High Bush Blueberry Stem Gall Wasp Final Report

By Pat LaPoint – LaPoint's Hill 'n' Hollow
7087 Rogers Rd. Pavilion, NY 14525
(585) 584-3978 e-mail lapoint@2ki.net

Soc.Sec.#133-30-9013
Project#: FNE01-383
Blueberry Stem Gall Wasp

Goals of the Project were:

1. To study the life cycle of the blueberry stem gall wasp *(Hemadas nubilipennis)*
2. Try to identify where the wasp is coming from; whether there is an alternative host not identified at this point
3. Ascertain whether pruning the new growth of the blueberry plant in order to remove the galls reduces production or increases growth for better production in the future.
4. Write a life cycle educational curriculum that can be used in schools and also put a price on the galls as an educational project.
5. Compare the alternatives of raising galls for education vs. raising blueberries for sale
6. Contact other blueberry growers, tell them of the study, share information and chart locations of gall infestations if possible. (compare organic vs. sprayed plantations for gall infestations)
7. Share the information through various fruit grower newsletters and fruit conferences.

Update on our farm since we received the grant:

At the time of the grant notification we were farming 88 acres; 2.5 acres of blueberries and raspberries and winter wheat, grain corn and alfalfa on the remaining acres. My husband and I both worked full time off the farm. Currently we have rented the farm to a neighbor who is raising the same crops we did. The only land we are operating are the 2.5 acres of blueberries and raspberries. The majority of the fruit is harvested by u-pickers; I have one wholesale account with a nearby farm stand and also fill some retail orders.

I am currently employed as the community agriculture educator with Cornell Cooperative Extension of Genesee County. I mention this as it gives me great contacts with other farmers and educators.

The cooperators and their collaboration in the project:

Name and address	Role in the project
Dr. J. D. Shorthouse Laurentian University Ramsey Lake Road Sudbury, Ontario Canada, P3E 2C6	Consultant, research provided initial information and examined a sample of galls to determine wasp vs. parasitoids count
Dr. Marvin Pritts 119 Plant Science Bldg. Cornell University Ithaca, NY 14853 MPP3@cornell.edu	Consultant, advisor for experimental research,
Dr. Greg English-Loeb Geneva Experiment Station Dept. of Entomology Geneva, NY 14456 GME1@cornell.edu	Consultant for entomology problems
John Will Batavia City School Adm. 39 Washington Ave. Batavia, NY 14020 jwill@bataviacsd.org	Science curriculum specialist (elementary)
Gary Heim Batavia High School State St. Batavia, NY 14020 gheim@bataviascd.org	Science curriculum specialist (high school)

I would like to describe the location of our blueberry acreage, as it may be an important part of the study. The 2 acre plot is located on top of a hill, elevation 1300'. The rows are aligned in a north-south pattern. The most westerly rows are the only rows that have galls. There is a hedgerow on the western border of the plot, toward the back (north) there is a good sized clump of sumac that break the westerly wind. The south/western end of the plot is sheltered by a narrow strip of woods that breaks the wind. There is a deep valley on the west; generally speaking, there is usually a stiff breeze, in the north end of the plot. Please note: When I speak of number of rows of blueberries, I always begin on the west side, row one being next to the hedgerow.

2000 – 2001:

In order to make observations, I did not prune the galls from the blueberry bushes, as is my usual habit. Dead and damaged wood was pruned, as well as scrub bushes that creep in from the hedgerow. I marked (colored plastic tape) and counted each gall as it was found in the rows. In past years I had only found galls in the first three rows. This year I counted 3 galls in the fifth row, which was a first time occurrence (no galls in the fourth row). Also, in past years the galls had been much larger (in size and quantity) than the galls I found this time.

The total galls (81) counted and to be observed were:
Row one – 65, Row two – 10, Row three 3, Row four 0, Row five 3.

We had an unusually hot day on Friday, May 4th, followed by a very warm weekend. On Monday, May 7th Dr. Marvin Pritts (Cornell University, Plant Science) and Greg English-Loeb (Geneva Exp. Station, Entomologist) had determined they would visit the blueberry plot to decide what they could do to help me with the study. They arrive mid-morning to a patch alive with emerged insects, which we determined were *Hemadas nubilipennis*, the stem gall wasp in question. Previous research had determined the wasp lays its eggs in the new growth of the blueberry stems. Since it was very early in the season, the leaves were still in whorl stage, with no new growth appearing. *It proved to be an unusual season for the study!*

At the suggestion of Drs. Pritts and English-Loeb; I firmly secured 9 galls (showing no signs of emergence at that time) with Remay, which is a row cover I happened to have available. The purpose was to observe what would happen in a controlled area with no new growth. Later study showed that emergence took place within the Remay covering – but only 1 (very small) gall was made in the 9 covered areas; this being on old growth.

In the fall, after the leaves fell off the bushes I counted galls and to my surprise there was emergence holes in the spring galls and a new set of galls that had no holes in them.

> Note: it is easy to identify a new gall as it is smooth appearing reddish pink with no holes in it. An old gall is darkish brown/black, rough coated with emergence holes in various spots.

In order to keep track of the galls, I marked them with two different colored plastic tapes; spring being orange, summer being pink. This established the fact that there had been two life cycles of the stem gall wasp. I noticed overall gall size was somewhat larger in the summer galls, but I did not measure and compare. I remember thinking gall size related to the early emergence; there being no new spring growth available during the spring (2001) vs. a lot of new growth available in the summer.

The total galls (50) in each row for the second life cycle were as follows:
Row one – 32, Row two – 13 Row three – 5 Row four/five- none

In January 2002 I contacted Dr. Pritts with my results and inquired as to possibilities to make a report available for one of the fruit conferences. He mentioned the fact that he was speaking about blueberries at one of the conferences. He welcomed me to send him copies of a newsletter of my findings and he would make them available at his presentation. I attended a fruit juice seminar at Geneva, New York where I spoke informally to several blueberry growers who were also in attendance. One grower spoke of finding galls in the roots of a blueberry plant that was dug up for diagnosis of another problem.

I submitted my final report to NE SARE, requesting a six month extension and was granted a year extension in order to determine, if in fact, a second cycle of the stem gall wasp was apparent the next year.

2002-2003:

In order to keep observations the same, I did not prune any galls. Each season was marked by different colors and easily determined. Dead and damaged wood was pruned, as well as rogue trees and bushes that move in from the hedgerow. It was impossible to tell when emergence took place because of the weather. It was rainy and unusually cold. I spent time looking for emergence between May 19th and June 2nd. I never observed any wasps in the air because of the rain, but did find a few emergence holes in the galls. The galls were small and averaged 3 emergence holes per gall. New growth had appeared on the plants by the time I observed emergence holes. It is impossible to find new galls beginning because of the amount of leaf cover on the bushes.

In November I marked, mapped and counted the galls for the season. The count for the season was as follows:

Spring gall total (30) Summer (54)

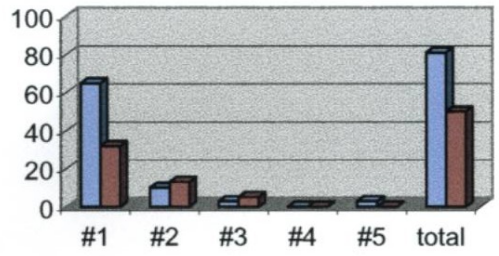
Spring:	Row one – 16	Row two – 6	Row three – 8
Summer:	Row one – 22	Row two – 20	Row three - 12 (no galls on further rows)

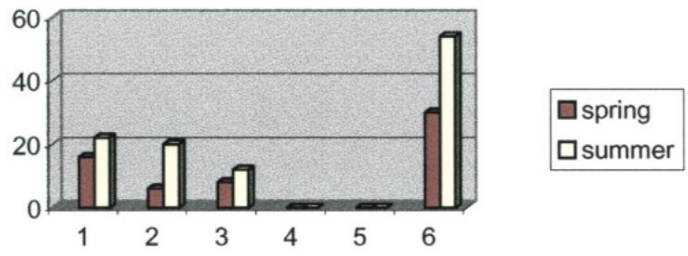
The most noticeable difference in the galls this count was the size of the summer galls. They averaged at least 4 times larger than the galls in the previous two years. In fact, they were the size of the galls in 1999 that prompted my writing this grant to begin studying the problem. I estimate the average size of the 2002 summer galls are approximately 1" in length and about ½" wide as opposed to the pencil eraser size of the last year. (see attached diagram) I have cut several galls open and found 2-3 rows of chambers with an average of 12-15 larvae inside each gall.

I spoke with Dr. Pritts in regards to the large sized summer galls. He surmises it may have to do with the health of the plant at the time of the wasp laying its eggs. This makes sense, since the wasp stabs the stem horizontally at the top of the egg masses. If the plant is in good health it would have excess nutrients to cover the eggs and make a substantial gall formation. However, more eggs are laid in the chambers, which seems it would have more to do with the well being of the wasp, than the plant. It may be that the second cycle wasp is more hearty because it does not go through the winter months.

I will continue to research and study this problem, even though the grant is completed.

2001	#1	#2	#3	#4	#5	total
spring	65	10	3	0	3	81
summer	32	13	5	0	0	50
2002						
spring	16	6	8	0	0	30
summer	22	20	12	0	0	54





Findings and Accomplishments:

My number one goal was to understand the life cycle of the blueberry stem gall wasp *Hemadas nubilipennis*. I feel I accomplished that goal. Finding the second life cycle was an unexpected result. It helps me understand the variations in size and amount of galls that appear. The weather variant makes it difficult to find a sensible conclusion to the project. In the two years of study there has been no way to establish a norm. I am sure that is to be expected. However, I will still count and mark the galls, keep track of the weather and record data. Possibly over the next few years there will be a commonality.

My number two goal was to determine how the wasp was re-infecting our plot, year after year, when galls have been removed. It seemed impossible that we would keep having large counts of galls with no area nearby to spread them our way.

1. I wondered if it was possible that there might be a host plant nearby that contained galls. After consulting with Dr. Shorthouse, I discovered that there are no host plants other than low-bush blueberries, which do not grow in our area because of our high pH.

2. Another possibility was underground galls attaching themselves to the roots of the blueberries, as has been discovered in the low-bush varieties. This is a difficult determination in our case because we have a trickle irrigation system beneath the plants (which is 23 years old). Digging a plant up is likely to cause leaks in the system because the roots would be wrapped around the tubing. I carefully dug into several plants that had large populations of galls on the new growth, I found no galls during that search. I can not rule this possibility out, but I feel I have to live with the situation if it is present rather than having to repair leaks because of the search. In an informal discussion with another blueberry grower mid-state, she reported finding galls on roots of a plant dug up for diagnosis purposes.

3. To me, the only feasible possibility is that the wasps are airborne and are dropping into the patch, after wind currents change when passing the hedgerow on the west side of the patch. The unusual situation of our patch having a deep valley on the western side of the patch makes this feasible to me. Seldom do I find galls in the beginning part of the patch where it is sheltered from westerly winds from a woods and a house. In the back part of the patch, (toward the north) the winds are

steady, even on a calm day. The valley is open except for the hedgerow that has clumps of sumac that break the wind currents.

Since the galls are usually found in the first three rows only, it seems possible they could drop there from the disruption in the wind current. When Drs. Pritts and English-Loeb visited the patch they also thought the unusual situation might be a factor. Since I discovered the second life cycle was where the largest population of galls was coming from, I wondered if it was possible that in July-August an airborne system of insects might be possible. I asked Dr. English-Loeb if he was aware of a way to set up a trap of some kind. He wondered about sticky paper.

I bought a roll of sticky fly trap paper and hung it from poles in the hedgerow on the west side of the sumac clumps. (Of course, that night a storm appeared and wrapped the paper up into the sumac bushes!) It was still sticky and on the west side so I left it to see what would happen. I collected very large amounts of insects, however, it was impossible for me to determine and identify the attached insects with my limited knowledge.

I am still fond of the airborne theory as the best cause of large populations of galls that appear in the back of the patch. It seems to me, as I look at the location of the galls, four things appear common.

1. Groups of galls are found near each other.
2. Most galls are toward the back of the patch toward the north end.
3. Only once in the 6 years that we have noticed the galls have we found galls past the third row. In this situation it was during the test study when I did not remove previous galls and destroy them.
4. Even when new galls were found, removed and destroyed before Emergence, new galls appeared the next season, in one case in alarmingly large populations.

It is not possible to come to a conclusion, based on the study so far, but I will keep records in order to help solve the puzzle.

The third goal of the study was to determine whether other people were affected by the blueberry stem gall wasp. If so, I would attempt to map areas where there were problems. I submitted an article in the *Berry Growers Newsletter* relating my goals. I invited growers or other interested people to contact me. I only received two inquiries. I also consulted with a random selection of growers I gathered from the *NYS Guide to Farm Fresh Products* and the *NYS Organic Food Guide* for berry growers. My findings were inconclusive but did show that organic growers were more often bothered by the gall. However, no grower reported a large enough population that they were concerned about the problem. Growers who sprayed their acreage seemed never to have seen the gall and were unconcerned about it.

In talking to one grower in Michigan, he felt the time to apply spray was also the time of spring wasp emergence – just before the first flowers appear. We discussed what I had been doing and he wants to remain in touch.

I did not produce a map of infected areas, as it seems our situation is unique, I am the one most interested in the project.

Another goal of the project was to finish and make available an educational life cycle curriculum using the study of the Blueberry Stem Gall Wasp as the subject. I have written and piloted the curriculum, it was accepted without question. I will gladly share it with any grower who has galls and is interested in promoting a science project in fourth – sixth grade. I have enclosed a copy of the curriculum with a disc so you may share it with anyone interested. I will also make my address available in The Berry Grower Newsletter when I write an article with my study results.

Another facet of the curriculum project was to determine how to price the galls and approach a science kit company to ascertain their interest in the project. I contacted two science kit companies and have received no replies. My feeling is this; since the galls supply is erratic in size and amounts, the project is better used on a local basis with local growers promoting the curriculum when they have galls available. I have found that I can freeze the galls (new, with no emergence holes) when I have large amounts and use them as I need them. I feel the contact of the local grower (or an Extension Educator or Farm Bureau representative) with the classroom gives a personal appeal and will help promote agriculture, education and careers in agriculture to a further extent.

The final goal of the project was to determine whether it was financially feasible to raise galls for sale with the science kit and curriculum or more beneficial to wait for production on the new growth on the pruned blueberry bushes (where galls have been removed). My experience has been observation based only. It has been four growing seasons since we had the large amount of galls in the first and second rows of blueberries. Until two years ago, we had pruned the galls from the plants, which left them without much new growth in the highly infected areas. I can say, with out a doubt the plants that were pruned drastically are much fuller and have potential for a lot of area for increased production. At this time we have not had flowers appear in that growth area. I expect with a good spring we may see some flowers for the first time in the four years. I have measured production in the highly infected area for the past two years and recorded the data. I will do so again this harvest season and the next to determine the variation in production, if in fact the infected areas do begin to produce.

At this point, I plan to prune the largest summer galls from the plants, freeze them to prevent a large infestation possibility. I will use them this spring and summer for science projects with the curriculum, locally. I will observe the remaining galls for emergence and keep recording data for my own use. As I mentioned before; the summer galls seem to be the larger sized and best for the curriculum project. Of course they also contain the greater possibility for further contamination of the patch. I will have to weigh the pros and cons as to which is more important the gall study and life cycle curriculum project vs. the production of blueberries.

At this point I feel the gall study and education project is most important. I will continue to collect data and try to understand what is happening. If the gall situation spreads past the third row I will prune the galls entirely to prevent contamination of the entire patch.

On a personal note: I have enjoyed the opportunity to work with this project on a professional level. I have learned a lot about keeping records and recording data.

I have tried to keep the report simple; if you require more records or data please contact me and I will gladly comply.

My biggest surprise was the lack of interest in the spread of the blueberry stem gall wasp. I believe the majority of growers spray so they do not feel they are at risk. It will be interesting to see if I ever have another huge population of galls as I did four years ago.

Pat LaPoint Pat LaPoint
February 28, 2003

The Blueberry Stem Gall

Introduction

The Blueberry Stem Gall is caused by a small chalcid wasp, *Hemadas nubilipennis*, which belongs to the family Pteromalidae. In recent years, these galls have become a concern because they occasionally contaminate the finished blueberry product. This fact sheet gives a description and life history of this insect.

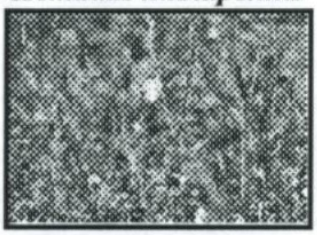
Adult stem gall wasp

Click picture to enlarge

Description

Blueberry stem galls are small kidney shaped to irregular spherical growths on the stems of blueberry plants. They range in size from 5 to 25 mm. The adult wasps are tiny, being only 2.0 - 2.5 mm in length. The head, thorax and abdomen are black. The legs and scape of the antenna are light amber. The antennal club is black. The wings are infuscated with black. The larvae are creamy white legless grubs.

Blueberry stem gall caused by *Hemadas nubilipennis*



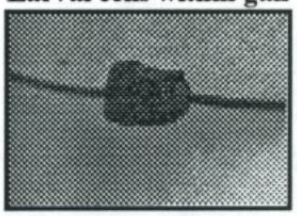
Click picture to enlarge

Biology

The adults are almost entirely females, and emerge from the gall in late May to early June, before the buds break. They seek out a developing blueberry shoot and lay several eggs in the stem. The majority of galls (up to 70%) are formed on stems within the leaf litter. The remainder are on stems above the surface. After laying her eggs, the female climbs to the tip of the shoot and stabs the tissue at the tip of the stem several times causing it severe damage. Egg laying damages the plant cells near the eggs, which causes abnormal tissue growth. A chamber is formed around each egg.

The eggs hatch in 12 - 14 days, and the larvae feed on tissue of the wall of the chamber. During larval feeding the plant cells divide and multiply into large masses of tissue which eventually form the gall. On average each gall will contain about 12 larvae.The gall continues to grow throughout the summer and reaches its maximum size by late August. The outer covering is at first soft, but becomes hard and woody by maturity. The larvae spend the winter in the gall, and pupate within the gall, in the spring.

Larval cells within gall



Click picture to enlarge

Damage

There are two concerns about the damage caused by the stem gall wasp. The first is the effect of the gall on the blueberry plant itself. The result of the female wasp injuring the growing tip, and the utilization of plant nutrients in forming the gall, and producing nutrients for the larvae, is that no fruit buds are formed on the stem. If this occurs during the vegetative cycle of production there may be a reduction in the yield the following year. A build up of gall populations over many cropping cycles may have a more serious impact. However, the effect of blueberry stem galls on the yield has not been studied.

The second concern is that galls, especially those higher on the stem, may break off the stem during harvesting. These galls can then pass through the processing line and end up as foreign objects in the finished product.

Control

There are a number of species of wasps, including parasites, that utilize the galls formed by the blueberry stem gall wasp. The relationship of these and their effect on blueberry stem gall wasp populations is not known, although high levels of parasitism (more than 50% of galls were parasitized in one study) are possible.

There are no chemical controls registered for this insect. Burning as a pruning method may have some effect. This has not been clearly established at this time.

References

Shorthouse, J. D., A.West, R.W.Landry, P.D.Thibideau, 1986. Structural damage by female *Hemadas nubilipennis* (Hymenoptera: Pteromalidae) as a factor in gall induction on lowbush blueberry. *Can. Ent.* 118 (3) pp. 249-254.

Shorthouse, J. D., I. F. MacKay, and T. J. Zmijowskyj, 1990. Role of parasitoids associated with galls induced by *Hemadas nubilipennis* (Hymenoptera: Pteromalidae) on lowbush blueberry. Environ. Entomol. 19(4): pp. 911-915.

West, A. and J. D. Shorthouse, 1989. Initiation and development of the stem gall induced by *Hemadas nubilipennis* (Hymenoptera: Pteromalidae) on lowbush blueberry, *Vaccinium angustifolium* (Ericaceae). *Can. J. Bot.* **67** (7) pp 2187-2198.