

Surveillance of cranberry fruitworm (*Acrobasis vaccinii*) moths and infested fruit within blueberry and cranberry farms in British Columbia – 2015

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

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INTRODUCTION

Cranberry fruitworm (*Acrobasis vaccinii*) is a critical fruit-contaminating pest of cranberries and blueberries 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 fruit 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 2012-2014, 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 three 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. In order to continue to refine monitoring methods, a degree day model from the Michigan State University was incorporated in the 2014 report. The future use of this degree day model looks promising, and with more work, we hope this model can be confidently used as part of a pest management program on BC farms.

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 2015 season was our fourth year of cranberry fruitworm monitoring in BC.

METHODS

Moth Surveillance in Cranberry Fields

Cranberry fruitworm moth flight was monitored with pheromone traps placed in cranberry fields in Richmond, Delta, Surrey, Langley, Chilliwack, Pitt Meadows and Maple Ridge. Traps were set up in 143 cranberry fields, on 39 commercial cranberry farms, and monitored weekly by E.S. Cropconsult staff from the week of May 24 until the week of August 10, 2015 (Table 1).

Between one to eight traps were placed per farm, based on field history and farm size. 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 22, 2015 and July 20, 2015). Wingtraps were hung on wooden stakes approximately 30-cm above ground-level and positioned so that the openings faced East-West. When multiple traps were hung on the same stake, cranberry fruitworm traps were paired with cranberry girdler traps, and not with sparganthis fruitworm or blackheaded fireworm traps, in order to minimize any potential pheromone interference. Traps were situated approximately 10m from the field edges.

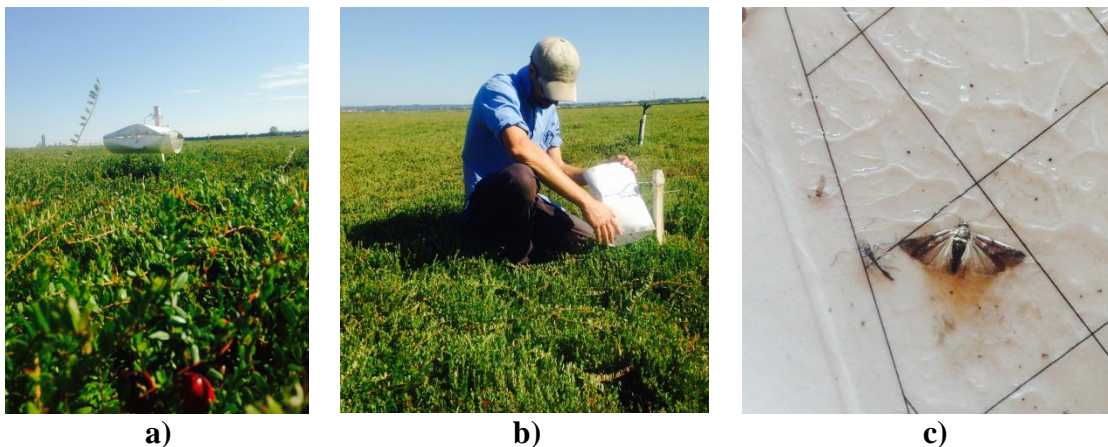


Figure 1. a) Cranberry fruitworm pheromone trap set-up b) Cranberry fruitworm trap inspection and c) Cranberry fruitworm moth caught on a sticky insert

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 were taken to the BCAGri Plant Diagnostic lab to confirm identifications for the first two weeks of catches. Afterwards, the identification was confirmed by E.S. Cropconsult Ltd. senior staff.

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

| Farm Name | Location | # 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 | 2 |
| 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 |
| 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 | 2 |
| 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 SITES = 39 | TOTAL REGIONS = 8 | TOTAL TRAPS = 143 |

Cranberry Fruit Assessment

Green fruit was collected between June 8, 2015 and August 7, 2015 from a total of 22 cranberry fields that had positive trap catches. More frequent collections were done from fields with successive weeks of trap catches. For each field assessment, approximately 200 berries were collected from a 5m radius around the positive pheromone trap.

Ripe fruit was collected two times from September 1 – 18, 2015. 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). Suspect cranberry fruitworm areas within the field were targeted during this sampling period. Berries were placed in plastic bags and held in a fridge until viewing. Fruit was examined under a dissecting microscope for eggs (new/yellow, hatched, or dead), larvae, bore holes, and damage.



Figure 2. Berry collection in the field (left) and berry assessment in the laboratory (right).

Moth Surveillance in Blueberry Fields

Moth flight was monitored in 28 blueberry fields located in Richmond, Delta, Surrey, Langley, Abbotsford, Matsqui, Chilliwack, Port Coquitlam, Pitt Meadows and Maple Ridge (Table 2). Wingtraps (Great Lake IPM Product # IPM-101-00) were baited with cranberry fruitworm lures (Great Lakes IPM Product # IPM-CFW-L1500) and monitored weekly from the week of May 24, 2015 until the week of August 17, 2015. Trap set-up was delayed due to supplier shipment problems. At each trapping site, two pheromone traps were placed along an outer edge of the blueberry field adjacent to hedgerow vegetation. Traps were spaced at least 50m apart and hung in the plant canopy at a height of 1-1.5 metres. Pheromone lures were replaced at four week intervals, during the weeks of June 22, 2015 and July 20, 2015. When suspect moths were caught in traps, sticky inserts were replaced. Inserts with suspect moths were taken to the BC Agri Plant Diagnostic lab to confirm identifications for the first two weeks of catches. Afterwards, the identification was confirmed by E.S. Cropconsult Ltd. senior staff.

Table 2. Summary of blueberry farm locations and number of traps per farm

| Farm Name | Location | Cultivar | # traps |
|-------------------------|---------------------------|-------------------------|----------------|
| Richmond 1 | Richmond | Duke | 2 |
| Richmond 2 | Richmond | Bluecrop | 2 |
| Richmond 3 | Richmond | Elliott | 2 |
| Ladner 1 | Ladner | Duke | 2 |
| Ladner 2 | Ladner | Elliott | 2 |
| East Delta 1 | East Delta | Bluecrop | 2 |
| East Delta 2 | East Delta | Bluecrop | 2 |
| East Delta 3 | East Delta | Duke | 2 |
| Surrey 1 | Surrey | Bluecrop | 2 |
| Surrey 2 | Surrey | Bluecrop | 2 |
| Surrey 3 | Surrey | Elliott | 2 |
| Langley 1 | Langley | Liberty | 2 |
| Langley 2 | Langley | Draper | 2 |
| Langley 3 | Langley | Duke | 2 |
| Abbotsford 1 | Abbotsford | Elliott | 2 |
| Abbotsford 2 | Abbotsford | Draper | 2 |
| Abbotsford 3 | Abbotsford | Bluecrop | 2 |
| Matsqui 1 | Matsqui | Duke | 2 |
| Matsqui 2 | Matsqui | Bluecrop | 2 |
| Matsqui 3 | Matsqui | Reka and Duke | 2 |
| Port Coquitlam 1 | Port Coquitlam | Bluecrop | 2 |
| Pitt Meadows 1 | Pitt Meadows | Bluecrop | 2 |
| Pitt Meadows 2 | Pitt Meadows | Elliott | 2 |
| Pitt Meadows 3 | Pitt Meadows | Elliott | 2 |
| Pitt Meadows 4 | Maple Ridge | Draper | 2 |
| Maple Ridge 1 | Maple Ridge | Duke | 2 |
| Chilliwack 1 | Chilliwack | Liberty | 2 |
| Chilliwack 2 | Chilliwack | Duke | 2 |
| TOTAL SITES = 28 | TOTAL REGIONS = 11 | TOTAL TRAPS = 56 | |

Blueberry Fruit Assessment

Green and colouring fruit was collected June 1-July 30 from an average of 5 blueberry fields per week where moths from any species of fruitworm were captured in traps. There is a parallel project for *Grapholita packardii*, cherry fruitworm, also underway in blueberries; all fruit collected was inspected for eggs of both species of fruitworm. Approximately 200 berries were collected per field from a 20m radius around the pheromone traps, and stored in plastic bags in coolers for transport to the lab. Fruit was kept cool to prevent further development of the eggs or larvae until fruit could be assessed. Collections were examined under a dissecting microscope for eggs (new/yellow, hatched, or dead), larvae, bore holes, and damage, in the same way as for

cranberry fruit. An average of 1300 fruit were collected and assessed per week from blueberry fields.

Degree Day Model

The cranberry fruitworm degree day model from Michigan State was used to predict the timing of moth flight and egg laying 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 (10°C) and an upper development threshold of 86°F (30°C). 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 Surveillance in Cranberry Fields

Male moths were caught in pheromone traps for eight consecutive weeks, from the week of June 1 to the week of July 20, 2015. This was approximately one week earlier than the first catch in 2014, two weeks earlier than in 2013, and four weeks earlier than 2012. Moths were caught in traps for a period of nine weeks in 2014, eight weeks in 2013 and seven weeks in 2012 (Figure 3). The only farm with trap catches in the weeks of June 1 and June 8 was a new trapping site in 2015.

The 2015 total moth catch was lower than the levels observed in 2014 (Figure 3) and fewer farms had moth traps catches. On June 29, 2015, Great Lakes IPM informed us that the lures produced in the 2015 season were partially compromised and that trap catches would be lower as a result. Indeed that is what resulted: fewer moths were caught on fewer farms. New lures were placed as soon as possible (early July), but by then the moth numbers were declining. Apparent peak in moth flight occurred the week of July 7, 2015 (Figure 3), however, moth numbers were likely higher earlier but the poor lures did not reflect that.

Moth detection by pheromone traps is an important monitoring tool in the management the cranberry fruitworm. Having had this experience with poor lures, it is clear that relying on one method of monitoring may be risky, and could compromise pest management decision making. Additional tools for decision making are necessary.

Out of all the regions, South Richmond and West Delta fields caught the most moths in 2015 (Figure 4), which is consistent with data from previous years. Initial trap catches were first observed in the West Delta region on June 1 and were seen later in South Richmond on June 15. The East Delta, North Richmond and Pitt Meadows/Maple Ridge (PMMR) regions also had trap catches, but fewer moths were caught. There were no moths caught in traps in the Langley, Surrey and Chilliwack regions 2012-2015.

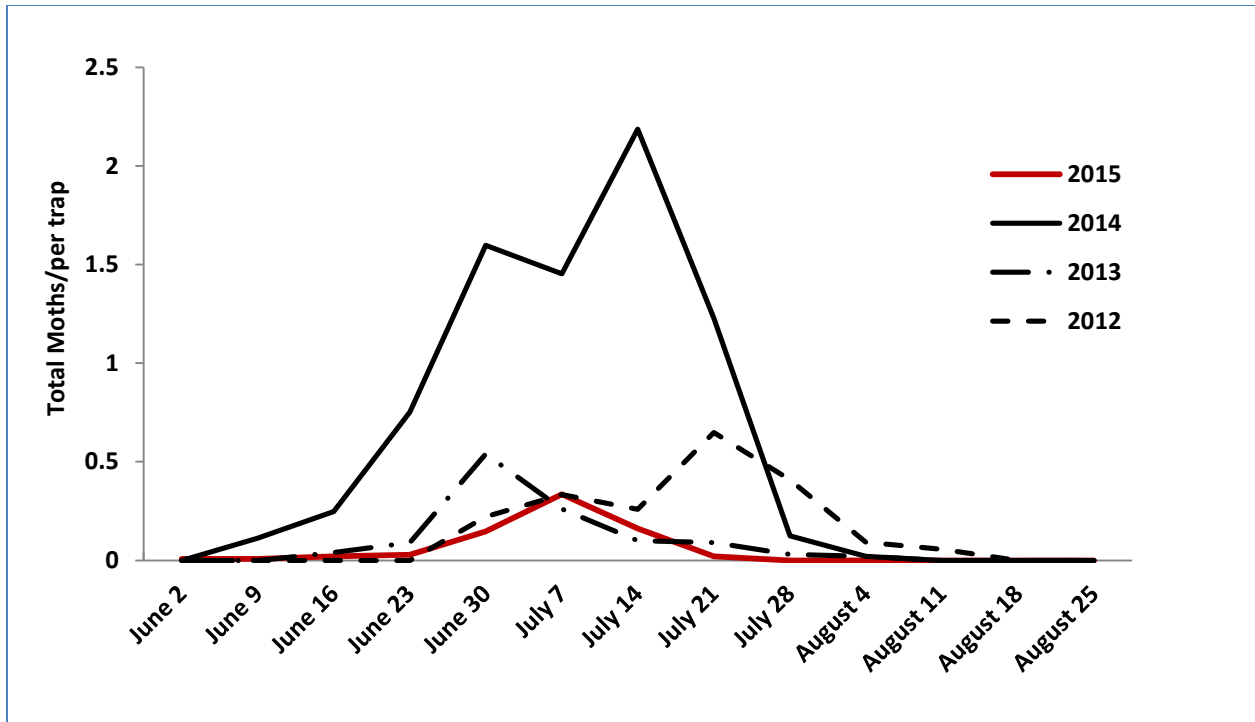


Figure 3. Pheromone trap catches of male cranberry fruitworm (*Acrobasis vaccinii*) moths in cranberries during the 2012-2015

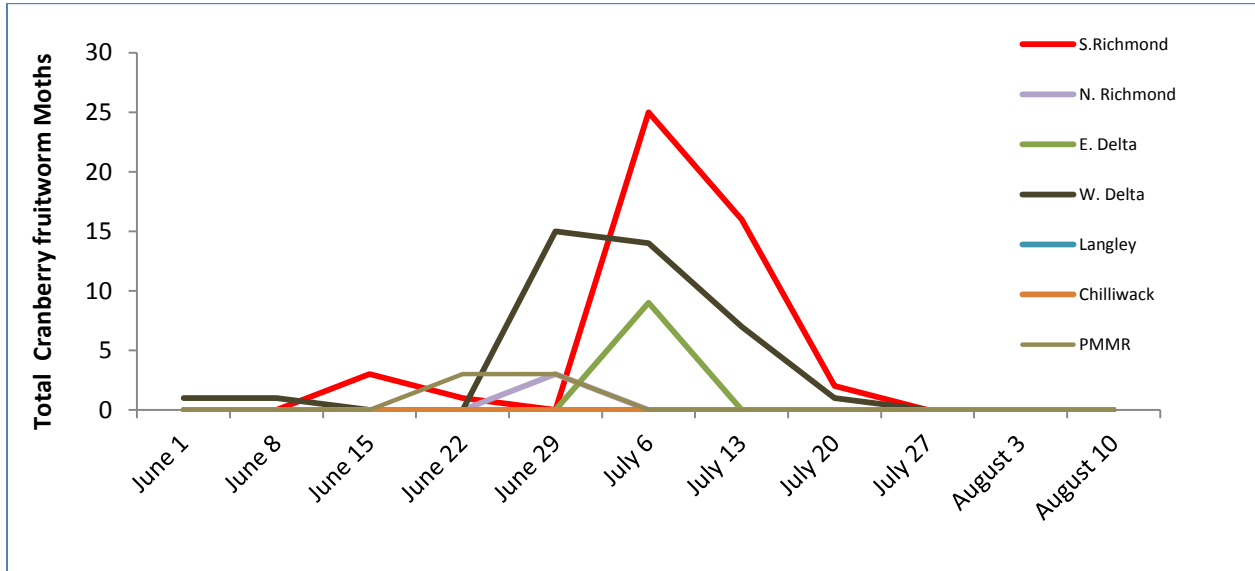


Figure 4. Total number of cranberry fruitworm moths caught in traps by region from the week of May 24 – August 10, 2015

Cranberry fruitworm moths were caught in 20% of traps (29 out of 143 fields). In comparison, 52% of traps were positive in 2014 (50 out of 97), 33% in 2013 (33 out of 100) and 26% in 2012 (14 out of 54). Trap catches in 2015 were overall lower in all regions when compared to the

previous season (Figure 5). The decrease in trap catches is likely primarily due to the compromised efficacy of the pheromone lures.

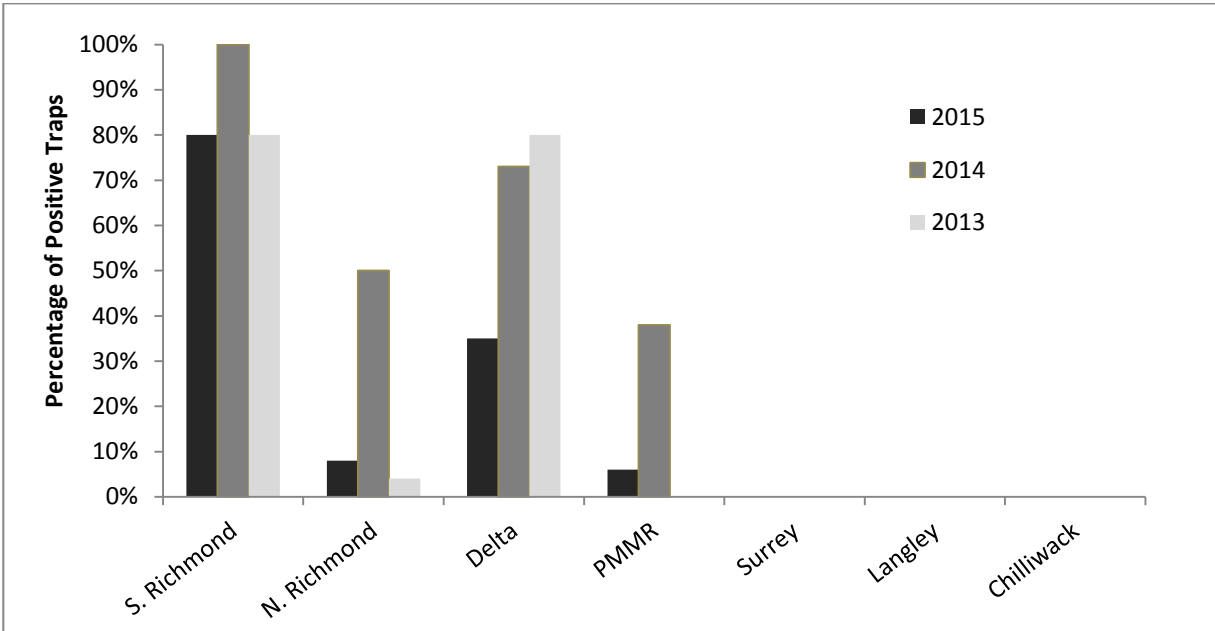


Figure 5. Regional comparison of the percentage of positive cranberry fruitworm pheromone traps in cranberry fields within the Fraser Valley during the 2015 growing season.

Moth Surveillance in Blueberry Fields

A total of four cranberry fruitworm moths were caught in three blueberry fields over two consecutive weeks from July 6-17, 2015. Fields were located in Ladner and Delta, which are the regions where moths were caught in cranberry fields (Table 3).

Table 3. Number of cranberry fruitworm moths caught in blueberry fields by region

| Region | # traps | Total # moths caught |
|---------------------|---------|----------------------|
| Richmond | 6 | 0 |
| Ladner | 4 | 1 |
| East Delta | 6 | 3 |
| Surrey | 6 | 0 |
| Langley | 6 | 0 |
| Abbotsford | 6 | 0 |
| Matsqui | 6 | 0 |
| Port Coquitlam | 2 | 0 |
| Pitt Meadows | 8 | 0 |
| Maple Ridge | 2 | 0 |
| Chilliwack/Rosedale | 4 | 0 |

Cranberry Fruit Assessment

Recently laid yellow eggs were detected in collected fruit from June 22 to June 29 in West Delta; approximately three weeks after the first moth catch in this region. Following that, only hatched eggs and fruit damage (bore holes, larvae, frass) were found (Figure 6). In comparison, eggs were first detected in 2014 on June 27 and continued to be found until August 4, 2014.

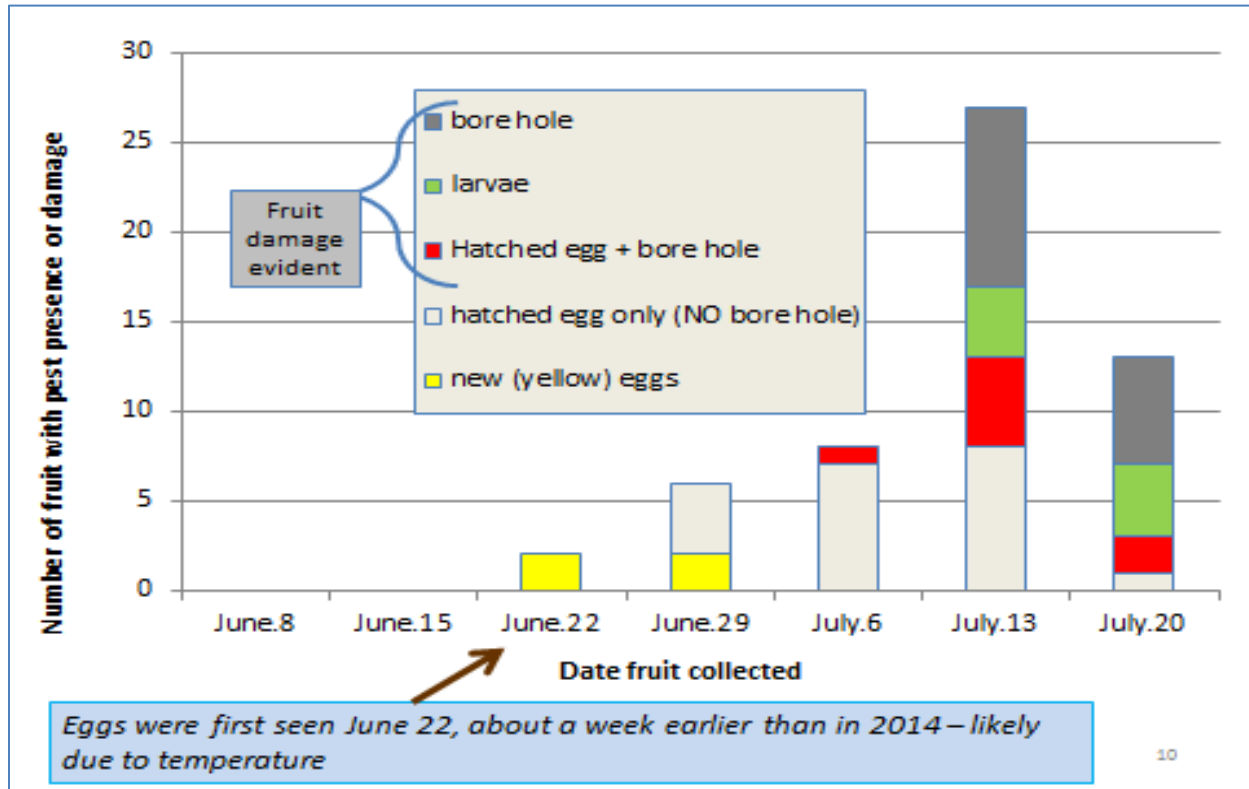


Figure 6. Fruitworm egg stage and damage observed in collected green cranberry fruit, 2015

Eggs were not found in all fields with positive moth traps. In eastern North American growing regions, the threshold for triggering cranberry fruitworm control is set at one egg found per hundred berries (Mahr, 2011). In the experience of E.S. Cropconsult Ltd cranberry scouting staff, cranberry fruitworm egg counts have been highly variable and therefore additional information is needed to make spray recommendations to growers. A history of cranberry fruitworm damage in a particular field combined with moth catches in the current year has been a better indicator of whether to spray for this pest in Fraser Valley cranberry fields. Currently, E.S. Cropconsult's collection method is slightly different from the protocol described by Mahr (2011). A key difference is the number of berries collected per acre and the number of collection sites within a field. It is recommended by Mahr (2011) to collect 200 berries for a 1- 4 acre field, with 50 berries collected with each additional 2 acres. Furthermore, berries are recommended to be taken randomly throughout the bed. Due to the large amount of acreage covered in the B.C. study, this protocol may not be appropriate for our area-wide monitoring program. Nevertheless, some

adjustments to our current methodology in future seasons may improve the viability of egg sampling as a monitoring tool in recommending timing of insecticide sprays.

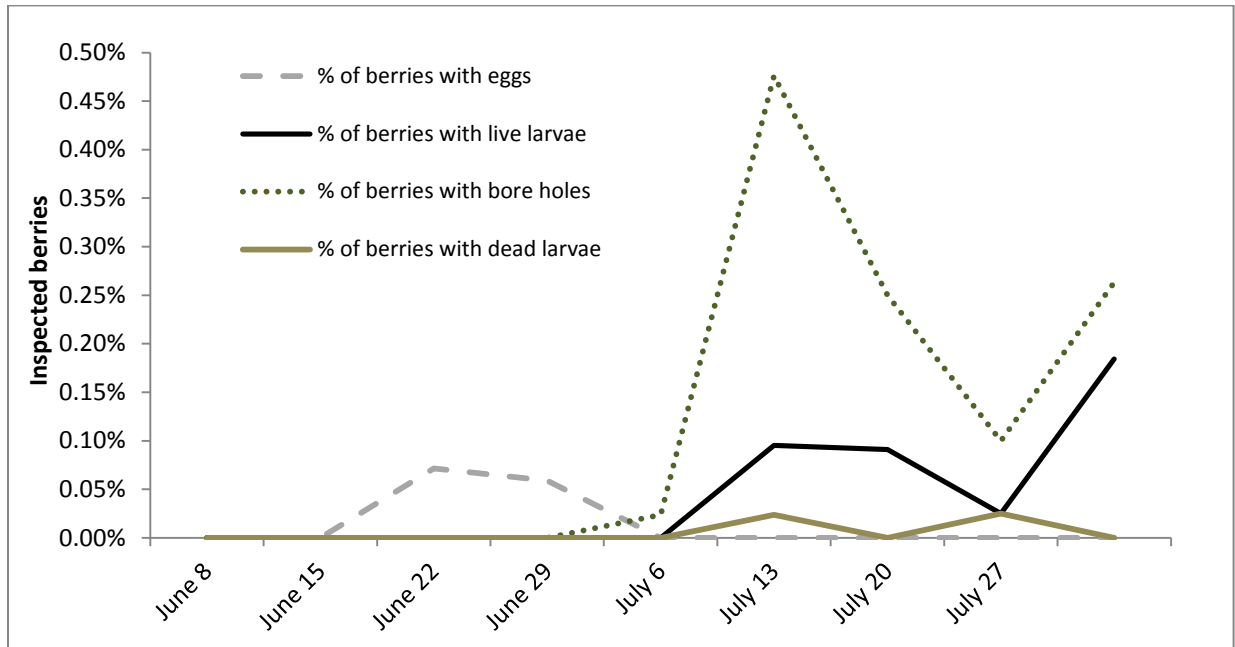


Figure 7. Cranberry Fruit Assessment for fruitworm eggs, larvae and damage, June 8 – August 7, 2015.

Bore holes on collected fruit were first observed on the week of July 6, 2015, and larvae were first recorded during the week of July 13, 2015 (one week later than in 2014). Larvae and berry damage were found until the final week of fruit collection on August 4, 2015 (Figure 7). Dead larvae were observed from the weeks of July 13 to July 27, 2015. Insecticide sprays for cranberry fruitworm were applied from the weeks of June 8 to July 13, 2015 (Figure 8).

Most growers who took part in our study made two insecticide applications with an appropriate insecticide (ie. Altacor or Intrepid) if cranberry fruitworm was detected on their farm in pheromone traps, and if their farm had a history of cranberry fruitworm (Table 6). In many cases, treatments done for the cranberry fruitworm were combined with applications for other lepidopteran pests such as the blackheaded fireworm (2nd generation) and the sparganothis fruitworm. The live cranberry fruitworm larvae peak seen after the last insecticide application on Figure 8 suggests that some fields may require a third insecticide spray to completely prevent berry damage.

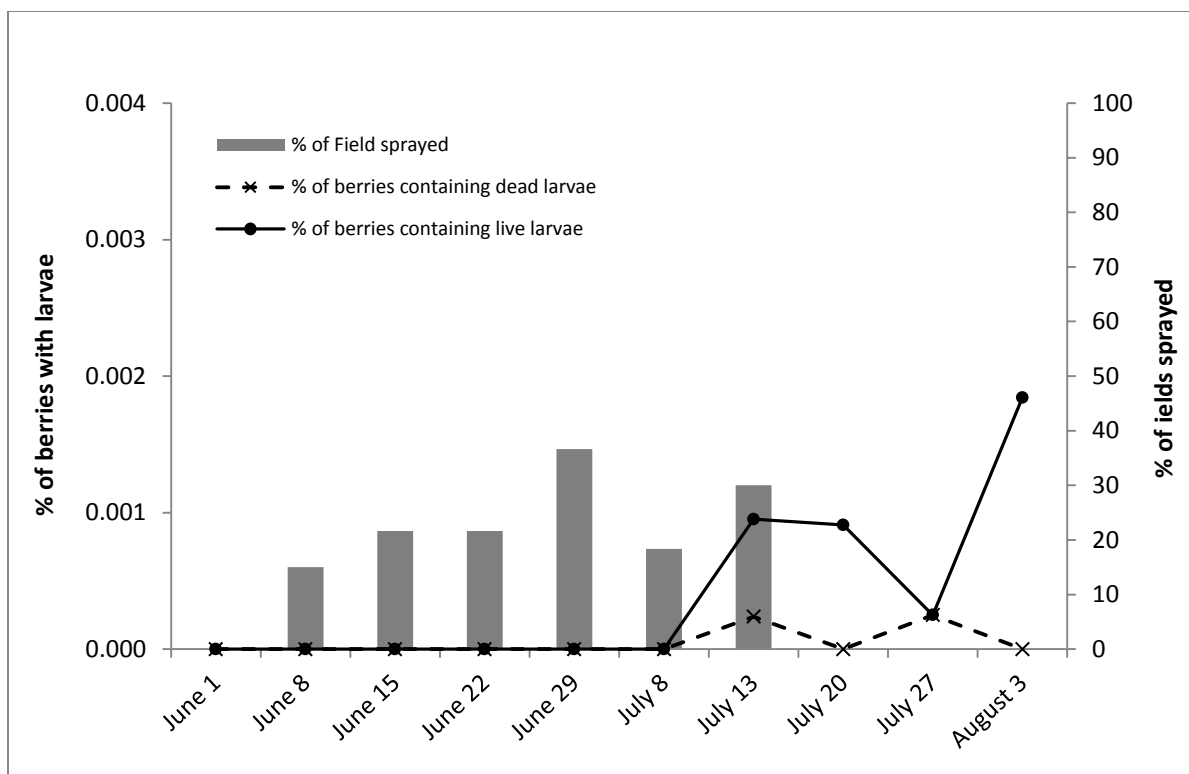


Figure 8. Percentage of cranberry fields sprayed for cranberry fruitworm and percentage of sampled berries with dead or live cranberry fruitworm larvae, 2015

Pre-harvest ripe berry damage levels ranged from 0% to 1.11% (Table 4). Overall, ripe berry damage in 2015 was lower than previous years. In 2014, berry damage ranged from 0% to 10.73%, and from 0 to 6.85% in 2013. Although pre-harvest ripe berry damage assessments appear to be accurate in recording levels of fruit contamination during harvest, it should be noted that these assessments may underestimate the amount of total fruitworm damage to the crop in a season. Berries damage in the early season may wilt and decompose before the final pre-harvest assessment. E.S. Cropconsult staff observed increased levels of cranberry fruitworm damage in some fields this season that was not reflected in the damage counts on green or ripe berries. Adjustments to pre-harvest berry collections timing and/or frequency may better represent total damage in future seasons.

Lure failure aside, it appears that due to low moth catches, low eggs finds, and low damage levels even in fields with a history of fruitworm, 2015 may have been a lower fruitworm pressure year compared to 2014.

Blueberry Fruit Assessment

No blueberry fruit had any eggs or damage characteristic of cranberry fruitworm.

Table 4. 2015 post-harvest berry damage assessment in select fields.

| Field | Trap catches | First Assessment (% damage) | Second Assessment (% damage) |
|------------------------|---------------------|------------------------------------|-------------------------------------|
| W. Delta 3-3 | 15 | 0.26 | 0.41 |
| W. Delta 4-1 | 8 | 1.11 | 0.14 |
| S. Richmond 2-2 | 5 | 0.29 | 1.11 |
| W. Delta 2-3 | 3 | 0.24 | 0 |
| W. Delta 1- 5 | 2 | 0.14 | 0 |
| PMMR2-5 | 2 | 0 | 0 |
| PMMR8-1 | 2 | 0 | 0 |
| S. Richmond 1-1 | 1 | 0.12 | 0 |
| N. Richmond 4-6 | 1 | 0 | 0 |
| N. Richmond 3-1 | 1 | 0 | 0 |
| Surrey 1-5 | 0 | 0 | 0 |
| Langley 3 | 0 | 0 | 0 |
| Langley 7 | 0 | 0 | 0 |
| PMMR 3-1 | 0 | 0 | 0 |
| 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 29, 2015 (Table 5). The first trap catch occurred in cranberries fields in West Delta on June 1 and in blueberries in Ladner on July 6, 2015. The first trap catches in Richmond cranberries did not occur until June 15. The degree day model predicted egg laying would occur between June 1-25, 2015. Eggs were detected on cranberries on June 23 and June 29.

Degree day models are useful in predicting the timing of insect development and are best used in conjunction with other monitoring tools. In both 2014 and 2015, the cranberry fruitworm degree day model accurately predicted the timing of moth flight in Richmond, but predicted egg laying would occur earlier than eggs were detected on collected fruit. Larger fruit collections for eggs may result in more comparable data.

The degree day model predictions in Pitt Meadows did not correspond well to trap catches or egg detections in 2015. When Pitt Meadows airport temperatures were entered into the model, moth flight was predicted to start on May 22 and egg hatch on May 29, 2015. The first trap catch occurred on June 22, 2015 and the only damaged berry was found on July 8, 2015. As in 2014, trap catches were low in Pitt Meadows, with only 6 moths caught over the entire trapping period. 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. Furthermore, the March 1st used in the Michigan model may not be appropriate for our region due to climatic conditions. The warmer winter temperatures of the Pacific Northwest should be considered when further developing this model for the region.

Table 5. Predicted and observed dates of first moth flight and egg laying in Richmond and Delta cranberry and blueberry fields using Richmond airport temperatures in the CRANBERRY FRUITWORM degree day model from MSU.

| Event | DD50 | Predicted date of occurrence | Cranberry - observed date of occurrence | Blueberry - observed date of occurrence |
|----------------------------|--|------------------------------|---|---|
| First moth flight (biofix) | 350 DD ₅₀ after March 1 | May 29, 2015 | June 1, 2015 | July 6, 2015 |
| Egg laying begins | 85-100 DD ₅₀ after first trap catch | June 1, 2015 | June 23, 2015 | No eggs found |
| Egg laying ends | 400 DD ₅₀ after first trap catch | June 25, 2015 | June 29, 2015 | No eggs found |

SUMMARY

Cranberries

- Cranberry fruitworm activity continues to be concentrated in West Delta and South Richmond region. No cranberry fruitworm moths have been observed in Langley, Surrey or Chilliwack.
- Challenges with pheromone lures in 2015 supports the need for more than one method of gathering information on pest life stage before making management decisions.
- Peak trap catch occurred the week of July 6, 2015; one week earlier than 2014.
- Moths were caught in 20% of fields in the 2015 growing season. This was the lowest detection since the beginning of the area-wide monitoring program: 2014 (52%), 2013 (33%), and 2012 (26%).
- Fewer eggs were found on collected green fruit this year. Eggs were only detected on fruit collected the weeks of June 22 and June 29. It is possible that the sample sizes were not large enough to detect low levels of eggs, or that the pest population was actually lower in 2015 than in 2014.
- Cranberry fruit damage prior to harvest ranged from 0 to 1.11% which was a decrease from the 0-10.7% range in 2014.
- The degree day model prediction of initiation of moth flight in Richmond matched our trap catches, but it predicted the start of egg laying earlier than we detected eggs by sampling. It may be that our sample size of fruit for assessment may not be large enough.

Blueberries

- Only 4 moths were caught in blueberry fields
- No damaged fruit were found

- Cranberry fruitworm appears to not be a pest problem in blueberries at this time, even though they are in proximity to cranberry fields.

NEXT STEPS

Blueberries:

- Blueberries do not appear to be affected by cranberry fruitworm, and very few moths are caught. Only a very limited monitoring program is suggested for 2016.

Cranberries:

- Continue to monitor cranberry fruitworm with pheromone traps in the Fraser Valley in at some cranberry fields, in at least in the regions we know have cranberry fruitworm.
- For cranberries, the start date for the DD should be January 1 in coastal BC rather than March 1 as in Michigan.
- Suggest implementing wider use of the DD model in cranberries in BC as a monitoring tool.
- A combination of monitoring tools should be used in concert, and will provide the best information for making fruitworm management decisions.

REFERENCES

- Isaacs, R. and C.G. Salazar. 2009. Using MSU's cranberry fruitworm degree day model. Michigan State University Extensions, Department of Entomology. Accessed October 31, 2014. http://msue.anr.msu.edu/news/using_msus_cranberry_fruitworm_degree_day_model
- Mahr, D.L. 2011. CranberryFruitworm. <http://fruit.wisc.edu/wpcontent/uploads/2011/05/Cranberry-Fruitworm.pdf>. Accessed on October 13, 2015.

Appendix

Table 6. 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 2013, 2014 and 2015.

| Field | Total trap catch (2013) | Week of peak trap catches (2013) | Insecticide spray date and product (2013) | 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) |
|----------------------------|-------------------------|----------------------------------|---|-------------------------|-----------------------------------|---|---------------------------|-------------------------------------|---|
| East Delta 1-1 | 1 | July 1 | Altacor: July 12 | 1 | June 30 | Altacor: July 9 Sevin: July 26 | 0 | N/A | Intrepid: June 14 Altacor: July 8 |
| East Delta 1-4 | 3 | July 1 | Altacor: July 12 | 0 | N/A | Altacor: July 9 Sevin: July 26 | 0 | N/A | Intrepid: June 14 Altacor: July 8 |
| East Delta 2-1 | 11 | July 1 | Intrepid: July 12 | 2 | July 7 | Intrepid: June 25 Intrepid: July 11 | 3 | July 6 | Intrepid: June 9 Intrepid: July 14 |
| East Delta 2-2 | 13 | July 1/8* | Intrepid: July 12 | 2 | June 23/ July 7 | Intrepid: June 25 Intrepid: July 11 | 6 | July 6 | Intrepid: June 9 Intrepid: July 14 |
| West Delta 2-2 | 1 | June 24 | Intrepid: July 13 | 1 | August 4 | Intrepid: June 25 Altacor: July 10 | 0 | N/A | Intrepid: June 17 Intrepid: July 1 |
| West Delta 2-3 | 1 | July 15 | Intrepid: July 13 | 3 | June 23/June 30/July 14 | Intrepid: June 25 Altacor: July 10 | 0 | N/A | Intrepid: June 17 Intrepid: July 1 |
| West Delta 2-4 | 2 | July 1/8 | Intrepid: July 3 Altacor: July 13 | 6 | June 30 | Intrepid: July 1 Altacor: July 15 | 2 | July 6/July 13 | Intrepid: June 24 Intrepid: July 6 |
| West Delta 2-5 | 1 | July 1 | Intrepid: July 3 Intrepid: July 13 | 0 | N/A | Intrepid: June 25 Altacor: July 10 | 1 | July 6 | Intrepid: June 24 Intrepid: July 6 |
| West Delta 3-1 | 1 | July 8 | No spray | 53 | July 14 | Diazinon: July 2 Intrepid: July 28 | 0 | N/A | Diazinon: June 25 Altacor: July 10 |
| West Delta 3-2 | 6 | July 8 | No spray | 38 | July 21 | Diazinon: July 2 Intrepid: July 28 | 3 | June 29 | Diazinon: June 25 Altacor: July 10 |
| West Delta 3-3 | 4 | July 15 | No spray | 43 | July 14 | Diazinon: July 2 Intrepid: July 28 | 15 | June 29 | Diazinon: June 11 Altacor: July 10 |
| West Delta 3-4 (taken out) | 1 | July 1 | No spray | 22 | July 14 | Diazinon: July 2 Intrepid: July 28 | - | - | - |
| West Delta 3-5 | 5 | July 22 | No spray | 9 | July 14 | Entrust: July 18 | 0 | N/A | Diazinon: June 11 Altacor: July 10 |
| West Delta 3-6 | 1 | July 22 | No spray | 17 | July 21 | Entrust: July 25 | 0 | N/A | Dipel: June 12 Entrust: July 17 |
| West Delta 3-7 | 0 | N/A | No spray | 11 | July 14 | Diazinon: July 2 Intrepid: July 28 | 0 | N/A | Diazinon: June 25 Altacor: July 10 |
| West Delta 3-8 | 1 | July 8 | No spray | 23 | July 14 | Diazinon: July 2 Intrepid: July 28 | 2 | July 6 | Diazinon: June 25 Altacor: July 10 |
| West Delta 1-1 | 1 | July 22 | Intrepid: July 12 Intrepid: July 18 | 4 | July 7 | Intrepid: July 4 Sevin: July 15 | 0 | N/A | Intrepid: June 17 Intrepid: June 30 |
| West Delta 1-3 | 0 | N/A | Intrepid: July 12 Intrepid: July 18 | 4 | June 30 | Intrepid: July 4 Sevin: July 15 | 0 | N/A | Intrepid: June 17 Diazinon: June 27 |
| West Delta 1-4 | 4 | July 8/15 | Intrepid: July 12 Intrepid: July 18 | 2 | June 23/ July 7 | Intrepid: July 4 Sevin: July 15 | 0 | N/A | Intrepid: June 17 Diazinon: June 27 |
| *West Delta 1-5 | 2 | July 1 | Intrepid: July 12 Intrepid: July 18 | 2 | June 23/ July 7 | Intrepid: July 1 Sevin: July 15 | 2 | June 29/ July 6 | Intrepid: June 20 Intrepid: June 30 |
| West Delta 1-East | 3 | July 8 | Intrepid: July 12 Intrepid: July 18 | 0 | N/A | Intrepid: July 1 Intrepid: July 17 | 1 | June 29 | Intrepid: June 10 Intrepid: June 30 |
| West Delta 1-West | 5 | July 1 | Intrepid: July 12 Intrepid: July 18 | 1 | June 30 | Intrepid: July 1 Intrepid: July 17 | 0 | N/A | Intrepid: June 10 Intrepid: June 30 |
| West Delta 4-1 | N/A | N/A | N/A | N/A | N/A | N/A | 8 | July 6 | - |
| West Delta 4-2 | N/A | N/A | N/A | N/A | N/A | NA | 5 | July 6 | - |
| South Richmond 1-1 | 3 | June 24 | Altacor: July 5 Altacor: July 19 | 29 | June 23 | Intrepid: July 2 Altacor: July 15 | 1 | July 13 | Intrepid July 4 Intrepid July 13 |
| South Richmond 1-2 | 0 | N/A | Altacor: July 5 Altacor: July 19 | 12 | June 23 | Intrepid: July 2 Altacor: July 15 | 3 | July 13 | Intrepid July 4 Intrepid July 13 |
| South Richmond 1-3 | 2 | July 22/29 | Altacor: July 5 Altacor: July 19 | 17 | July 7 | Intrepid: July 2 Altacor: July 15 | 3 | July 6 | Intrepid July 4 Intrepid July 13 |
| South Richmond 1-4 | 5 | July 1 | Altacor: July 5 Altacor: July 19 | 14 | June 23 | Intrepid: July 2 Altacor: July 15 | 2 | July 6/July 20 | Intrepid July 4 Intrepid July 13 |
| South Richmond 2-1 | 1 | July 29 | No Sprays | 51 | July 21 | Altacor: July 2 Altacor: July 29 | 8 | July 13 | Altacor July 3 Altacor July 13 |
| South | N/A | N/A | N/A | N/A | N/A | - | 5 | July 6/ July | Altacor July 3 |

| | | | | | | | | | |
|----------------------------|-----|---------|-------------------------------------|-----|---------------------|---------------------------------------|----|------------------|--------------------------------------|
| Richmond 2-2 | | | | | | | | 13 | Altacor July 13 |
| South Richmond 4-1 | 0 | N/A | Altacor: July 7 Altacor: July 16 | 55 | July 14 | Altacor: July 2 Altacor: July 15 | 0 | N/A | - |
| *South Richmond 4-2 | 8 | July 1 | Altacor: July 7 Altacor: July 16 | 27 | June 30 | Altacor: July 2 Altacor: July 15 | 0 | N/A | - |
| South Richmond 4-3 | 7 | July 1 | Altacor: July 7 Altacor: July 16 | 67 | June 30/July 14 | Altacor: July 2 Altacor: July 15 | 0 | N/A | Altacor July 3 Altacor July 14 |
| South Richmond 4-4 | 1 | July 1 | Altacor: July 7 Altacor: July 16 | 21 | June 30 | Altacor: July 2 Altacor: July 15 | 5 | July 6 | Altacor July 3 Altacor July 14 |
| *South Richmond 3-1 | 11 | July 1 | Altacor: July 7 Altacor: July 16 | 56 | June 30 | Altacor: July 2 Altacor: July 15 | 0 | N/A | Altacor July 3 Altacor July 14 |
| South Richmond 3-2 | 2 | July 1 | Altacor: July 7 Altacor: July 16 | 14 | June 30/ July 14 | Altacor: July 2 Altacor: July 15 | 1 | July 6 | Altacor July 3 Altacor July 14 |
| South Richmond 3-3 | 1 | July 1 | Altacor: July 7 Altacor: July 16 | 34 | July 14 | Altacor: July 2 Altacor: July 15 | 2 | July 13 | Altacor July 3 Altacor July 14 |
| South Richmond 3-4 | 1 | July 8 | Altacor: July 7 Altacor: July 16 | 42 | July 7 | Altacor: July 2 Altacor: July 15 | 0 | N/A | Altacor July 3 Altacor July 14 |
| South Richmond 3-5 | N/A | N/A | N/A | N/A | N/A | - | 11 | July 6 | Altacor July 3 Altacor July 14 |
| South Richmond 5-2 | 7 | July 1 | Altacor: July 7 Altacor: July 20 | 21 | June 30/July 14 | Altacor: July 1 Altacor: July 15 | 2 | July 6 | Altacor July 3 Altacor July 14 |
| South Richmond 5-3 | 0 | N/A | Altacor: July 7 Altacor: July 20 | 20 | June 23 | Altacor: July 1 Altacor: July 15 | 4 | July 6 | Altacor July 3 Altacor July 14 |
| North Richmond 1-4 | 1 | June 24 | No spray | 1 | June 30 | Altacor: July 29 | 1 | June 29 | Altacor: June 22 |
| North Richmond 8-1 | N/A | N/A | N/A | 1 | June 30 | Altacor: July 17 | 0 | N/A | No spray |
| North Richmond 5-2 | 0 | N/A | N/A | 1 | July 7 | Diazinon: July 4 Sevin: July 20 | 0 | N/A | Altacor: June 20 |
| North Richmond 5-10 | 0 | N/A | N/A | 3 | July 14 | Diazinon: July 4 Sevin: July 20 | 0 | N/A | Altacor: June 20 |
| North Richmond 5-11 | 0 | N/A | N/A | 1 | July 14 | Diazinon: July 4 Sevin: July 20 | 0 | N/A | Altacor: June 20 |
| North Richmond 6-2 | 0 | N/A | N/A | 1 | June 30 | Altacor: July 3 | 0 | N/A | No spray |
| North Richmond 2-1 | 0 | N/A | N/A | 1 | July 14 | Diazinon: July 30 | 0 | N/A | Altacor: June 19 Altacor: July 6 |
| North Richmond 3-1 | N/A | N/A | N/A | N/A | N/A | - | 1 | June 29 | No Spray |
| North Richmond 4-3 | 0 | N/A | N/A | 2 | July 7/ July 21 | None | 0 | N/A | Diazinon: June 19 Altacor: July 4 |
| North Richmond 4-4 | 0 | N/A | N/A | 1 | June 30 | Altacor: July 5 Diazinon: July 11 | 0 | N/A | Diazinon: June 27 |
| North Richmond 4-5 | 0 | N/A | N/A | 2 | July 7/ July 21 | Diazinon: July 5 Sevin: July 18 | 0 | N/A | Diazinon: June 27 Altacor: July 4 |
| North Richmond 4-6 | 0 | N/A | N/A | 2 | July 7/July 28 | Diazinon: July 5 Diazinon: July 11 | 1 | June 29 | Diazinon: June 27 Altacor: July 4 |
| PMMR 2-1 | 0 | N/A | N/A | 1 | June 30 | Altacor: June 30 | 2 | June 22/ June 29 | Intrepid June 18 |
| PMMR 2-2 | 0 | N/A | N/A | 5 | June 30/July 7 | Altacor: June 30 | 0 | N/A | Intrepid June 18 |
| PMMR 2-5 | 0 | N/A | N/A | 0 | N/A | - | 2 | June 22/June 29 | Intrepid June 18 |

| | | | | | | | | | |
|-----------------|---|-----|-----|---|---------|------------------|---|-----------------|-----------------|
| PMMR 1-3 | 0 | N/A | N/A | 1 | June 22 | Altacor: July 1 | 0 | N/A | - |
| PMMR 1-5 | 0 | N/A | N/A | 1 | July 7 | Altacor: July 1 | 0 | N/A | - |
| PMMR 1-6 | 0 | N/A | N/A | 1 | July 7 | Altacor: July 10 | 0 | N/A | - |
| PMMR 8-2 | 0 | N/A | N/A | 0 | N/A | - | 2 | June 22/June 29 | Altacor June 25 |

Table 7. Vegetation surrounding positive pheromone traps in cranberry fields during the 2015 growing season.

| 2015 Positive Trap Catch Fields | VEGETATION NEAR TRAPS (blueberries, cranberries, grassland, shrubs, forest, weeds, or weeds etc.) | | | |
|--|--|-------------|---------------------|-----------------|
| | North | East | South | West |
| East Delta 2-1 | Corn | Grassland | Grassland | Cranberries |
| East Delta 2-2 | Corn | Cranberries | Grassland | Grassland |
| West Delta 2-4 | Ditch | Cranberries | Cranberries | Industrial |
| West Delta 2-5 | Cranberries | Cranberries | Corn | Industrial |
| West Delta 3-2 | Cranberries | Vegetables | Cranberries | Cranberries |
| West Delta 3-3 | Forest | Vegetables | Grassland | Forest |
| West Delta 3-8 | Cranberries | Vegetables | Farmyard | Cranberries |
| West Delta 1-5 | Road/ditch | Greenhouse | Cranberries | Vegetables |
| West Delta 1-West | 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 1-4 | Cranberries | Cranberries | Corn | Cranberries |
| North Richmond 3-1 | Cranberries | Cranberries | Cranberries | Cranberries |
| North Richmond 4-6 | Cranberries | Cranberries | Cranberries | Cranberries |
| PMMR 2-1 | Blueberries | Cranberries | Cranberries | Ravine |
| PMMR 2-5 | Cranberries | Residential | Raspberry/Blueberry | Cranberries |
| PMMR 8-2 | Blueberries | Blueberries | Bare land | Cranberries |

Table 8. Cranberry fruitworm degree day model used to predict moth flight with Richmond airport temperature data starting on March 1, 2015 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:                 7 1
```

```
=====CALCULATOR OUTPUT=====
```

Weather station: 2015 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 | 46.40 | 33.80 | 0.00 | 0.00 | 0.0 | * START * Cum. DDs: 0 |
| 3 | 2 | 48.20 | 35.60 | 0.00 | 0.00 | 0.0 | |
| 3 | 3 | 46.40 | 32.00 | 0.00 | 0.00 | 0.0 | |
| 3 | 4 | 46.40 | 28.40 | 0.00 | 0.00 | 0.0 | |
| 3 | 5 | 50.00 | 33.80 | 0.00 | 0.00 | 0.0 | |
| 3 | 6 | 50.00 | 37.40 | 0.00 | 0.00 | 0.0 | |
| 3 | 7 | 51.80 | 35.60 | 0.00 | 0.26 | 0.3 | |
| 3 | 8 | 48.20 | 37.40 | 0.00 | 0.00 | 0.3 | |
| 3 | 9 | 50.00 | 35.60 | 0.00 | 0.00 | 0.3 | |
| 3 | 10 | 46.40 | 39.20 | 0.00 | 0.00 | 0.3 | |
| 3 | 11 | 55.40 | 46.40 | 0.00 | 1.91 | 2.2 | |
| 3 | 12 | 62.60 | 48.20 | 0.00 | 5.67 | 7.8 | |
| 3 | 13 | 55.40 | 44.60 | 0.00 | 1.72 | 9.6 | |
| 3 | 14 | 59.00 | 46.40 | 0.00 | 3.54 | 13.1 | |
| 3 | 15 | 46.40 | 42.80 | 0.00 | 0.00 | 13.1 | |
| 3 | 16 | 50.00 | 37.40 | 0.00 | 0.00 | 13.1 | |
| 3 | 17 | 53.60 | 37.40 | 0.00 | 0.74 | 13.8 | |
| 3 | 18 | 57.20 | 42.80 | 0.00 | 2.29 | 16.1 | |
| 3 | 19 | 51.80 | 48.20 | 0.00 | 0.57 | 16.7 | |
| 3 | 20 | 55.40 | 46.40 | 0.00 | 1.91 | 18.6 | |
| 3 | 21 | 53.60 | 46.40 | 0.00 | 1.15 | 19.8 | |
| 3 | 22 | 53.60 | 44.60 | 0.00 | 1.01 | 20.8 | |
| 3 | 23 | 51.80 | 42.80 | 0.00 | 0.35 | 21.1 | |
| 3 | 24 | 55.40 | 41.00 | 0.00 | 1.46 | 22.6 | |
| 3 | 25 | 51.80 | 44.60 | 0.00 | 0.39 | 23.0 | |
| 3 | 26 | 62.60 | 51.80 | 0.00 | 7.20 | 30.2 | |
| 3 | 27 | 60.80 | 46.40 | 0.00 | 4.38 | 34.6 | |
| 3 | 28 | 57.20 | 48.20 | 0.00 | 3.05 | 37.6 | |
| 3 | 29 | 50.00 | 48.20 | 0.00 | 0.00 | 37.6 | |
| 3 | 30 | 62.60 | 50.00 | 0.00 | 6.30 | 43.9 | |
| 3 | 31 | 53.60 | 44.60 | 0.00 | 1.01 | 44.9 | |
| 4 | 1 | 51.80 | 41.00 | 0.00 | 0.32 | 45.2 | |
| 4 | 2 | 53.60 | 37.40 | 0.00 | 0.74 | 46.0 | |
| 4 | 3 | 51.80 | 44.60 | 0.00 | 0.39 | 46.4 | |

| | | | | | | |
|---|----|-------|-------|------|-------|-------|
| 4 | 4 | 53.60 | 37.40 | 0.00 | 0.74 | 47.1 |
| 4 | 5 | 51.80 | 33.80 | 0.00 | 0.24 | 47.4 |
| 4 | 6 | 55.40 | 39.20 | 0.00 | 1.37 | 48.7 |
| 4 | 7 | 57.20 | 37.40 | 0.00 | 1.92 | 50.6 |
| 4 | 8 | 55.40 | 39.20 | 0.00 | 1.37 | 52.0 |
| 4 | 9 | 59.00 | 41.00 | 0.00 | 2.86 | 54.9 |
| 4 | 10 | 53.60 | 44.60 | 0.00 | 1.01 | 55.9 |
| 4 | 11 | 53.60 | 42.80 | 0.00 | 0.92 | 56.8 |
| 4 | 12 | 51.80 | 41.00 | 0.00 | 0.32 | 57.1 |
| 4 | 13 | 48.20 | 42.80 | 0.00 | 0.00 | 57.1 |
| 4 | 14 | 53.60 | 41.00 | 0.00 | 0.84 | 58.0 |
| 4 | 15 | 53.60 | 39.20 | 0.00 | 0.78 | 58.8 |
| 4 | 16 | 55.40 | 41.00 | 0.00 | 1.46 | 60.2 |
| 4 | 17 | 57.20 | 42.80 | 0.00 | 2.29 | 62.5 |
| 4 | 18 | 57.20 | 42.80 | 0.00 | 2.29 | 64.8 |
| 4 | 19 | 59.00 | 42.80 | 0.00 | 3.04 | 67.8 |
| 4 | 20 | 62.60 | 44.60 | 0.00 | 4.90 | 72.7 |
| 4 | 21 | 57.20 | 46.40 | 0.00 | 2.72 | 75.5 |
| 4 | 22 | 55.40 | 44.60 | 0.00 | 1.72 | 77.2 |
| 4 | 23 | 50.00 | 42.80 | 0.00 | 0.00 | 77.2 |
| 4 | 24 | 53.60 | 41.00 | 0.00 | 0.84 | 78.0 |
| 4 | 25 | 51.80 | 42.80 | 0.00 | 0.35 | 78.4 |
| 4 | 26 | 57.20 | 42.80 | 0.00 | 2.29 | 80.7 |
| 4 | 27 | 64.40 | 48.20 | 0.00 | 6.56 | 87.2 |
| 4 | 28 | 59.00 | 50.00 | 0.00 | 4.50 | 91.7 |
| 4 | 29 | 59.00 | 44.60 | 0.00 | 3.26 | 95.0 |
| 4 | 30 | 57.20 | 48.20 | 0.00 | 3.05 | 98.0 |
| 5 | 1 | 60.80 | 50.00 | 0.00 | 5.40 | 103.4 |
| 5 | 2 | 57.20 | 46.40 | 0.00 | 2.72 | 106.1 |
| 5 | 3 | 59.00 | 41.00 | 0.00 | 2.86 | 109.0 |
| 5 | 4 | 60.80 | 44.60 | 0.00 | 4.07 | 113.1 |
| 5 | 5 | 57.20 | 46.40 | 0.00 | 2.72 | 115.8 |
| 5 | 6 | 59.00 | 44.60 | 0.00 | 3.26 | 119.1 |
| 5 | 7 | 64.40 | 44.60 | 0.00 | 5.73 | 124.8 |
| 5 | 8 | 68.00 | 44.60 | 0.00 | 7.43 | 132.2 |
| 5 | 9 | 71.60 | 50.00 | 0.00 | 10.80 | 143.0 |
| 5 | 10 | 64.40 | 53.60 | 0.00 | 9.00 | 152.0 |
| 5 | 11 | 60.80 | 51.80 | 0.00 | 6.30 | 158.3 |
| 5 | 12 | 66.20 | 53.60 | 0.00 | 9.90 | 168.2 |
| 5 | 13 | 62.60 | 53.60 | 0.00 | 8.10 | 176.3 |
| 5 | 14 | 60.80 | 51.80 | 0.00 | 6.30 | 182.6 |
| 5 | 15 | 62.60 | 53.60 | 0.00 | 8.10 | 190.7 |
| 5 | 16 | 66.20 | 53.60 | 0.00 | 9.90 | 200.6 |
| 5 | 17 | 62.60 | 55.40 | 0.00 | 9.00 | 209.6 |
| 5 | 18 | 69.80 | 53.60 | 0.00 | 11.70 | 221.3 |
| 5 | 19 | 69.80 | 53.60 | 0.00 | 11.70 | 233.0 |
| 5 | 20 | 66.20 | 51.80 | 0.00 | 9.00 | 242.0 |
| 5 | 21 | 69.80 | 55.40 | 0.00 | 12.60 | 254.6 |
| 5 | 22 | 66.20 | 55.40 | 0.00 | 10.80 | 265.4 |
| 5 | 23 | 64.40 | 55.40 | 0.00 | 9.90 | 275.3 |
| 5 | 24 | 66.20 | 55.40 | 0.00 | 10.80 | 286.1 |
| 5 | 25 | 64.40 | 55.40 | 0.00 | 9.90 | 296.0 |
| 5 | 26 | 66.20 | 57.20 | 0.00 | 11.70 | 307.7 |
| 5 | 27 | 68.00 | 59.00 | 0.00 | 13.50 | 321.2 |
| 5 | 28 | 71.60 | 55.40 | 0.00 | 13.50 | 334.7 |

5 29 71.60 59.00 0.00 15.30 350.0

Table 9. Cranberry fruitworm degree day model used to predict egg laying with Richmond airport temperature data starting on May 26, 2015 (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: 7 1

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

Weather station: 2015 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 | 26 | 66.20 | 57.20 | 0.00 | 11.70 | 11.7 | * START * |
| 5 | 27 | 68.00 | 59.00 | 0.00 | 13.50 | 25.2 | |
| 5 | 28 | 71.60 | 55.40 | 0.00 | 13.50 | 38.7 | |
| 5 | 29 | 71.60 | 59.00 | 0.00 | 15.30 | 54.0 | |
| 5 | 30 | 71.60 | 53.60 | 0.00 | 12.60 | 66.6 | |
| 5 | 31 | 68.00 | 51.80 | 0.00 | 9.90 | 76.5 | |
| 6 | 1 | 66.20 | 57.20 | 0.00 | 11.70 | 88.2 | |
| 6 | 2 | 62.60 | 53.60 | 0.00 | 8.10 | 96.3 | |
| 6 | 3 | 64.40 | 55.40 | 0.00 | 9.90 | 106.2 | |
| 6 | 4 | 68.00 | 55.40 | 0.00 | 11.70 | 117.9 | |
| 6 | 5 | 71.60 | 53.60 | 0.00 | 12.60 | 130.5 | |
| 6 | 6 | 73.40 | 55.40 | 0.00 | 14.40 | 144.9 | |
| 6 | 7 | 75.20 | 60.80 | 0.00 | 18.00 | 162.9 | |
| 6 | 8 | 73.40 | 57.20 | 0.00 | 15.30 | 178.2 | |
| 6 | 9 | 68.00 | 57.20 | 0.00 | 12.60 | 190.8 | |
| 6 | 10 | 68.00 | 57.20 | 0.00 | 12.60 | 203.4 | |
| 6 | 11 | 68.00 | 59.00 | 0.00 | 13.50 | 216.9 | |
| 6 | 12 | 64.40 | 53.60 | 0.00 | 9.00 | 225.9 | |
| 6 | 13 | 66.20 | 51.80 | 0.00 | 9.00 | 234.9 | |
| 6 | 14 | 69.80 | 53.60 | 0.00 | 11.70 | 246.6 | |
| 6 | 15 | 75.20 | 53.60 | 0.00 | 14.40 | 261.0 | |
| 6 | 16 | 71.60 | 55.40 | 0.00 | 13.50 | 274.5 | |
| 6 | 17 | 69.80 | 53.60 | 0.00 | 11.70 | 286.2 | |
| 6 | 18 | 69.80 | 57.20 | 0.00 | 13.50 | 299.7 | |
| 6 | 19 | 68.00 | 53.60 | 0.00 | 10.80 | 310.5 | |
| 6 | 20 | 68.00 | 53.60 | 0.00 | 10.80 | 321.3 | |
| 6 | 21 | 75.20 | 53.60 | 0.00 | 14.40 | 335.7 | |
| 6 | 22 | 73.40 | 57.20 | 0.00 | 15.30 | 351.0 | |
| 6 | 23 | 75.20 | 53.60 | 0.00 | 14.40 | 365.4 | |
| 6 | 24 | 71.60 | 60.80 | 0.00 | 16.20 | 381.6 | |
| 6 | 25 | 77.00 | 60.80 | 0.00 | 18.90 | 400.5 | |