Surveillance of cranberry fruitworm (*Acrobasis vaccinii*) moths and infested fruit within cranberry farms in British Columbia – 2016

Project Report to:
BC Cranberry Commission
Agriculture and Agri-food Canada: Agriculture Innovation Program

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INTRODUCTION

Cranberry fruitworm (*Acrobasis vaccinii*) is a fruit-contaminating pest of cranberries found within several regions of the United States and Canada. This lepidopteran insect was first observed in British Columbia (BC) in 2011, and has become an increasing concern to cranberry producers within the province. In 2012, an area-wide monitoring program was initiated to record cranberry fruitworm moth flight and berry damage in BC blueberry and cranberry fields.

During 2012-2015, moth flight was recorded in both cranberry and blueberry fields, but feeding damage was observed on cranberries only in all seasons. Total trap catch numbers in 2012 and 2013 were observed to be similar, but a significant increase in moth flight and berry infestation was recorded in 2014. In all seasons of monitoring, the majority of cranberry fruitworm activity has been centralized within the Delta and South Richmond regions. In addition to these areas, lower levels of cranberry fruitworm have also been observed within the North Richmond and Pitt Meadows/Maple Ridge (PMMR) regions.

Throughout the course of our study, we have found our current monitoring tools to be valuable in identifying area-wide trends.

A degree day model from the Michigan State University was incorporated in the 2014-2016, project, in order to improve pest monitoring information. In all three years of monitoring, the first cranberry fruitworm trap catches in Richmond corresponded with the degree day model predictions for moth flight, indicating that this could be used with some degree of confidence in the Richmond area.

Since the beginning of our study, significant advances have been made in understanding the life-cycle and impact of the cranberry fruitworm in both cranberry and blueberry fields within BC. The information provided from this ongoing study has directly benefited growers, consultants and other industry professionals in further developing monitoring and management strategies.

The 2016 season was our fifth year of cranberry fruitworm monitoring in BC.

METHODS

Moth surveillance in cranberries

Cranberry fruitworm moth flight was monitored with pheromone traps placed in cranberry fields in Richmond, Delta, Surrey, Langley, Chilliwack, Pitt Meadows and Maple Ridge. In total, 147 traps were set up on 40 commercial cranberry farms, and monitored weekly by E.S. Cropconsult staff from the week of May 30 until the week of August 25th, 2016 (Table 1). Between one to 27 traps were placed per farm, based on field history and farm size. Surrounding field vegetation was recorded to investigate if any relationship exists between moth catches and vegetation (Appendix II). Wingtraps (Contech Delta Trap Product # 300000075 and Great Lake IPM Product # IPM-101-00) were baited with cranberry fruitworm lures (Great Lakes IPM Product # IPM-CFW-L1500). Pheromone lures were replaced at 4 week intervals (replaced during the weeks of June 20, 2016 and July 18, 2016). Wingtraps were hung on wooden stakes approximately 30-cm above ground-level and positioned so that the openings faced East-West (Fig.1). When multiple traps were hung on the same stake, cranberry fruitworm traps were paired with cranberry girdler traps, and not with sparganothis fruitworm or

blackheaded fireworm traps, in order to minimize any potential pheromone interference. Traps were situated approximately 10m from the field edges.

a) b) c)

Figure 1. a) Cranberry fruitworm pheromone trap set-up b) Cranberry fruitworm trap inspection and c) Cranberry fruitworm moth caught on a sticky insert

Wingtraps were inspected weekly for moth catches. Once moth catches began, sticky inserts containing suspect moths were removed and a new insert was placed in the trap. Inserts with suspect moths had identification confirmed by E.S. Cropconsult Ltd. senior staff. Any further questions about moth ID were forwarded to BC Ministry of Agriculture.

Infested Fruit Surveillance in Cranberry

Green fruit was collected between June 6 July 19, 2016 from a total of four cranberry fields (two fields in West Delta and one field each in South Richmond and Pitt Meadows) (Table 2). These fields were chosen based on high trap catches and damage observed in previous years. Fruits were assessed weekly for a total of 7 assessments. For each assessment, 400 berries were collected from a 20m radius around the pheromone trap (Fig. 2). The intention of these collections was to determine when eggs where present, and when larvae were first detected in the fruit.

Two additional collections of ripe fruit were done September 9th and 26th, 2016, with the intention of determining level of fruit damage close to harvest. For the September fruit collection, berries were collected from five 30 X 30cm locations in 15 fields with varying moth catch numbers (zero, low, medium and high) (Table 2). Areas with suspected cranberry fruitworm damage within the field were targeted during this sampling period.

Berries were placed in plastic bags and held in a fridge until viewing. Green fruit assessments were done by staff at the BC Ministry of Agriculture (BCAGRI) in Abbotsford, by examining under a dissecting microscope for eggs (hatched, yellow, or dead), larvae, bore holes, or damage. Ripe fruit at harvest assessments were done by ES Cropconsult staff at their field offices using the same assessment methods.

Table 1. Summary of cranberry farm locations and number of traps per farm, 2016

Farm Name	Region	# traps/farm
Surrey 1	Surrey	2
East Delta 1	East Delta	3
East Delta 2	East Delta	2
West Delta 1	West Delta	7
West Delta 2	West Delta	5
West Delta 3	West Delta	7
West Delta 4	West Delta	4
South Richmond 1	South Richmond	4
South Richmond 2	South Richmond	2
South Richmond 3	South Richmond	5
South Richmond 4	South Richmond	3
South Richmond 5	South Richmond	2
North Richmond 1	North Richmond	3
North Richmond 2	North Richmond	2
North Richmond 3	North Richmond	2
North Richmond 4	North Richmond	7
North Richmond 5	North Richmond	9
North Richmond 6	North Richmond	2
North Richmond 7	North Richmond	4
North Richmond 8	North Richmond	2
North Richmond 9	North Richmond	3
North Richmond 10	North Richmond	2
Langley 1	Langley	1
Langley 2	Langley	4
Langley 3	Langley	4
Langley 4	Langley	3
Langley 6	Langley	2
Langley 7	Langley	1
Langley 8	Langley	1
Langley 9	Langley	1
PMMR 1	Pitt Meadows/ Maple Ridge	27
PMMR 2	Pitt Meadows	5
PMMR 3	Pitt Meadows	4
PMMR 4	Pitt Meadows	1
PMMR 5	Pitt Meadows	4
PMMR 6	Pitt Meadows	1
PMMR 7	Pitt Meadows	2
PMMR 8	Pitt Meadows	2
Chilliwack 1	Chilliwack	1
Chilliwack 2	Chilliwack	1
Total farms: 40	**Total regions: 8**	**Total traps: 147**

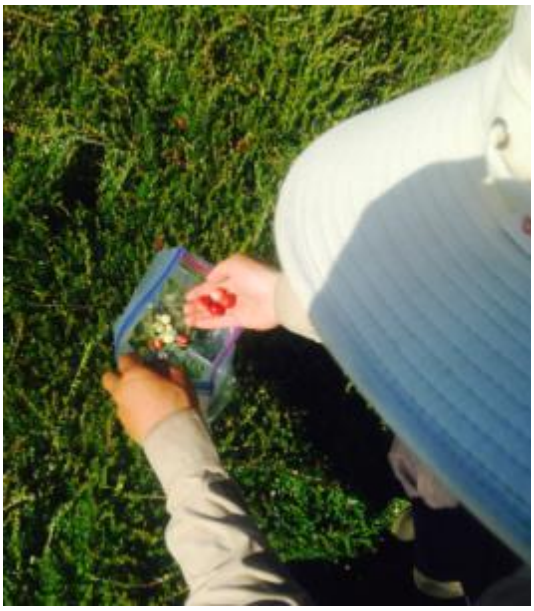


Figure 2. Berry collection in the field (left) and berry assessment under a dissecting microscope (right).

Table 2. Summary of green and ripe fruit collection location and cranberry fruitworm level

Area	Number of fields green fruit	Number of fields ripe fruit	Fruitworm level (based on trap catches)
West Delta	2	4	High
South Richmond	1	3	High
East Delta	0	0	Moderate
Pitt Meadows/ Maple Ridge	1	3	Moderate
North Richmond	0	2	Low to moderate
Surrey	0	1	Low
Langley	0	2	Zero
Chilliwack	0	0	Zero

Degree Day Model

The cranberry fruitworm degree day model from Michigan State predicts moth flight to begin approximately $350DD_{50°F}$ after March 1st (Isaacs and Salazar 2009). The biofix date is the trap check date immediately prior to first sustained moth catch. This degree day model predicts egg laying will begin $85DD_{50}$ following the biofix date, and continue until $400DD_{50}$ have elapsed (Isaacs and Salazar 2009).
The model prediction was compared to actual timing of moth flight based on trap catches and egg laying based on egg searches in Richmond and Pitt Meadows. Temperature data (in Fahrenheit) from the Richmond and Pitt Meadows airports was used in a single sine degree day model from Oregon State University (http://uspest.org/risk/models) with a start date of March 1st , a lower development temperature threshold of

50°F and an upper development threshold of 86°F. The biofix date for the cranberry fruitworm degree day calculations was established as seven days before the first sustained trap catch in Richmond or Pitt Meadows.

RESULTS AND DISCUSSION

Moth flight activity (Cranberries)

Male moths were caught in pheromone traps for eleven consecutive weeks, from the week of May 30th to the week of August 21, 2016 (Fig. 3; Appendix I). This was approximately the same as 2015 for first initial catch, one week earlier than 2014, two weeks earlier than 2013, and four weeks earlier than 2012. However the length of positive trap catches for eleven consecutive weeks was longer this year. Moths were caught in traps for a period of eight weeks in 2015, nine weeks in 2014, eight weeks in 2013 and seven weeks in 2012.

A single peak in moth flight was recorded during the week of June 20th 2016(Fig. 3). The peak trap catch of 2.3 moths per trap across all sites was slightly higher than the 2014 2.19 peak per trap catch, and higher that all other years. Cranberry fruitworm moth detection by pheromone traps is an important monitoring tool, and has now been incorporated into the standard monitoring practices for cranberry fields in BC.

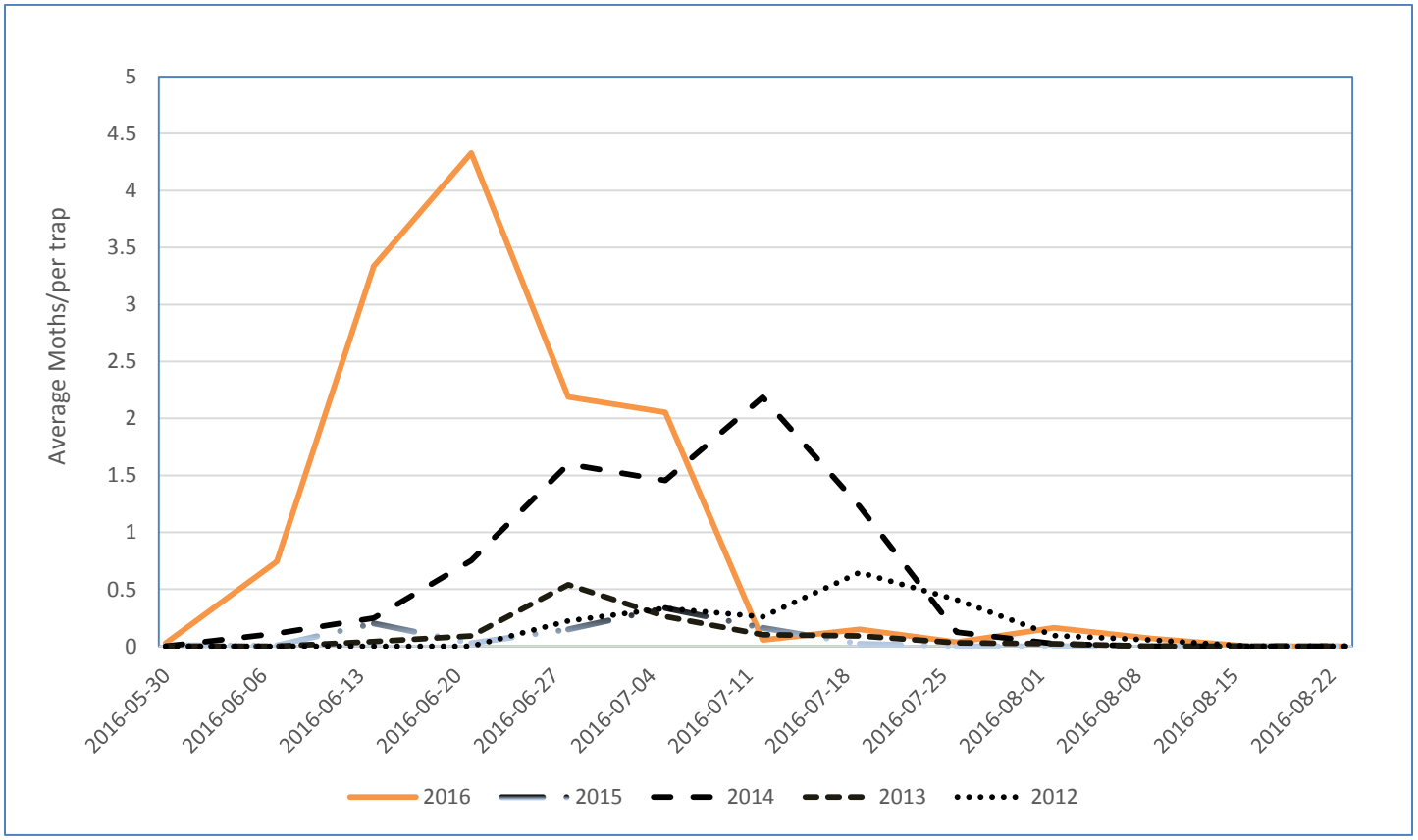

Figure 3. Average Pheromone trap catches of male cranberry fruitworm (*Acrobasis vaccinii*) moths in cranberries during the 2012, 2013, 2014, 2015, and 2016 field seasons

Out of all the regions where traps were placed, South Richmond fields caught the most moths in 2016 (Fig. 4). This is consistent with previous seasons. Initial trap catches were observed in the South and North Richmond

regions on May 30th and were seen a week later in other regions on June 6th. The Delta, North Richmond and Pitt Meadows/Maple Ridge (PMMR) regions had lower trap catches. Traps placed in the Langley and Chilliwack regions have not caught any moths in any years of our study.

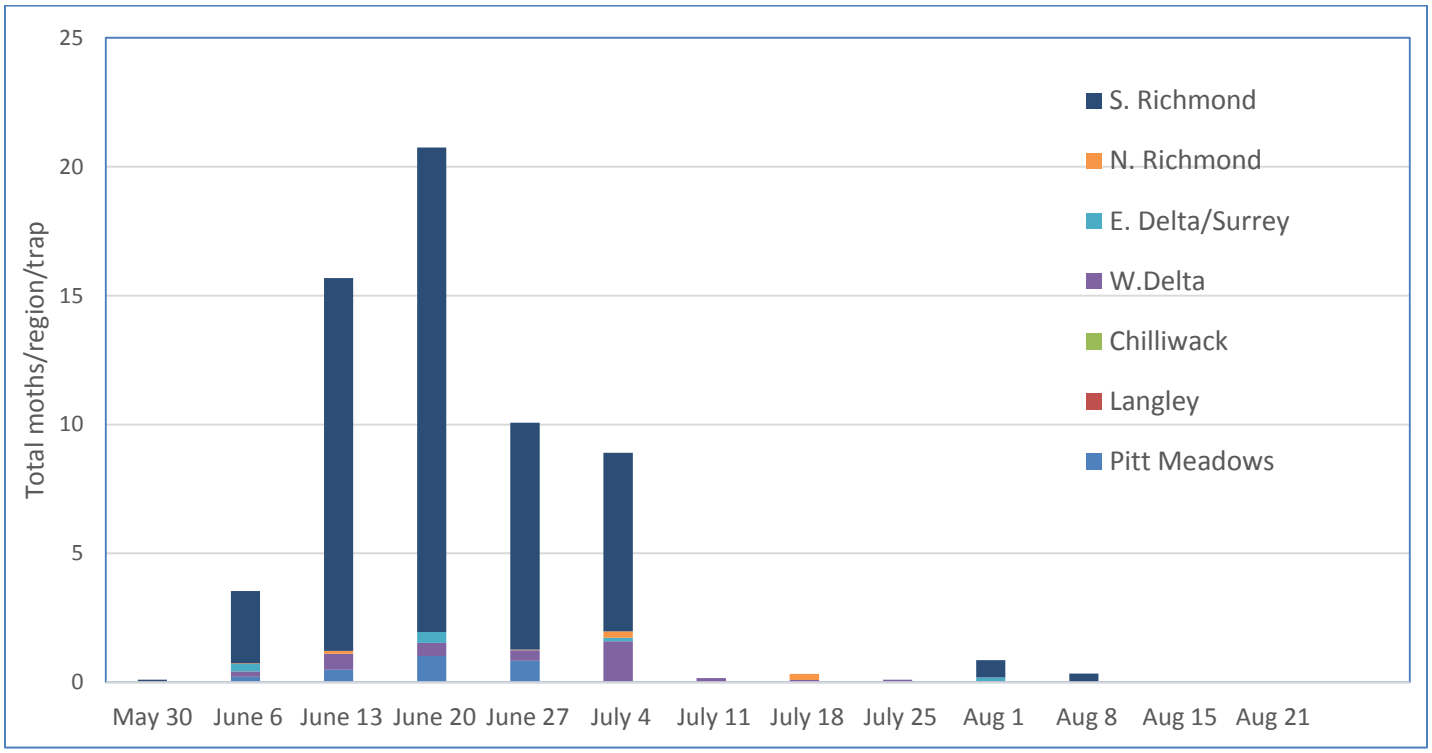

Figure 4. Total moths per region per trap, May 30 – August 21, 2016

Cranberry fruitworm moths were caught in 44% of traps (64 out of 147 fields). In comparison, 20% of traps were positive in 2015 (29 out of 143 fields), 52% of traps were positive in 2014 (50 out of 97), 33% in 2013 (33 out of 100) and 26% in 2012 (14 out 54). Trap catches in 2016 were overall similar to previous years in all regions, except Surrey as this was our first year of trapping on this farm and in this region (Fig. 5)

Fruit damage (Cranberries)

Though 8000 fruit were inspected in June and July 2016, no eggs were found in 2016 samples. In previous years, eggs could readily be found in fields with a history of fruitworm and moth catches. In other growing regions, the threshold for cranberry fruitworm control is set at one egg found per hundred berries (Mahr, 2011). In our experience, cranberry fruitworm egg counts have been highly variable and time consuming, so therefore it is not recommended as a primary monitoring and decision making tool for BC cranberry growers.

Pre-harvest ripe berry damage levels ranged from 0% to 9.2% (Table 3). Overall, ripe berry damage in 2016 was higher than 2014 but comparable to other years. In 2015, berry damage ranged from 0% to 1.11%. In 2014, berry damage ranged from 0% to 10.73%, and from 0 to 6.85% in 2013. While it is clear there is variability in damage assessment results, it appears that if moth catches are 'high' there will be detectable damage to fruit, using the methods in this study.

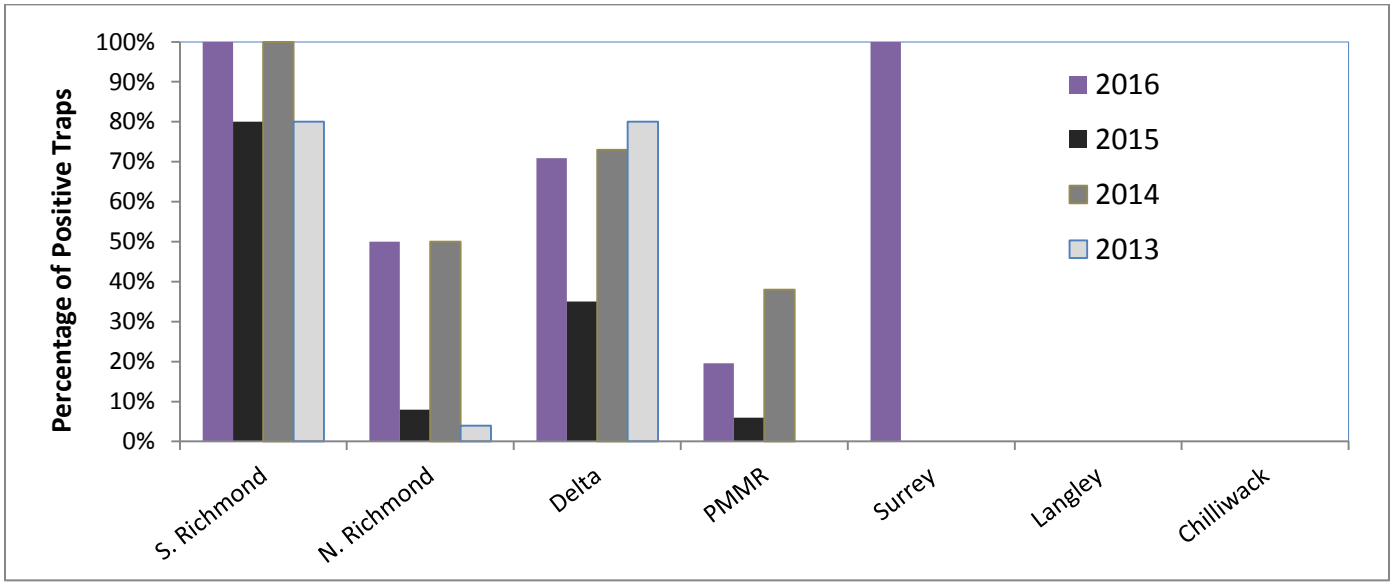

Figure 5. Regional comparison of the percentage of positive cranberry fruitworm pheromone traps in cranberry fields within the Fraser Valley during the 2016 growing season.

Table 3. 2016 post-harvest berry damage assessment in select fields.

Relative abundance of fruitworm	Field	Trap catches	First Assessment (Sept 9) (% damage)	Second Assessment (Sept 26) (% damage)	Sprays on "High fields in 2016:
High	**S. Richmond 4-3**	80	9.2%	4.4%	Altacor, June 15 and 28
High	**S. Richmond 2-1**	69	0	0.39%	Altacor, June 15 and 29
High	**S.Richmond 1-1**	60	0	0	Intrepid, June 6 and 27
Moderate	**W. Delta 2-4**	11	0	0	
Moderate	**W. Delta 1- 6**	1	0	0	
Moderate	**PMMR2-4**	7	0	0	
Moderate	**W. Delta 3-2**	11	0	0	
Moderate	**W. Delta 4-1**	17	0	0	
Low	**N. Richmond 4-6**	1	0	0	
Low	**N. Richmond 3-1**	2	0	0	
Low	**Surrey 1-5**	1	0	0	
Nil	**Langley 3**	0	0	0	
Nil	**Langley 7**	0	0	0	
Nil	**PMMR 1-14**	0	0	0	
Nil	**PMMR7-2**	0	0	0	

Degree Days

The cranberry fruitworm degree day model with Richmond airport temperature data predicted that moth flight would begin on May 24, 2016 (Table 4; Appendix III). The first trap catch occurred in cranberry fields in South Richmond on May 30th, the other traps started catching moths on June 6th Using the biofix date of May 23rd (7 days before first sustained trap catch), the degree day model predicted egg laying would occur from June 2- July 1 2016. As no eggs were detected in 2016, this comparison cannot be made. When Pitt Meadows airport temperatures were entered into the model, moth flight was predicted to start on May 12th. Using the date of actual first trap catch (June 6th), and a biofix date of May 30th (7 days before first sustained trap catch), the degree day model predicted egg laying would occur from June 4- July 2, 2016. Again, no eggs were detected in 2016, so the accuracy of the model in predicting egg laying cannot be assessed.

In 2014, 2015, and 2016 the cranberry fruitworm degree day model accurately predicted the timing of moth flight in Richmond. As in previous years, the degree day model predictions in Pitt Meadows did not correspond well to trap catches or egg detections in 2016Trap catches were higher this year in Pitt Meadows, with 24 moths caught over the trapping period. However this is still quite low compared to South Richmond (684 moths) caught in 2016. The poor fit of the degree day model in Pitt Meadows may be due to the low cranberry fruitworm population or variability between airport temperatures and field temperatures. It may be more appropriate to use a January 1 start date in BC rather than March 1st as used in the Michigan, although in 2016, using a January 1st start date in the model only pushed the predicted start date of moth flight 1 day earlier in Richmond and 2 days earlier in Pitt Meadows

Table 4. Predicted and observed dates of first moth flight and egg laying in Richmond/ Delta and Pitt Meadows cranberry fields using Richmond and Pitt Meadows airport temperatures in the cranberry fruitworm degree day model from MSU.

Event	DD50	Predicted date of occurrence in Richmond	Observed date of occurrence in Richmond	Predicted date of occurrence in Pitt Meadows	Observed date of occurrence in Pitt Meadows
First moth flight (biofix)	350 DD_{50} after March 1	May 23, 2016	May 30, 2016	May 12, 2016	June 6, 2016
Egg laying begins	85-100 DD_{50} after first trap catch	June 2, 2016	no eggs found	June 4, 2016	no eggs found
Egg laying ends	400 DD_{50} after first trap catch	July 1, 2016	no eggs or damage found	July 2, 2016	no eggs or damage found

SUMMARY

- Cranberry fruitworm activity continues to be concentrated in Delta, Richmond, and Pitt Meadows/ Maple Ridge region. No cranberry fruitworm moths have been observed in Langley or Chilliwack.

- Moths were caught in 44% of fields in the 2016 growing season, similar to what was found in previous years.

- Peak trap catch occurred the week of June 20, 2016; which is at least 1 week earlier than previous years.

- While the egg detection method used in our study was useful in determining pest phenology in most years, it is not reliable enough to use for timing insecticide sprays in BC cranberry fields.

- Cranberry fruit damage prior to harvest ranged from 0 to 9.2% which is an increase from the 0-1.11% range in 2015 but comparable to the 0%- 10.7% in 2014. Caution should be taken when comparing these values as assessments are higly variable from field to field and year to year.

- Pheromone trapping appears to be a good monitoring tool in BC cranberry fields, and has been incorporated into regular monitoing protocols.

- The cranberry fruitworm degree day model accurately predicted the timing of moth flight in Richmond for the third consecutive year. The degree day model could be relied on more heavily in future years to predict moth flight in Richmond. It has not been accurate in predicting moth flight in Pitt Meadows.

NEXT STEPS

- Continue to monitor cranberry fruitworm with pheromone traps in cranberry fields on all farms across the Fraser Valley.

- Incorporate weekly degree day model checks into cranberry fruitworm monitoring protocols for cranberry fields in 2017 to predict timing of egg laying and recommendations for insecticide sprays.

LITERATURE CITED

Isaacs, R.and C.G. Salazar. 2009. Michigan State University Extensions, Department of Entomology. **Using MSU's cranberry fruitworm degree day model.** Accessed March 27, 2017 http://msue.anr.msu.edu/news/using_msus_cranberry_fruitworm_degree_day_model

Mahr, D.L. 2011. University of Wisconsin – Madison. **CranberryFruitworm**. Accessed April 18, 2017 https://fruit.wisc.edu/wp-content/uploads/sites/36/2011/05/Cranberry-Fruitworm.pdf

Appendix I. Seasonal total cranberry fruitworm trap catches, date of peak trap catch and timing of insecticide application(s) per field for cranberry fruitworm-positive fields in 2014, 2015 and 2016.

Field	Total trap catch (2014)	Week of peak trap catch in (2014)	Insecticide spray date and product (2014)	Total trap catches (2015)	Week of peak trap catches in (2015)	Insecticide spray date and product (2015)	Total trap catches (2016)	Week of peak trap catches in (2016)	Insecticide spray date and product (2016)
East Delta 1-1	1	June 30	Altacor: July 9 Sevin: July 26	0	N/A	Intrepid: June 14 Altacor: July 8	0	N/A	Altacor: June 13
East Delta 1-4	0	N/A	Altacor: July 9 Sevin: July 26	0	N/A	Intrepid: June 14 Altacor: July 8	1	June 6	Altacor: June 13
East Delta 2-1	2	July 7	Intrepid: June 25 Intrepid: July 11	3	July 6	Intrepid: June 9 Intrepid: July 14	2	June 20	Intrepid: June 17 Intrepid: June 30
East Delta 2-2	2	June 23/ July 7	Intrepid: June 25 Intrepid: July 11	6	July 6	Intrepid: June 9 Intrepid: July 14	2	June 6 July 25	Intrepid: June 17 Intrepid: June 30
West Delta 2-1	0	-	-	0	-	-	6	July 4	Intrepid: June 17 Intrepid: July 1
West Delta 2-2	1	August 4	Intrepid: June 25 Altacor: July 10	0	N/A	Intrepid: June 17 Intrepid: July 1	4	June 13 June 20	Intrepid: June 17 Intrepid: July 1
West Delta 2-3	3	June 23/June 30/July 14	Intrepid: June 25 Altacor: July 10	0	N/A	Intrepid: June 17 Intrepid: July 1	12	July 4	Intrepid: June 17 Intrepid: July 1
West Delta 2-4	6	June 30	Intrepid: July 1 Altacor: July 15	2	July 6/July 13	Intrepid: June 24 Intrepid: July 6	11	July 4	Intrepid: June 17 Intrepid: July 1
West Delta 2-5	0	N/A	Intrepid: June 25 Altacor: July 10	1	July 6	Intrepid: June 24 Intrepid: July 6	4		Intrepid: June 17 Intrepid: July 1
West Delta 3-1	53	July 14	Diazinon: July 2 Intrepid: July 28	0	N/A	Diazinon: June25 Altacor: July 10	1	June 6	Diazinon: June 14
West Delta 3-2	38	July 21	Diazinon: July 2 Intrepid: July 28	3	June 29	Diazinon: June25 Altacor: July 10	11	July 4	Diazinon: June 14
West Delta 3-3	43	July 14	Diazinon: July 2 Intrepid: July 28	15	June 29	Diazinon: June 11 Altacor: July 10	8	July 4	Diazinon: June 14
West Delta 3-4 (taken out)	22	July 14	Diazinon: July 2 Intrepid: July 28	-	-	-	-	-	-
West Delta 3-5	9	July 14	Entrust: July 18	0	N/A	Diazinon: June 11 Altacor: July 10	1	July 4	Diazinon: June 14
West Delta 3-6	17	July 21	Entrust: July25	0	N/A	Dipel: June 12 Entrust: July 17	5	July 4 July 10	No Sprays
West Delta 3-7	11	July 14	Diazinon: July 2 Intrepid: July 28	0	N/A	Diazinon: June25 Altacor: July 10	1	June 20	Diazinon: June 14
West Delta 3-8	23	July 14	Diazinon: July 2 Intrepid: July 28	2	July 6	Diazinon: June25 Altacor: July 10	0	N/A	Diazinon: June 14
West Delta 1-1	4	July 7	Intrepid: July 4 Sevin: July 15	0	N/A	Intrepid: June 17 Intrepid: June 30	0	N/A	No Sprays
West Delta 1-3	4	June 30	Intrepid: July 4 Sevin: July 15	0	N/A	Intrepid: June 17 Diazinon: June 27	0	N/A	No Sprays
West Delta 1-4	2	June 23/July 7	Intrepid: July 4 Sevin: July 15	0	N/A	Intrepid: June 17 Diazinon: June 27	2	June 20	No Sprays
***West Delta 1-5**	2	June 23/ July 7	Intrepid: July 1 Sevin: July 15	2	June 29/ July 6	Intrepid: June 20 Intrepid: June 30	0	N/A	No Sprays
West Delta 1-6	0	N/A	-	0	N/A	-	1	June 13	No Sprays
West Delta 1-East	0	N/A	Intrepid: July 1 Intrepid: July 17	1	June 29	Intrepid: June10 Intrepid: June 30	0	N/A	No Sprays
West Delta 1-West	1	June 30	Intrepid: July 1 Intrepid: July 17	0	N/A	Intrepid: June10 Intrepid: June 30	0	N/A	No Sprays
West Delta 4-1	N/A	N/A	N/A	8	July 6	-	17	June 27	Altacor June 20 Altacor June 30 Intrepid July 11
West Delta 4-2	N/A	N/A	NA	5	July 6	-	4	July 4	Altacor June 20 Altacor June 30 Intrepid July 11
South Richmond 1-1	29	June 23	Intrepid: July 2 Altacor: July 15	1	July 13	Intrepid July 4 Intrepid July 13	61	June 20	Intrepid June 6 Intrepid June 27
South Richmond 1-2	12	June 23	Intrepid: July 2 Altacor: July 15	3	July 13	Intrepid July 4 Intrepid July 13	48	June 27	Intrepid June 6 Intrepid June 27
South Richmond 1-3	17	July 7	Intrepid: July 2 Altacor: July 15	3	July 6	Intrepid July 4 Intrepid July 13	56	July 4	Intrepid June 6 Intrepid June 27
South Richmond 1-4	14	June 23	Intrepid: July 2 Altacor: July 15	2	July 6/July 20	Intrepid July 4 Intrepid July 13	44	June 13	Intrepid June 6 Intrepid June 27

South Richmond 2-1	51	July 21	Altacor: July 2 Altacor: July 29	8	July 13	Altacor July 3 Altacor July 13	69	June 20	Altacor June 15 Altacor June 29
South Richmond 2-2	N/A	N/A	-	5	July 6/ July 13	Altacor July 3 Altacor July 13	43	June 13	Altacor June 15 Altacor June 29
South Richmond 4-1	55	July 14	Altacor: July 2 Altacor: July 15	0	N/A	-	0	N/A	Altacor June 15 Altacor June 28
***South Richmond 4-2**	27	June 30	Altacor: July 2 Altacor: July 15	0	N/A	-	67	June 13	Altacor June 15 Altacor June 28
South Richmond 4-3	67	June 30/July 14	Altacor: July 2 Altacor: July 15	0	N/A	Altacor July 3 Altacor July 14	80	June 20	Altacor June 15 Altacor June 28
South Richmond 4-4	21	June 30	Altacor: July 2 Altacor: July 15	5	July 6	Altacor July 3 Altacor July 14	42	June 20	Altacor June 15 Altacor June 28
***South Richmond 3-1**	56	June 30	Altacor: July 2 Altacor: July 15	0	N/A	Altacor July 3 Altacor July 14	0	N/A	-
South Richmond 3-2	14	June 30/ July 14	Altacor: July 2 Altacor: July 15	1	July 6	Altacor July 3 Altacor July 14	34	June 20	Altacor June 15 Altacor June 28
South Richmond 3-3	34	July 14	Altacor: July 2 Altacor: July 15	2	July 13	Altacor July 3 Altacor July 14	68	June 13	Altacor June 15 Altacor June 28
South Richmond 3-4	42	July 7	Altacor: July 2 Altacor: July 15	0	N/A	Altacor July 3 Altacor July 14	29	June 20	Altacor June 15 Altacor June 28
South Richmond 3-5	N/A	N/A	-	11	July 6	Altacor July 3 Altacor July 14	62	June 20	Altacor June 15 Altacor June 28
South Richmond 5-2	21	June 30/July 14	Altacor: July 1 Altacor: July 15	2	July 6	Altacor July 3 Altacor July 14	53	June 13 June 20	Altacor June 16 Altacor June 29
South Richmond 5-3	20	June 23	Altacor: July 1 Altacor: July 15	4	July 6	Altacor July 3 Altacor July 14	37	June 13	Altacor June 16 Altacor June 29
North Richmond 1-4	1	June 30	Altacor: July 29	1	June 29	Altacor: June 22	0	N/A	No Sprays
North Richmond 1-5	-	N/A	-	-	N/A	-	1	July 4	No Sprays
North Richmond 8-1	1	June 30	Altacor: July 17	0	N/A	No spray	2	July 4	Altacor July 8
North Richmond 5-2	1	July 7	Diazinon: July 4 Sevin: July 20	0	N/A	Altacor: June 20	1	June 6	No Sprays
North Richmond 5-4	-	-	N/A	-	-	N/A	2	July 10	No Sprays
North Richmond 5-10	3	July 14	Diazinon: July 4 Sevin: July 20	0	N/A	Altacor: June 20	0	N/A	No Sprays
North Richmond 5-11	1	July 14	Diazinon: July 4 Sevin: July 20	0	N/A	Altacor: June 20	1	July 10	No Sprays
North Richmond 6-1	-	-	-	-	-	-	1	June 27	No Sprays
North Richmond 6-2	1	June 30	Altacor: July 3	0	N/A	No spray	0	N/A	No Sprays
North Richmond 2-1	1	July 14	Diazinon: July 30	0	N/A	Altacor: June 19 Altacor: July 6	1	July 10	No Sprays
North Richmond 2-2	-	-	-	-	-	-	2	July 10	No Sprays
North Richmond 3-1	N/A	N/A	-	1	June 29	No Spray	2	July 4	No Sprays
North Richmond 4-2	-	-	-	-	-	-	1	July 4	Altacor June 22
North Richmond 4-3	2	July 7/ July 21	None	0	N/A	Diazinon: June 19 Altacor: July 4	2	July 4 July 11	Altacor: June 22
North Richmond	1	June 30	Altacor: July 5 Diazinon: July 11	0	N/A	Diazinon: June 27	2	July 4	Altacor June 22

4-4									
North Richmond 4-5	2	July 7/ July 21	Diazinon: July 5 Sevin: July 18	0	N/A	Diazinon: June 27 Altacor: July 4	0	N/A	Altacor: June 22
North Richmond 4-6	2	July 7/July 28	Diazinon: July 5 Diazinon: July 11	1	June 29	Diazinon: June 27 Altacor: July 4	1	June 13	Altacor: June 22
North Richmond 9-7	-	-	-	-	-	-	2	June 13	No Sprays
N. Richmond 10-1	-	-	-	--	-	-	1	June 13	Diazinon June 14
N. Richmond 10-2	-	-	-	-	-	-	1	May 30	Diazinon June 14
PMMR 4-1	-	-	-	-	-	-	1	June 27	No Sprays
PMMR 2-1	1	June 30	Altacor: June 30	2	June 22/ June 29	Intrepid June 18	9	June 27	Altacor June 14 Altacor July1
PMMR 2-2	5	June 30/July 7	Altacor: June 30	0	N/A	Intrepid June 18	3	June 6	Altacor June 14 Altacor July1
PMMR 2-3	-	-	-	-	-	-	1	June 13	Altacor June 14 Altacor July1
PMMR 2-4	-	-	-	-	-	-	7	June 20	Altacor June 14 Altacor July1
PMMR 2-5	0	N/A	-	2	June 22/June 29	Intrepid June 18	2	June 27	Altacor June 14 Altacor July1
PMMR 1-3	1	June 22	Altacor: July 1	0	N/A	-	0	N/A	-
PMMR 1-5	1	July 7	Altacor: July 1	0	N/A	-	0	N/A	-
PMMR 1-6	1	July 7	Altacor: July 10	0	N/A	-	0	N/A	-
PMMR 1-10	-	-	-	-	-	-	1	June 27	No Sprays
PMMR 8-1	-	-	-	-	-	-	65	June 20	Altacor June 16 Altacor July 1
PMMR 8-2	0	N/A	-	2	June 22/June 29	Altacor June 25	30	June 20	Altacor June 16 Altacor July 1
Surrey 1-3	0	N/A	-	0	N/A	-	1	July 4	No sprays
Surrey 1-5	0	N/A	-	0	N/A	-	1	June 27	No sprays

Appendix II. -Vegetation surrounding <u>positive</u> pheromone traps in cranberry fields during the 2016 growing season.

	VEGETATION WITHIN 100 m OF TRAPS (blueberries, cranberries, grassland, shrubs, forest, weeds, or weeds etc.)			
2016 Positive Trap Catch Fields	**North**	**East**	**South**	**West**
East Delta 1-2	Cranberries	Cranberries	Farmyard	Blueberries
East Delta 2-1	Corn	Grassland	Grassland	Cranberries
East Delta 2-2	Corn	Cranberries	Grassland	Grassland
East Delta 2-3	Cranberries	Vegetables	Grassland	Cranberries
West Delta 1-4	Vegetables	Vegetables	Cranberries	Cranberries
West Delta 1-6	Vegetables	Cranberries	Vegetables	Cranberries
West Delta 2-4	Ditch	Cranberries	Cranberries	Industrial
West Delta 2-5	Cranberries	Cranberries	Corn	Industrial
West Delta 3-1	Cranberries	Vegetables	Cranberries	Cranberries
West Delta 3-2	Cranberries	Vegetables	Cranberries	Cranberries
West Delta 3-3	Forest	Vegetables	Grassland	Forest
West Delta 3-5	Barns	Farmyard	Cranberries	Cranberries

West Delta 3-6	Cranberries	Cranberries	Farmyard	Vegetables
West Delta 3-7	Cranberries	Vegetables	Farmyard	Cranberries
West Delta 1-5	Road/ditch	Greenhouse	Cranberries	Vegetables
West Delta 1-W	Cranberries	Cranberries	Ditch	Strawberries
W. Delta 4-1	Forest	Industrial	Forest	Cranberries
W. Delta 4-2	Forest	Cranberries	Forest	Cranberries
South Richmond 1-1	Golf Course	Cranberries	Forest	Clear Cut
South Richmond 1-2	Golf Course	Cranberries	Forest	Cranberries
South Richmond 1-3	Golf Course	Cranberries	Forest	Cranberries
South Richmond 1-4	Golf Course	Bare Land	Forest	Cranberries
South Richmond 2-1	Cranberries	Forest	Vegetables	Livestock barns
South Richmond 2-2	Clear Cut	Forest	Cranberries	Livestock barns
South Richmond 4-4	Cranberries	Blueberries	Cranberries	Cranberries
South Richmond 3-2	Cranberries	Cranberries	Cranberries	Forest
South Richmond 3-3	Cranberries	Cranberries	Cranberries	Forest
South Richmond 3-5	Cranberries	Cranberries	Cranberries	Forest
South Richmond 5-2	Blueberries	Cranberries	Cranberries	Cranberries
South Richmond 5-3	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 1-5	Cranberries	Cranberries	Corn	Cranberries
North Richmond 3-1	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 4-2	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 4-3	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 4-4	Cranberries	Cranberries	Cranberries	Corn
North Richmond 4-6	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 5-2	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 5-4	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 5-11	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 6-1	Cranberries	Residential	Cranberries	Cranberries
North Richmond 7-3	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 7-9	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 8-1	River	Cranberries	Cranberries	Cranberries
North Richmond 9-7	Cranberries	Cranberries	Cranberries	Cranberries
North Richmond 10-1	River	Cranberries	Cranberries	Cranberries
North Richmond 10-2	River	Cranberries	Cranberries	Cranberries
Surrey 1-3	Blueberries	Blueberries	Cranberries	Cranberries
Surrey 1-5	Blueberries	Cranberries	Blueberries	Blueberries
PMMR 1-10	Cranberries	Cranberries	Blueberries	Cranberries
PMMR 2-1	Blueberries	Cranberries	Cranberries	Ravine
PMMR 2-2	Blueberries	Cranberries	Cranberries	Ravine
PMMR 2-3	Cranberries	Cranberries	Corn	Ravine
PMMR 2-4	Blueberries	Cranberries	Cranberries	Cranberries
PMMR 2-5	Cranberries	Residential	Raspberry/Blueberry	Cranberries
PMMR 4-1	Cranberries	Ravine	Golf Course	Cranberries
PMMR 8-1	Blueberries	Blueberries	Cranberries	Blueberries
PMMR 8-2	Blueberries	Blueberries	Bare land	Cranberries

Appendix III. Cranberry fruitworm degree day model used to predict moth flight with Richmond airport temperature data starting on March 1, 2016 using a lower development threshold of 50°F and an upper development threshold of 86°F (http://uspest.org/risk/models)

Output from uspest.org/wea Degree-day Model & Calculator web program:

Heat Units from daily weather data

Output from uspest.org/wea Degree-day Model & Calculator web program:
Heat Units from daily weather data

==========CALCULATOR INPUTS==========
Calculation method: single sine
Lower threshold: 50 degrees Fahrenheit
Upper threshold: 86 degrees Fahrenheit
Directions for starting/BIOFIX: user specified
Starting/BIOFIX date: 1 1
No ending date, set to: default date 12 31

==========CALCULATOR OUTPUT==========
Weather station: 2016 CYVR CANADA Vancouver Int Air-Pt B BC Lat:49.1831 Long:-123.1667 Elev:10

mn	day	max	min	precip	DD50	CUMDD50	event
3	1	51.80	42.80	0.00	0.35	0.3	* START *
3	2	51.80	44.60	0.00	0.39	0.7	
3	3	55.40	46.40	0.00	1.91	2.7	
3	4	53.60	46.40	0.00	1.15	3.8	
3	5	62.60	46.40	0.00	5.24	9.0	
3	6	53.60	46.40	0.00	1.15	10.2	
3	7	48.20	42.80	0.00	0.00	10.2	
3	8	50.00	41.00	0.00	0.00	10.2	
3	9	51.80	42.80	0.00	0.35	10.5	
3	10	51.80	44.60	0.00	0.39	10.9	
3	11	50.00	41.00	0.00	0.00	10.9	
3	12	50.00	41.00	0.00	0.00	10.9	
3	13	46.40	41.00	0.00	0.00	10.9	
3	14	48.20	42.80	0.00	0.00	10.9	
3	15	50.00	35.60	0.00	0.00	10.9	
3	16	48.20	35.60	0.00	0.00	10.9	
3	17	50.00	33.80	0.00	0.00	10.9	
3	18	50.00	35.60	0.00	0.00	10.9	
3	19	55.40	41.00	0.00	1.46	12.4	
3	20	53.60	46.40	0.00	1.15	13.5	
3	21	55.40	48.20	0.00	2.19	15.7	
3	22	59.00	44.60	0.00	3.26	19.0	
3	23	48.20	46.40	0.00	0.00	19.0	
3	24	50.00	44.60	0.00	0.00	19.0	
3	25	50.00	41.00	0.00	0.00	19.0	
3	26	51.80	42.80	0.00	0.35	19.3	
3	27	51.80	42.80	0.00	0.35	19.7	
3	28	53.60	37.40	0.00	0.74	20.4	
3	29	53.60	35.60	0.00	0.70	21.1	
3	30	59.00	41.00	0.00	2.86	24.0	
3	31	62.60	42.80	0.00	4.62	28.6	
4	1	60.80	44.60	0.00	4.07	32.7	
4	2	59.00	46.40	0.00	3.54	36.2	

4	3	59.00	46.40	0.00	3.54	39.8
4	4	57.20	48.20	0.00	3.05	42.8
4	5	51.80	44.60	0.00	0.39	43.2
4	6	60.80	50.00	0.00	5.40	48.6
4	7	59.00	42.80	0.00	3.04	51.6
4	8	64.40	42.80	0.00	5.43	57.1
4	9	57.20	48.20	0.00	3.05	60.1
4	10	59.00	44.60	0.00	3.26	63.4
4	11	57.20	50.00	0.00	3.60	67.0
4	12	53.60	44.60	0.00	1.01	68.0
4	13	53.60	42.80	0.00	0.92	68.9
4	14	53.60	46.40	0.00	1.15	70.1
4	15	57.20	44.60	0.00	2.48	72.5
4	16	57.20	46.40	0.00	2.72	75.3
4	17	59.00	41.00	0.00	2.86	78.1
4	18	71.60	44.60	0.00	9.15	87.3
4	19	64.40	50.00	0.00	7.20	94.5
4	20	68.00	50.00	0.00	9.00	103.5
4	21	64.40	55.40	0.00	9.90	113.4
4	22	59.00	51.80	0.00	5.40	118.8
4	23	60.80	51.80	0.00	6.30	125.1
4	24	55.40	48.20	0.00	2.19	127.3
4	25	55.40	46.40	0.00	1.91	129.2
4	26	59.00	44.60	0.00	3.26	132.4
4	27	59.00	44.60	0.00	3.26	135.7
4	28	62.60	50.00	0.00	6.30	142.0
4	29	60.80	51.80	0.00	6.30	148.3
4	30	60.80	44.60	0.00	4.07	152.4
5	1	66.20	48.20	0.00	7.44	159.8
5	2	75.20	51.80	0.00	13.50	173.3
5	3	68.00	57.20	0.00	12.60	185.9
5	4	59.00	48.20	0.00	3.92	189.8
5	5	62.60	50.00	0.00	6.30	196.1
5	6	66.20	52.00	0.00	9.10	205.2
5	7	68.00	53.60	0.00	10.80	216.0
5	8	59.00	50.00	0.00	4.50	220.5
5	9	64.40	44.60	0.00	5.73	226.3
5	10	68.00	48.20	0.00	8.33	234.6
5	11	69.80	50.00	0.00	9.90	244.5
5	12	68.00	48.20	0.00	8.33	252.8
5	13	71.60	46.40	0.00	9.59	262.4
5	14	71.60	55.40	0.00	13.50	275.9
5	15	62.60	55.40	0.00	9.00	284.9
5	16	60.80	53.60	0.00	7.20	292.1
5	17	66.20	51.80	0.00	9.00	301.1
5	18	66.20	53.60	0.00	9.90	311.0
5	19	57.20	51.80	0.00	4.50	315.5
5	20	62.60	50.00	0.00	6.30	321.8
5	21	64.40	48.20	0.00	6.56	328.4
5	22	66.20	51.80	0.00	9.00	337.4
5	23	62.60	55.40	0.00	9.00	346.4
5	24	64.40	55.40	0.00	9.90	356.3

Cranberry fruitworm degree day model used to predict egg laying with Richmond airport temperature data starting on May 23, 2016 (biofix) using a lower development threshold of 50°F and an upper development threshold of 86°F (http://uspest.org/risk/models)

Output from uspest.org/wea Degree-day Model & Calculator web program:
Heat Units from daily weather data

==========CALCULATOR INPUTS==========

Calculation method:	single sine
Lower threshold:	50 degrees Fahrenheit
Upper threshold:	86 degrees Fahrenheit
Directions for starting/BIOFIX:	user specified
Starting/BIOFIX date:	1 1
No ending date, set to:	default date 12 31

==========CALCULATOR OUTPUT==========

Weather station: 2016 CYVR CANADA Vancouver Int Air-Pt B BC Lat:49.1831 Long:-123.1667 Elev:10

mn	day	max	min	precip	DD50	CUMDD50	event
5	23	62.60	55.40	0.00	9.00	9.0	* START *
5	24	64.40	55.40	0.00	9.90	18.9	
5	25	66.20	55.40	0.00	10.80	29.7	
5	26	59.00	50.00	0.00	4.50	34.2	
5	27	60.80	48.20	0.00	4.79	39.0	
5	28	57.20	48.20	0.00	3.05	42.0	
5	29	62.60	50.00	0.00	6.30	48.3	
5	30	64.40	48.20	0.00	6.56	54.9	
5	31	68.00	50.00	0.00	9.00	63.9	
6	1	69.80	57.20	0.00	13.50	77.4	
6	2	66.20	57.20	0.00	11.70	89.1	
6	3	71.60	59.00	0.00	15.30	104.4	
6	4	71.60	60.80	0.00	16.20	120.6	
6	5	77.00	60.80	0.00	18.90	139.5	
6	6	75.20	59.00	0.00	17.10	156.6	
6	7	71.60	55.40	0.00	13.50	170.1	
6	8	64.40	55.40	0.00	9.90	180.0	
6	9	64.40	51.80	0.00	8.10	188.1	
6	10	64.40	51.80	0.00	8.10	196.2	
6	11	62.60	51.80	0.00	7.20	203.4	
6	12	66.20	53.60	0.00	9.90	213.3	
6	13	64.40	55.40	0.00	9.90	223.2	
6	14	57.20	48.20	0.00	3.05	226.2	
6	15	59.00	46.40	0.00	3.54	229.8	
6	16	62.60	48.20	0.00	5.67	235.5	
6	17	68.00	50.00	0.00	9.00	244.5	
6	18	59.00	55.40	0.00	7.20	251.7	
6	19	62.60	53.60	0.00	8.10	259.8	
6	20	69.80	50.00	0.00	9.90	269.7	
6	21	68.00	55.40	0.00	11.70	281.4	
6	22	68.00	55.40	0.00	11.70	293.1	
6	23	68.00	55.40	0.00	11.70	304.8	
6	24	66.20	53.60	0.00	9.90	314.7	
6	25	66.20	55.40	0.00	10.80	325.5	
6	26	71.60	53.60	0.00	12.60	338.1	
6	27	75.20	59.00	0.00	17.10	355.2	

6	28	71.60	57.20	0.00	14.40	369.6
6	29	75.20	57.20	0.00	16.20	385.8
6	30	69.80	55.40	0.00	12.60	398.4
7	1	68.00	57.20	0.00	12.60	411.0

Cranberry fruitworm degree day model used to predict moth flight with Pitt Meadows airport temperature data starting on March 1, 2016 using a lower development threshold of 50°F and an upper development threshold of 86°F (http://uspest.org/risk/models)

Online Phenology Models and Degree-day Calculator
for agricultural decision support in the US

Output from uspest.org/wea Degree-day Model & Calculator web program:
Heat Units from daily weather data

==========CALCULATOR INPUTS==========

Calculation method:	single sine
Lower threshold:	50 degrees Fahrenheit
Upper threshold:	86 degrees Fahrenheit
Directions for starting/BIOFIX:	user specified
Starting/BIOFIX date:	1 1
Ending date:	12 1

==========CALCULATOR OUTPUT==========

Weather station: 2016 CWMM CANADA P. Mems Coastal Stn Au BC Lat:49.2000 Long:-122.6831 Elev:16

mn	day	max	min	precip	DD50	CUMDD50	event
3	1	50.70	42.60	0.53	0.09	0.1	* START * Cum. DDs: 0
3	2	52.30	41.90	0.57	0.47	0.6	
3	3	55.40	41.90	0.28	1.52	2.1	
3	4	52.30	41.90	0.18	0.47	2.5	
3	5	60.80	43.70	0.26	3.94	6.5	
3	6	53.20	47.10	0.23	1.05	7.5	
3	7	46.20	40.60	0.55	0.00	7.5	
3	8	48.90	39.60	0.06	0.00	7.5	
3	9	52.30	41.90	0.89	0.47	8.0	
3	10	53.80	42.40	0.99	0.97	9.0	
3	11	53.60	39.20	0.00	0.78	9.8	
3	12	50.00	41.00	0.00	0.00	9.8	
3	13	46.40	41.00	0.00	0.00	9.8	
3	14	48.20	41.00	0.11	0.00	9.8	
3	15	50.20	39.20	0.00	0.01	9.8	
3	16	51.60	38.30	0.00	0.24	10.0	
3	17	55.90	31.60	0.00	1.27	11.3	
3	18	61.00	34.00	0.00	3.12	14.4	
3	19	59.70	38.30	0.00	2.92	17.3	
3	20	52.00	47.70	0.13	0.61	17.9	
3	21	55.40	46.80	0.17	1.96	19.9	
3	22	56.80	45.50	0.07	2.41	22.3	
3	23	48.00	43.70	0.83	0.00	22.3	
3	24	49.30	42.60	0.02	0.00	22.3	
3	25	53.80	42.30	0.00	0.96	23.3	
3	26	58.30	40.60	0.02	2.55	25.8	
3	27	53.60	42.30	0.71	0.89	26.7	
3	28	58.10	36.70	0.00	2.21	28.9	
3	29	63.70	34.70	0.00	4.22	33.1	

3	30	72.70	39.90	0.00	8.76	41.9	
3	31	71.10	40.10	0.00	8.06	49.9	
4	1	68.50	41.90	0.00	7.16	57.1	Cum. DDs: 57
4	2	61.50	45.00	0.01	4.46	61.6	
4	3	68.70	43.70	0.02	7.58	69.1	
4	4	57.40	47.50	0.63	3.00	72.1	
4	5	52.90	45.30	0.04	0.79	72.9	
4	6	62.20	47.70	0.00	5.35	78.3	
4	7	76.50	42.30	0.00	10.99	89.3	
4	8	74.50	45.10	0.00	10.66	99.9	
4	9	67.50	41.90	0.00	6.70	106.6	
4	10	60.30	43.30	0.00	3.67	110.3	
4	11	58.50	48.60	0.00	3.78	114.1	
4	12	55.80	44.60	0.13	1.88	116.0	
4	13	52.50	41.90	0.00	0.53	116.5	
4	14	54.00	43.90	0.01	1.12	117.6	
4	15	55.80	44.20	0.01	1.85	119.5	
4	16	61.90	41.90	0.00	4.19	123.6	
4	17	72.70	41.20	0.00	8.98	132.6	
4	18	84.70	45.30	0.00	15.70	148.3	
4	19	80.20	49.10	0.00	14.71	163.0	
4	20	75.00	-16.20	0.00	5.72	168.8	
4	21	70.00	56.80	0.02	13.40	182.2	
4	22	59.70	50.50	0.03	5.10	187.3	
4	23	60.40	51.60	0.09	6.00	193.3	
4	24	54.70	45.10	0.55	1.48	194.7	
4	25	59.70	43.50	0.14	3.43	198.2	
4	26	60.80	39.40	0.00	3.46	201.6	
4	27	63.10	45.50	0.00	5.29	206.9	
4	28	63.30	49.50	0.01	6.44	213.4	
4	29	63.00	50.40	0.00	6.70	220.1	
4	30	68.40	42.30	0.00	7.18	227.2	
5	1	77.20	43.50	0.00	11.59	238.8	Cum. DDs: 239
5	2	86.00	48.00	0.02	17.20	256.0	
5	3	74.30	55.60	0.02	14.95	271.0	
5	4	62.80	50.90	0.04	6.85	277.8	
5	5	70.70	45.70	0.00	8.97	286.8	
5	6	79.00	46.00	0.00	13.10	299.9	
5	7	76.30	47.10	0.00	12.09	312.0	
5	8	62.40	47.30	0.06	5.34	317.3	
5	9	70.00	43.70	0.00	8.19	325.5	
5	10	74.80	44.20	0.00	10.59	336.1	
5	11	65.50	51.10	0.00	8.30	344.4	
5	12	75.40	44.10	0.00	10.86	355.3	

Cranberry fruitworm degree day model used to predict egg laying with Pitt Meadows airport temperature data starting on May 30, 2016 (biofix) using a lower development threshold of 50°F and an upper development threshold of 86°F (http://uspest.org/risk/models)

Output from uspest.org/wea Degree-day Model & Calculator web program:
Heat Units from daily weather data

==========CALCULATOR INPUTS==========

Calculation method:	single sine
Lower threshold:	50 degrees Fahrenheit
Upper threshold:	86 degrees Fahrenheit
Directions for starting/BIOFIX:	user specified
Starting/BIOFIX date:	1 1
Ending date:	12 1

==========CALCULATOR OUTPUT==========

Weather station: 2016 CWMM CANADA P. Mems Coastal Stn Au BC Lat:49.2000 Long:-122.6831 Elev:16

mn	day	max	min	precip	DD50	CUMDD50	event	
5	30	70.90	45.50	0.00	9.02	9.0	* START *	
5	31	76.50	49.80	0.00	13.16	22.2		
6	1	73.20	56.50	0.28	14.85	37.0	Cum. DDs:	37
6	2	67.80	56.80	0.23	12.30	49.3		
6	3	75.70	57.70	0.00	16.70	66.0		
6	4	84.70	56.30	0.00	20.50	86.5		
6	5	89.80	57.60	0.00	23.14	109.7		
6	6	81.90	60.40	0.00	21.15	130.8		
6	7	79.50	56.50	0.00	18.00	148.8		
6	8	64.90	56.30	0.06	10.60	159.4		
6	9	62.80	52.70	0.00	7.75	167.2		
6	10	64.40	52.70	0.08	8.55	175.7		
6	11	59.50	49.80	0.03	4.66	180.4		
6	12	67.60	50.90	0.00	9.25	189.6		
6	13	63.90	52.00	0.09	7.95	197.6		
6	14	54.50	47.10	0.85	1.61	199.2		
6	15	64.20	45.50	0.07	5.81	205.0		
6	16	65.50	43.70	0.18	6.08	211.1		
6	17	72.90	45.70	0.00	10.04	221.1		
6	18	57.40	53.80	0.50	5.60	226.7		
6	19	66.90	50.90	0.02	8.90	235.6		
6	20	71.60	49.30	0.00	10.50	246.1		
6	21	65.50	55.00	0.00	10.25	256.4		
6	22	73.80	55.00	0.00	14.40	270.8	Mn	
6	23	65.50	56.50	0.22	11.00	281.8		
6	24	64.20	52.90	0.26	8.55	290.3		
6	25	70.70	56.50	0.00	13.60	303.9		
6	26	79.50	50.70	0.00	15.10	319.0		
6	27	82.40	57.40	0.01	19.90	338.9		
6	28	76.80	56.30	0.00	16.55	355.5		
6	29	75.00	56.50	0.00	15.75	371.2		
6	30	70.90	54.50	0.00	12.70	383.9		
7	1	69.80	56.10	0.00	12.95	396.9	Cum. DDs:	397
7	2	74.80	58.80	0.00	16.80	413.7		