

Horticulture Nova Scotia *Research*



Final Report 2013

Aphid monitoring in Nova Scotia for improved virus management in strawberries

Project Number: NS0399

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CAAP Project Final Report

Aphid monitoring in Nova Scotia for improved virus management in strawberries

Date: November 27, 2013

Project activities:

The project began on April 10, 2013 and much has been accomplished. Most significantly, aphid monitoring sites were established with cooperating growers at 23 farms across the province and two student biologists were trained and subsequently recorded populations of both non-winged and winged forms of strawberry aphid until the end of August. A third student biologist was then hired to monitor for both forms of aphids in September and October.

Two virus testing projects were also conducted through the study period, the first focusing on the presence and distribution of the two problem viruses across the province, and the second examining levels of infections in new plantings as an indicator of virus management success.

Communication of monitoring data and virus testing results has been an important aspect of the project. To this end aphid monitoring results were communicated weekly to project cooperators and ten project updates were communicated to growers periodically through the growing season. Finally, all monitoring and testing data was compiled and is enclosed in the report below.

Specific project activity reports are detailed below:

1) Purchase of project equipment

A stereomicroscope was purchased and is being utilized for aphid identification and counting at one of the two labs being used for the project.

2) Purchase of project supplies

Two separate purchases of 'Koppert' yellow sticky traps have been obtained and used effectively to monitor the active "winged" aphid stage of aphid development. Supplementary supplies including sample bags, plastic wrap, wooden stakes, etc have also been purchased as required.

3) Training of student biologist

A training session with Deb Moreau, research entomologist with AAFC Kentville, was organized and held April 29th. The two student biologists hired for the project participated as did several industry consultants, and a number of prominent grower staff, the latter so that they could conduct their own aphid monitoring in 2013.

4) Sample processing

The student biologist and project leader conducted site visits and training with cooperating growers and deployed the first round of sticky traps. Subsequently, their activities involved the processing of the many leaf and trap samples and aphid population tabulations on a weekly basis. At the end of each week, they also emailed or phoned each of the cooperators growers and communicated their aphid numbers for that week. Participating growers were also instructed to contact the project leader for management options and many chose to do so on a regular basis.

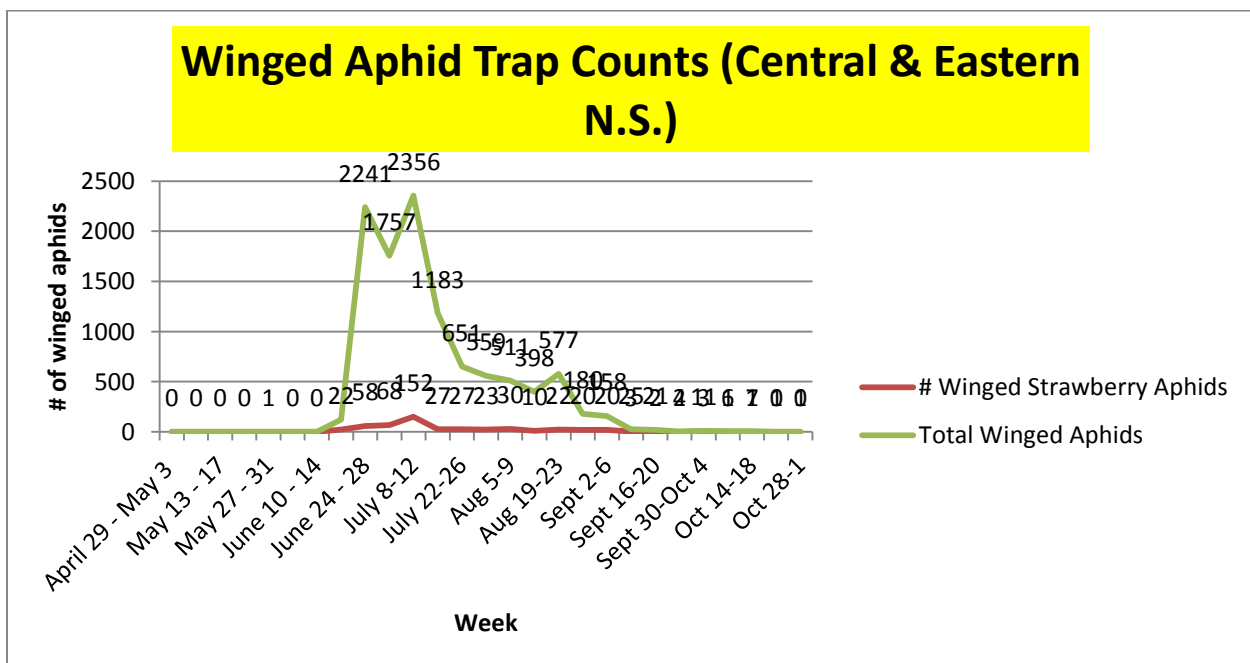
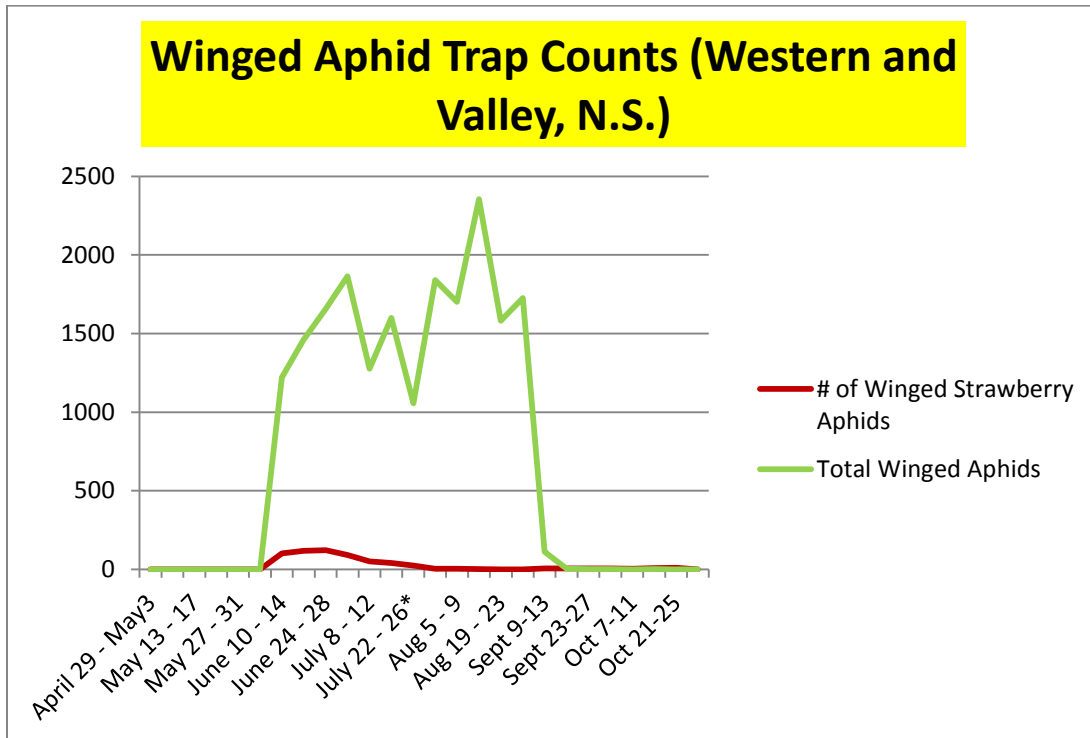
The student biologists also participated in a June sampling project to determine the full distribution of the two viruses in Nova Scotia. In addition to the actual sampling, they also packaged and facilitated the shipping of all samples to the British Columbia lab that was employed to conduct the bulk of the virus testing analysis.

5) Leaf and sticky trap sampling

Of the 23 cooperating growers, approximately half, usually the most distant, collected the leaf and sticky trap samples and sent them by courier to the respective labs for processing. For the most part this worked very well and minimized the travel time and costs that would otherwise have been required by the student biologists.

6) Distribution of "Virus Alert" newsletter

Ten "aphid monitoring project update" e-newsletters were prepared and delivered. Among other things, these newsletters identified the beginning of the high risk "spring flight" of strawberry aphid as well as aphid and virus identification photos. An example of some of the data compiled and presented in these newsletters includes the following:



7) Laboratory analysis for virus sampling

Spring virus testing of fruiting fields: Composite three-leaf samples targeting symptomatic plants in fruiting fields from all known commercial strawberry fruit farms in Nova Scotia were collected and sent for RT-PCR testing in late May/ June to ascertain the full distribution of SMYEV and SMoV around the province. Sixty-two farms were tested and both SMYEV and SMoV were confirmed on forty-two (68%) of these farms, while at least one of the two viruses were confirmed on sixteen (26%) of the farms. Only four farms (6%) tested negative for both viruses. Overall, 282 samples were collected from different fields on these farms and 53.5% tested positive for both viruses, 27.7% tested positive for only one, and 18.8% tested negative for both virus. Most importantly, this testing confirmed that the two viruses were well distributed around the province.

8) Laboratory analysis for virus sampling

September/October testing of newly planted fields: This was a random 3-leaf sampling of newly planted fields in known commercial strawberry fruit farms. The purpose of the testing was to assess the success of virus management efforts during the 2013 growing season and to provide an indication of potential yield impact of the viruses on the 2014 crop. The methodology differed from that used in the spring testing and allowed not just the determination of the presence of the viruses but the level of infection in the fields as well. Sixty-five farms were tested and of the 2478 samples tested by ELISA for SMYEV, 26% tested positive, while of the 254 samples tested by RT-PCR for SMoV, 16% of these tested positive.

Unfortunately, we have no comparable data from 2012 (or earlier) to help us measure the success of our efforts this season. However, these levels of virus remain a concern and suggest that aggressive management of aphid vectors should continue for the foreseeable future. Additionally, the aggressive removal of older fields with high levels of infection remains a priority. With a target level of both viruses below 5%, it appears it will take 2-4 years before we can relax our management focus on this pest issue.

There was considerable variability in the infection levels found in the new fields from farm to farm around the province. For the most part this reflected the attentiveness of the grower to the issue with some growers having excellent success minimizing new infections while others having less success as a result of a less attentive approach to vector management. Hopefully, the number of growers in the former category will increase in 2014 and we can accelerate our progress to the 5% virus targets noted above.

9) Preparation of full season compilation and report

Aphid monitoring was conducted on 23 farms from May through August. In September the number of sites was reduced but monitoring continued to determine if there was an additional flight period in the two study areas. A full data compilation for both the Western/Valley and Central/Eastern has been completed and is attached (Appendix 1 and 2). Additionally, a presentation on the monitoring and virus testing results is scheduled for the Scotia Horticultural Congress in January.

Summary:

Much has been learned as a result of this project. Proceeding into the 2013 growing season, we did not know how strawberry aphid overwintered, as eggs, nymphs, adults, or a combination. We now know that eggs are the predominant overwintering form and we have been able to demonstrate a very easy and effective monitoring method for these eggs that allow growers to accurately assess their aphid populations and risk before the season begins.

Similarly, we did not know if strawberry aphid would be a major species in strawberries. Certainly this was our expectation given the levels of virus found during the fall of 2012, but it had been fifty years since aphids had last been studied in strawberries in Nova Scotia and in this work strawberry aphid was a minor species at best. Not surprisingly, the present student clearly demonstrated that our hypothesis was correct and that there has been a dramatic demographic shift of aphid species in strawberries over the last five decades and that indeed strawberry aphid is now the dominant species on strawberries in Nova Scotia.

Also, we did not know the full distribution of the two problem viruses in the province at the beginning of the project and as a result of the comprehensive testing made possible by the project funding we now know that the viruses can be found essentially from one end of the province to the other, although there are clearly hot spots where higher levels are being found.

Additionally, 'spring flights' of aphids are widely reported but the start time and duration of these flights vary across regions and we did not know when they would occur in Nova Scotia. For 2013, we found that the spring flight period began in early June and had a long duration of approximately eight weeks. The Western/Valley flight began about a week earlier than the Central/Eastern flight and had a shorter duration likely due to the earlier and warmer temperatures in this region. These findings are critical to know as the flight period is the time of greatest risk for virus transmission and it is essential to know its arrival and duration to optimize vector management strategies. Ideally, monitoring would continue in 2014 to establish if there is year-to-year variation in the flight period that would affect management success.

'Fall flights' are also reported in many jurisdictions and it was important to monitor into the fall season to assess whether Nova Scotia also has a fall flight period. Interestingly, a significant fall flight was not found during the 2013 monitoring. This is great news because if it holds true in future it means that growers need not be so aggressive with their aphid management during this time and may focus their efforts primarily during the flight period in June and July.

Finally, the project allowed us to assess the level of infection in newly planted fields with the virus testing survey conducted in September and October. This was important as a way of assessing our virus management success during the 2013 growing season as well as providing a preview of what the 2014 crop may look like. The levels of SMYEV and SMOV, 26% and 16% respectively, is higher than hoped and a negative yield impact in 2014 should still be expected due to these viruses. However, these levels also establish an important benchmark from which we may monitor progress in the ongoing fight against this disease. It is hoped that funding may be obtained to conduct this comparison in 2014 and beyond if possible.

Appendix 1 Aphid counts on farms in central and eastern Nova Scotia collected on a weekly-biweekly basis in 2013

Aphid counts

Week	Wingless ¹				Winged ²	
	New Fields		Fruiting Fields		New and Fruiting Fields	
	Strawberry Aphids	Other Aphids	Strawberry Aphids	Other Aphids	Strawberry Aphids	Other Aphids
April 29- May 3	0	0	11	7	0.0	0.0
May 6-10	0	0	22	4	0.0	0.0
May 13-17	0	0	22	1	0.0	0.0
May 20-24	0	0	6	1	0.0	0.0
May 27-31	1	0	2	0	0.0	0.0
June 3-7	0	0	16	0	0.0	0.0
June 10-14	0	0	2	0	0.0	0.0
June 17-21	1	1	1	0	0.2	1.0
June 24-28	3	6	7	0	0.4	16.7
July 1-5	4	4	9	0	0.6	15.0
July 8-12	1	5	31	2	1.2	19.0
July 15-19	1	3	30	5	0.2	9.7
July 22-26	1	11	9	5	0.2	5.7
July 29-2	0	9	15	13	0.2	5.2
Aug5-9	0	1	5	34	0.3	5.3
Aug 12-16	0	3	1	7	0.1	4.1
Aug 19-23	0	0	0	52	0.3	8.1
Aug 26-30	3	4	0	0	0.3	2.6
Sept 2-6	0	0	1	7	0.2	1.7
Sept 9-13	0	0	1	0	0.0	0.3
Sept 16-20	1	0	0	0	0.0	0.4
Sept 23-27	0	0	0	0	0.0	0.1
Sept 30-4	0	0	0	0	0.1	0.2
Oct 7-11	0	0	0	0	0.0	0.1
Oct 14-18	0	6	0	0	0.0	0.1
Oct 21-25	0	0	0	0	0.0	0.1
Oct 28-1	0	0	0	0	0.0	0.0
Nov 4-8					0.1	0.4

¹ Wingless aphid counts are per 60 leaf sample.

² Winged aphid counts are per trap.

Appendix 2 Aphid counts on farms in western and valley Nova Scotia collected on a weekly-biweekly basis in 2013

Aphid counts

Week	Wingless ³				Winged ⁴	
	New Fields		Fruiting Fields		New and Fruiting Fields	
	Strawberry Aphids	Other Aphids	Strawberry Aphids	Other Aphids	Strawberry Aphids	Other Aphids
April 29- May 3	0	0	3	4	0	0
May 6-10	0	0	9	1	0	0
May 13-17	0	0	15	1	0	0
May 20-24	0	0	9	1	0	0
May 27-31	0	0	26	1	0	0
June 3-7	1	0	22	0	0	0
June 10-14	0	1	34	1	1	12
June 17-21	0	15	6	0	1	16
June 24-28	0	6	4	1	1	18
July 1-5	0	6	12	0	1	20
July 8-12	1	1	4	0	0	12
July 15-19	0	0	13	0	0	17
July 22-26	0	3	7	1	0	14
July 29-2	1	1	22	3	0	22
Aug 5-9	0	1	1	1	0	20
Aug 12-16	0	1	4	1	0	25
Aug 19-23	0	0	0	1	0	21
Aug 26-30	0	0	0	0	0	23
Sept 2-6	N/A ⁵	N/A	N/A	N/A	N/A	N/A
Sept 9-13	1	0	0	0	0	2
Sept 16-20	0	0	0	0	0	0
Sept 23-27	0	0	0	0	0	0
Sept 30-4	0	0	1	0	0	0
Oct 7-11	0	0	0	0	0	0
Oct 14-18	0	0	0	0	0	0
Oct 21-25	0	0	0	0	0	0
Oct 28-1	0	0	0	0	0	0

³ Wingless aphid counts are per 60 leaf sample.

⁴ Winged aphid counts are per trap.

⁵ Abbreviation: N/A, not applicable

