goal of better understanding aphid populations in cranberry fields in the Lower Mainland of BC. This project documented the presence of aphids in cranberry fields in 2022 showing regional differences and a peak in late-June to early-July, and a decline in August. Preliminary results using morphological identification keys indicated the presence of *Ericaphis frimbiata/scamelli.*

Since this was only one year of data collection, more work remains to be done in terms of monitoring aphid levels in cranberry fields. Only a relatively small sample size of fields were included, and there is an opportunity to increase this number in the future, especially in regions that were sampled less intensively during this project. Another area that can be expanded upon is the timeframe of the project. Starting aphid collections and prevalence count in May would give us more data at a different stage in the growing season.

Although aphids are not considered to be a major pest in cranberries, this project demonstrated that they are present in all local cranberry growing regions and at high levels in some fields. High levels of aphids can increase chances of virus transmission in fields including blueberry scorch virus, which has been detected in cranberries (Wegner *et al.*2004*)*. Monitoring aphid levels in cranberries over time is important to track pest levels and improve understanding of the impact of aphids on the health and vigour on cranberry bogs in British Columbia.

Acknowledgements

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