Gooseberries
Ribes hirtellum
Exploratory Research Into Production and Pest Management Strategies Throughout Three Regions of the United States
Research Objective

To identify and understand the pest issues facing today’s gooseberry growers in order to research and publish recommendations for biological and cultural control measures to incorporate into existing pest management programs.
Problem Area

- Lack of adequate current published information in the areas of cultural and biological control of gooseberry pests as well as for other Ribes

- Published information is from the 1800’s

- Ribes fruits fell out of favor with the general public since the ban in the early 1900’s due to alternate host for White Pine blister rust fungus, even though ban was recinded in 1966
Theoretical Perspectives

- Increasing epidemiological evidence of the benefits of diets rich in fruits and vegetables to reduce risk of heart disease, cancer and other chronic diseases
- Berries rich in antioxidants to include anthocyanins
- Research has been done and is currently being done on the antioxidant quantities of berries (Moyer, 2002–National Clonal Germplasm Repository) (Zhou, 2010–Wayne State University) other than simple measuring vitamin C quantity
Theoretical Perspectives

- Ban on growing gooseberries and other Ribes was rescinded in 1966 in most states
- Laws vary in many states and ban has been modified to allow immune or resistant varieties (blister rust fungus) to be grown
- There are very few growers across the US
- Very popular still in UK, Poland, and Latvian countries
- Population of gooseberry and currant lovers is aging
Related Literature  (all cited in research paper)

- Researched many state extension publications that may have been critiqued by professional colleagues regarding pest guidelines
- Researched several papers from professional journals and also old books, on topics specific to potential choices for biological controls
- Researched professional journal articles, and books relating to the possible identification of a mystery, sawfly in New York
- Researched professional journal article on Anthocyanins, Phenolics, and Antioxidant Capacity of Small Fruits
- Communicated by email with entomologists around the US regarding my ideas for biological controls and positive identification of mystery sawfly in New York
Challenging Related Research

- When reading the related research I kept thinking, but what if this and what if that?
- You will see my thought process further on in my recommendations for further research and recommendations for cultural and biological control of the– Mystery NY sawfly!!
- “If this works for this than why not that”, I kept saying to myself
- I made an amazing contact, a retired entomologist, Dave Smith ....Wash.D.C. What a story I have for you! We wrote back and forth daily for weeks with my ideas. He kept me thinking and pointed me towards other old references you could not find anywhere! You will see the result of endless emails and pictures sent!!!!
Approach & Methodology

- Needed to find out what gooseberry growers were already doing for production and pest management
- Created an interview guide (Appendix A)
- Researched potential population
- Determined relative sample
- Conducted in person interviews and phone interviews to determine growers insight from experience and needs as a result of new problems
Qualitative Procedures

- Primary and secondary research was conducted
- A thorough review of published literature on IMP for Ribes was reviewed
- Needed to find out what growers were actually doing about their production and pest management as compared to what was scantly published
- Conducted in person and phone interviews with growers from three different regions of the US which led to further research on my own regarding pest issues they were dealing with
Rationale for Personal Interviews

I felt the need to talk directly to growers of all sizes. I interviewed small growers that had less than one acre of gooseberries, medium growers with over 5 acres and large growers that had over 10 acres of berries. I spent hours riding in trucks while very busy growers were managing their operations. I took copious notes! This is how I got real data to work with! I talked for hours on the phone! I ate lunch in diners with them! As they had pest issues I dug deeper into my research! Mystery worm in NY, mystery herbicide resistant weed in OR! I was their hope for bio and/or chemical controls!!
Subjects Selection Process

- I started by searching the Internet for gooseberry growers and found only 2 people which turned out to be commercial growers only, however they gave me leads!
- Referrals lead to other referrals!
- I contacted 40 farmers off the “Local Harvest” on-line association of farms and distributors who had a link to gooseberries in some way
- I was able to contact two of the largest gooseberry growers in Oregon—Both agreed to meet with me!
Participants/Subjects

- I interviewed 21 growers across the US
- 18 were identified as small or under an acre of gooseberries
- 2 were very large growers that had over 10 acres
- 1 was classified as a medium grower and they had 5 acres
- All but 1 grower grew many other crops as well and some grew only berries as a business
I interviewed 10 growers at their farms
I interviewed 11 growers over the phone
I interviewed while they worked!
I interviewed in pick-up truck!!!
I interviewed under a giant willow tree!
I interviewed while walking acres and acres of gooseberries, asking questions every minute!
I sampled gooseberry jam in Anna Mae’s certified kitchen and wrote notes!
I met pet dogs, sheep, horses, and goats!
I spent hours and hours in airports!!!!
Interviews With Gooseberry Growers Across the United States
Close Collaboration

- Once I sat down with the grower and talked seriously about their issues they were instantly my friend and Ribes colleague!

- Before visiting the growers I had spoken with them via email or phone many times. We were happy to actually meet and they were very open to participating in my research. I brought everyone a bag of Cape Cod dried cranberries!!!! Even the largest Oregon growers spent a minimum of three hours each with me!!! Even the growers I interviewed over the phone were eager to provide information for the research, in hopes to have better IPM for their gooseberries!!!
I created a short (12 question) questionnaire to use while I was interviewing.

I sent it to each grower to read and make comments on before the actual interview.

Interview guide (questionnaire) will be attached to research paper as an appendix.

The questions I chose were reviewed and validated by my committee members and my advisor, Josh Freeman, as being appropriate for the participants and for my research objective.
Influence of Researchers Presence

- When I personally interviewed the growers, I believe that I was able to get them to open up more and talk in more detail than when I was interviewing them over the phone.
- I believe that since the growers knew I had flown in from far away, they were more forthcoming with data than were the growers I interviewed over the phone.
Spread of Interviews

Pacific Northwest Region
2–very large growers–Oregon
3–small growers–Oregon
2– small growers–Washington (one certified organic)

Central & Midwest Region
3– small –Minnesota
1–small– Iowa
1–small–Missouri
1–small–Ohio
1–small–Wisconsin
2–small–Illinois

Northeast Region
3–small–New York
1–medium–Pennsylvania
1–small–Pennsylvania
National Clonal Germplasm Repository, Corvallis, Oregon repository for what?

- Kim E. Hummer—Research Leader
  USDA Agricultural Research Service
  is in charge of the repository in Corvallis and the Arctic and Subarctic Plant Gene Bank in Palmer, Alaska.

- She gave me a tour of all the Ribes stock (in field 1318 plants, indoor 549, seed 551, in vitro 35) she has there and we talked for two hours about my ideas and my many questions?
While at the repository I was introduced to Joseph Postman who is the Plant Pathologist/Curator. Joe and I talked about my mystery weed from a large OR grower and we talked about my mystery green defoliating gooseberry worm in NY that others were misidentifying as an imported currant worm! I met with James Oliphant who is the Greenhouse Manager and we talked about ideas for biological and cultural control of this gooseberry worm! I knew it wasn’t what people were stating it was! It’s not that same sawfly!!! And, I was right........
Organization of Data

- I compiled all my responses from each grower question by question in a raw data report, and attached as an appendix to the research report resistance to paraquat?
- After compiling all data question by question, I identified patterns and synthesized key ideas as seen in my “Findings” section
- I have identified areas where further research is needed for both biological and cultural control recommendations
Findings—Data Analysis: Cultivars You Choose to Grow

Q: Please list the cultivars of gooseberries you currently are growing?

- Cultivars of gooseberries grown showed some popular ones
- Hinnomaki Red and Hinnomaki Yellow was liked in all three regions by 10 out of 21 growers (50%)
- Some growers mentioned people really like them— and gives growers a variety of colors to sell
- An organic grower in WA stated that they perform very well
- Wholesale nursery grower stated that she has great demand for these
- People really like their taste
- One grower said that Hinnomaki yellow has the best flavor of all!
Findings: Gooseberry Cultivars Grown

- Tixia cultivar had mixed responses from growers
- One grower I didn’t include in my survey because she had lost all of her 200 Tixia and Red Hinnomaki plants to the mystery green worm? You will soon find out!
- Grower in MN said that this variety was prone to powdery mildew and worms prefer it
- Another grower in PA said they were very hardy and could survive their harsh winters
- An IL berry farmer grows Tixia because it is semi-thornless
- This variety produces more per bush than other varieties–PA
- 8 out of 21 (38%) growers grow Tixia—all regions
- Oregon Champ is preferred in Oregon because it is what everyone wants there! It sells to the largest buyer in the area which is Oregon Fruit. Sell canned gooseberries and many other canned berries.
- A grower in MN states that they are great and resist defoliation!!!!
Findings: Gooseberry Cultivars

• Although 7 growers—all regions—grow Johns Prairie, only one had anything good to say about them. They have poor vigor and did not like them at all—OR certified organic grower did like them—WA. One berry farmer in IL is growing them because they are winter hardy. No problems so far (only 3 years though)

• Poorman was another popular variety—with 7 out of 21(33%) growers—all regions—yet only one mentioned that they thought it was their best one

• Pixwell was another common one with 8 out of 21(38%) growers growing—all regions—with one stating that they didn’t like it and had poor vigor, while another grower grows these exclusively for their farmers market venture in MO.
Findings: Establishment Periods & Irrigation

Q: What are your establishment periods?
Q: How do you irrigate and fertilize your crop?

- Establishment periods ranged from 3–5 years with 4–5 years the best for full production
- Many growers stated that they could have a crop worth picking in 3 years though
- 11 out of 21 growers used drip irrigation with 2 of them only using it during establishment year
- Only 2 growers used exclusively overhead irrigation with one grower using both overhead and drip
• 8 growers did not irrigate at all for various reasons—very moist soil (WA), abnormally high rainfall (IL), mulch very well (NY)
• 10 out of 21 (47%) growers fertilized their gooseberries from a variety of sources
• Of the others who don’t, it was mainly due to their normally rich soil
• Of the ones who fertilize their gooseberries, most did so through their drip lines
• Most all growers did not have any method for scheduling their irrigations other than feeling the soils dryness and measuring rainfall
Only a very large grower in OR used Wade lateral Lines and applied irrigation regularly, since he has acres and acres of marion berries, red raspberries, as well as many vegetable crops.

Kraemer Farms
Mt. Angel, OR
Although most all growers did not have a specific method, they noted that they made sure the gooseberries received 1–2” of water per week.

One grower in IA uses a tensiometer and achieves – 50% field saturation.

Only one grower (OR*** ) used foliar analysis to monitor plant nutritional needs but a few growers mentioned that it was not a bad idea.

The other growers that applied fertilizer at all had scheduled applications.
Findings: Biggest Insect Pest Problems

Q: What are your biggest insect pest problems?

- By far, the largest pest for most growers was the sawfly in the East. (key research regarding this sawfly in conclusions section)
- NE growers thought the eggs came to them on bare root stock they had purchased in MA
- One grower not included in the survey results lost all 200 plants this year due to small green worm
- In the Midwest region 5 out of 9 growers commented that they had issues with either small green worms, the imported currant worm, and wasn’t sure but it was a sawfly!
- Only one grower in MN had complete defoliation by worms but not on his Tixia or Pixwell
Old/New Pest For Large Oregon Grower

- Black gooseberry Borer (Xylocrius agassizi) *italics* AKA flat–headed borer
- Emerges March through April or May and lays eggs at that time
- Difficult to control because of bee activity and fruit ripening time
Findings: Methods Used for Sampling Pests—All Regions

Q: What direct/indirect methods do you use for sampling your pests?

- Out of all the growers interviewed only 2 used an indirect method of sampling for pests and that those were both in OR– they used pheromone traps for crown species.
- The spotted wing drosophila may need to be checked in the near future (OR *** Other states?)
- All other growers used visual–direct methods
Findings: Major Weed Problems—Midwest

Q: What are your weed problems and the control method you use?

- In the Central & Midwest region, IL growers had major problems with grasses due to heavy rainfall.
- Of all the states in that region, growers controlled their weeds with a variety of herbicides and by heavily mulching with either wood chips, sawdust or pine needles.
- There were no common weeds in those states.
Weed Findings in Pacific NW Region

- There was no commonly found weed pest
- Most growers used either Round-up, Karmex, Casoron to keep area in the rows clean from weeds (large growers)
- Smaller growers hand cultivated their weeds and most of those heavily mulched as well
- One significant finding was with a very large grower in Oregon. He had a mystery weed he could not identify, that was resistant to Round-up and Gramoxone unusual? and was choking out his gooseberries. I took a picture and got working on that
Mystery HR Weed–Kraemer Farms
Mt. Angel, Oregon–July 12, 2010

Research findings on this weed in conclusions section
Findings: Weed Issues in NEast Region

- There were no common weeds in the NE
- Insects were more of an issue
- Most all growers heavily mulch with either, straw, wood chips and/or leaves
- Only weeds specifically mentioned were bindweed, wild grape, poison ivy wild morning glory and creeper vine
- One grower uses greenhouse fabric around all bushes to suppress weeds
- 2 out of 5 specifically mentioned hand-weeding and mowing
Findings: Disease Problems–All Regions

Q: What diseases have been a problem for you and how are they controlled?

- The one and only major disease is as expected, the fungus, powdery mildew
- The fungus is a problem in all regions with 9 out of 21 (43%) reporting problems
- Of the 9 with mildew problems, 7 (78%) of them spray with fungicides
- Only one grower in the PNW, large, mentioned a problem with Leaf spot and it is controlled with lime, sulfur, and either Abound, Rally, or Pristine.
- One grower in MO mentioned brown spots on leaves. I will contact him with ideas of either Leaf spot (Septoria leaf spot) or Anthracnose, both controlled with fungicides
- Another mystery disease was described as grey patches, waxy, scaly – WA – will send pictures of San Jose Scale to him
Findings: Rise/Decline in Pest Populations—All Regions

Q: Have you seen a rise/decline in pest populations, and if so, which pest(s) and explain your beliefs for this rise/decline?

- In PNW only one large grower mentioned that he had seen a rise in weeds resistant to glyphosate (OR***)
- In the MW region one grower commented that he has seen an increase in the imported currant worm (MO*)
- Grass weeds in IL due to excessive rain
- In PA, one grower noted that the currant borer rapidly gets out of hand and that Pixwell is particularly susceptible to currant worm. Pests populations rising after second year of planting
- A rise in sawflies in NY believed to have come in from MA nursery—“The Mystery Sawfly”
Mystery larvae of a small fly
Must be imported currant worm
Nematus ribesii—I say no it is not

So, I was on a mission !!!
Damage Was Bad—Complete Defoliation
Every minute I wasn’t interviewing I was reading and searching for proof I was right
But if not Nematus ribesii then who is it?
Over 750 species of sawflies?
Been around since prehistoric times?
Then went back to my old research references
Talked to three entomologists around the country—thought it was still imported currant worm
I did not give up!
Very Old References—Getting Closer

- 1895 report from MN entomologist of a damaging sawfly larvae fit description referred to as “native currant worm”
- Then old report from annual meeting NY State Agricultural Society, Albany 1868 describing devastating damage from small sawfly larvae originally in Ohio ten years ago (Ohio Currant Sawfly)—Pristiphora rufipes—now in New York and described the larvae just as mine was
- Sent emails to other entomologists (WSU, Uof I, Iowa State—all said needed more details and probably was imported currant worm 2\textsuperscript{nd} or 3\textsuperscript{rd} instar
- Then found photo on-line by amateur photographer submitted—Bug Guide—emailed him
Researched Article about old Sawfly Collection

- Can’t get article from VT library—so ordered it
- Photographer emails me
- Tells me he doesn’t know what sawfly it is but
- Hey, Dave Smith might know!
- Enter Dave Smith—Expert on Sawflies
- Retired entomologist—Museum of Natural History—Washington DC
- In charge of old national sawfly collection from H.G. Dyar (1893–1900)
- Was author of the article I was looking for! The Sawfly Work of H.G. Dyar—David R. Smith
Added Research

- Imperial Institute of Entomology “Bulletin of Entomological Research, Vol XXIII 1932
  “Biological Studies of Sawflies Infesting Ribes” by Herbert W. Miles, M.Sc, PhD, Victoria University of Manchester
- Sent to me by David Smith
- Once I read the description, I knew that it was the old Pristiphora pallipes and also called Pristiphora rufipes–New name had to come from the expert in sawflies!
Had to be Sure

- Had grower send adult sawflies to DC for positive identification–Kestral Perch Berry Farm–Ithaca, New York (Catherine Creeger)
- As interviews continued with gooseberry growers, I anxiously awaited Dave’s reply….
- The email came on July 30th! It was a positive identification!
- I (WE!) now knew exactly what we were dealing with as far as life cycle goes and now how do we interrupt it with natural enemies!
Pristiphora appendiculata!

Her new home is in the national collection of sawflies at the Museum of Natural History, Washington D.C.
Pristiphora appendiculata
“small gooseberry sawfly”

Named by Linda P. Johnson
as referred to in old literature
Synonymy of Pristiphora appendiculata

**Pristiphora appendiculata** (Hartig)

*Pristiphora pallipes* Serville. 1823. Preoccupied in Pristiphora by *P.pallipes* Fallen, 1808

*Pristiphora rufipes*, of authors, not Lepeletier 1823

*Nematus flavipes* Dahlbom, 1835. *Nomen oblitum*

*Tenthredo (Nematus) pallicornis* Harris, 1835. *Nomen nudum*

*Tenthredo (Nematus) labrata* Harris,1835. *Nomen nudum*

*Nematus appendiculatus* Hartig 1837. *Nomen protectum*

*Nematus (Diphadnus) fusciornis* Hartig, 1837.

*Nematus catheraticus* Foerster, 1854.

*Nematus pallicornis* Norton, 1861

*Nematus pallicornis* var. *labratus* Norton, 1861

*Nematus vitreipennis* Kawall, 1864

*Pristiphora grossulariae* Walsh,1866

*Nematus peletieri* Andre,1880

*Nematus pumilus* Zaddach, 1884

*Nematus ghilianii* Costa, 1894

Earliest valid name applied to this species is *appendiculata*

David Smith—Research Entomologist—National Museum of Natural History
Smithsonian Institution, Washington DC
Discussion/Conclusions

- There is a definite need for methods of biological control for the imported currant worm and for the newly identified small gooseberry sawfly.
- There is a definite need for cultural control methods for these two major pests.
- There is a need for further research into creating a Monitoring and Threshold Guide for IPM of Ribes.
- There is a need for further research into creating a Ribes Pest & Beneficial Activity Calendar—(snapshot of example in research paper—Ontario Apple IPM).
SCOUTING

Scouting Guide
Find out which pests to look for based on phenology here

Monitoring & Thresholds
Find the method for monitoring and thresholds for insect and disease pests here

Pheromone & Visual Traps
Guidelines for using pheromone and visual traps in orchards

Scouting Calendars
The activity of insects, diseases and beneficials in Ontario
Apple Pest & Beneficial Activity in Ontario

The periods of pest and beneficial activity illustrated below are general guidelines based upon both Ontario field experience and pestology research. The actual period of activity for any given pest will vary significantly from year to year, depending on over-wintering conditions; seasonal temperature accumulation; relative humidity; rainfall; prevailing wind patterns; and other environmental factors.

Click on an insect, disease or beneficial for more information.

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<th>Life stage</th>
<th># of generations</th>
<th>Phenology</th>
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<td>Larvae</td>
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<td>Larvae</td>
<td>Various</td>
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<td>Larvae in mines</td>
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BENEFICIALS

When developing any IPM program, remember the valuable contributions natural enemies make in reducing pest populations. Many pests are attacked by beneficial insects or mites and by various fungal, bacterial and viral agents. Often these natural enemies provide good suppression of pest populations, particularly indirect pests.

Choose to see one of the tables or browse the beneficials gallery below.
Recommendations for Biological Pest Control–Small Gooseberry Sawfly and Imported Currant Worm–Natural Enemies

**Predatory Stink bugs**–
- Stiretrus anchorago
- Podisus placidus (Placid soldier bug 1800’s) now possibly Spined Soldier Bug Podisus maculiventris– predatory on larvae and can be purchased commercially (Planet Natural)
1800’s– Placid Soldier Bug–Podisus placidus
Now– Spined Soldier Bug–Podisus maculiventris
Other Possibility—Stiretrus anchorago
Predatory on larvae

To be experimented on sawfly larvae
Good candidate
Parasitoids—Tachina Fly (1800’s)
Still here today!

- Internal parasite of sawfly larvae!

*Trichopoda pennipes*
Ichneumon fly/wasp

- Research needed to determine which fly would oviposit on gooseberry sawfly larvae. There are many kinds. Here is an example

_Megarhyssa macrurus_
Beetle Banks—Great Idea!

- An area of cultivated land that is used to breed predatory insects. It provides year-round protection for predatory ground beetles and other predatory insects that will dine on other insects & weed seeds.
Cultural Control Recommendations

- I recommend the trial use of green sticky card traps placed at the level of the gooseberry bushes to trap adult sawflies early in the spring when flying about. Since the apple sawflies are attracted to white sticky cards because it resembles the white apple blossoms then why not green sticky cards? Field research needs to be done on this. I would be interested in conducting this next summer
Identified as sharppoint fluvellin (from my picture)

*Kickxia elatine*—James Oliphant—USDA–ARS (Greenhouse Manager–Corvallis, OR)

This weed is spreading into the cropland of throughout the Willamette Valley of Oregon.

Little is known about controlling these weeds with herbicides.

May be able to be controlled by the herbicides, diuron, simazine, atrazine, and terbacil.

Preliminary trials suggest good control with Ally, Atrazine, Glean, Ignite, and Lexone
Further Research– Gooseberry rootborer
AKA– flat-headed borer(larvae)

- Further research is needed for identifying natural enemies for the adult longhorn beetle that lays its eggs on or near gooseberry stem forks and larvae burrow down into deeper roots.
Uses of endopathogenic fungi on gooseberry and other Ribes plants to ward off or kill chewing insects

Covering Ribes bushes with fabric covered moveable long tunnels, as an exclusion method, to keep sawflies out, or possibly growing bushes in a screened greenhouse

Using weed mats to cover all ground around bushes to prevent last drop of sawfly larvae from entering the ground for the winter
Canyon Gooseberry—Ribes menziesii

First Noted by expedition of Lewis & Clark, April 8, 1806, along the Columbia River, Oregon—Indians roasted these gooseberries and ate them