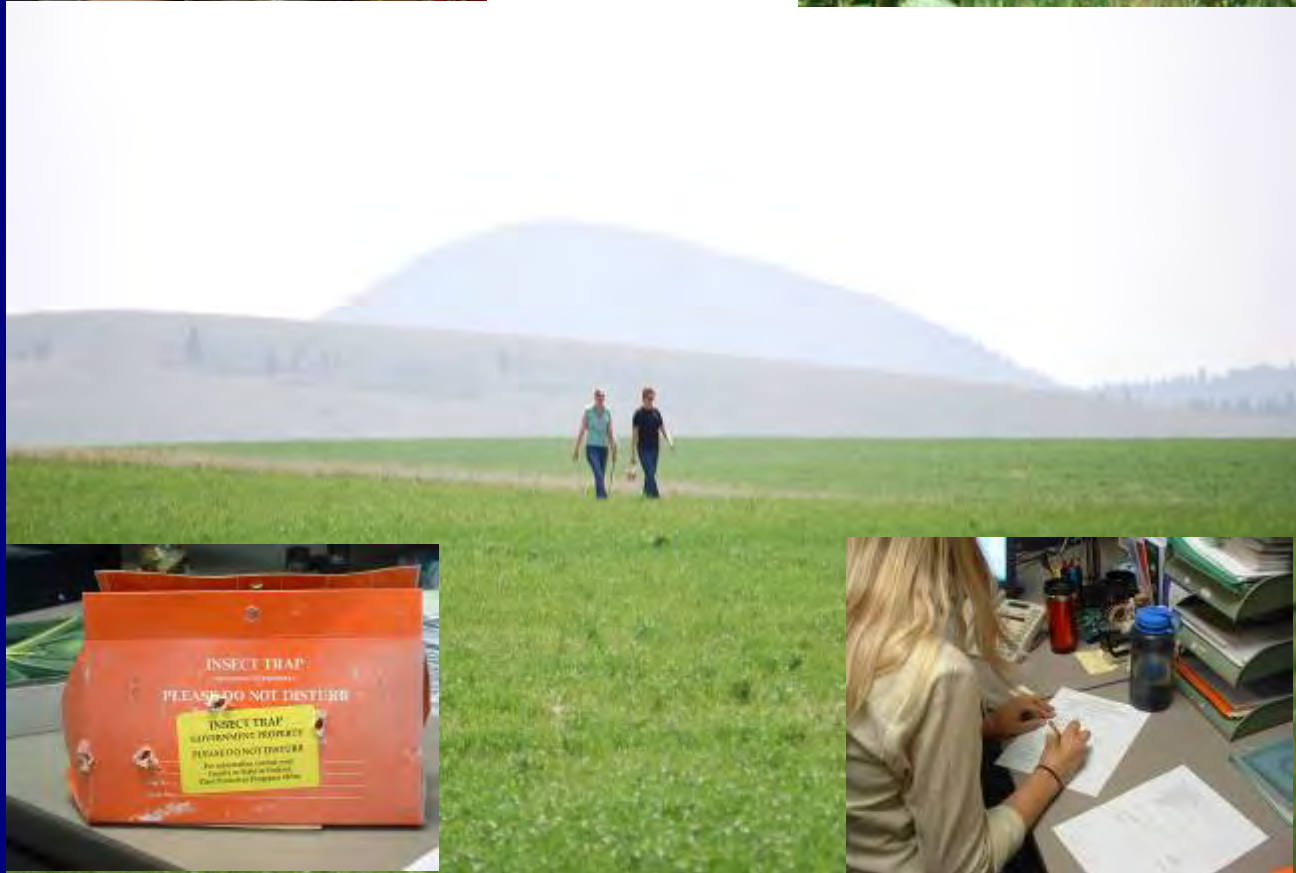


MONTANA DEPARTMENT OF AGRICULTURE PEST SURVEY REPORTS 2007



Contributors:

Montana Department of Agriculture Commodity Services Bureau

Pest Management Section

Kimberly Merenz
State Survey Coordinator
Michele Mettler
Nursery & Quarantine Specialist
Patricia Denke
Entomologist
Jura Hill and Duane Bay
GIS Specialists
Walter Scherer, Allisa Rafferty, April Wabeke
Pest Survey Interns
Kevin Grzebielski, Chris Helseth
Survey Technicians
Christine Norman, Kelly Elder
Data Entry Specialists

Commodity Section

Andy Gray
Commodity Section Supervisor

Bob Bales
Velda Baltrusch
Robyn Cassel
Chris Herron
Sean Mulla
Dan Poff
Lori Vance
Agricultural Specialists

Cooperators

USDA APHIS Plant Protection & Quarantine
USDA Forest Service
Montana Department of Natural Resources & Conservation
Montana State University Potato Laboratory

2007 Surveys

- | | |
|---|--|
| <ul style="list-style-type: none">• European and Asian Gypsy Moth• Karnal Bunt• Area-Wide Nematode• White Potato Cyst Nematode | <ul style="list-style-type: none">• Exotic Moths• Cereal Leaf Beetle• Cereal Leaf Beetle Biological Control• European Pine Shoot Moth |
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This report was compiled by Patricia Denke, Michele Mettler, and Kimberly Merenz,
with contributions from our survey interns and technicians.

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Introduction to the Program

The Cooperative Agricultural Pest Survey (CAPS) is a system of surveys conducted by USDA Animal Plant Health Inspection Service (APHIS) Plant Protection and Quarantine (PPQ), to detect and delimit the spread of introduced plant pests. To achieve this goal, the USDA APHIS PPQ enlists the assistance of state cooperators. In Montana, the state cooperators are coordinated through the Montana Department of Agriculture, and include not only the Department of Agriculture, but also programs from Montana State University.

The Interns and Other Program Assistants

The Montana Department of Agriculture conducts several of the surveys. This would not be possible without the assistance of a group of dedicated people, who join the Department personnel for the summer as interns and survey technicians. During 2007, we were also joined by several data management specialists. We also had the invaluable assistance of Margaret Rayda, Pest Survey Specialist for North Dakota and Montana with the USDA APHIS PPQ.

Interns included Allissa Rafferty, Walter Scherer and April Wabeke. Allissa and Walter joined us from New York, and concentrated on surveys on the west side of the continental divide, including the various moth surveys and the plum pox virus survey. April is from Montana and concentrated first on the cereal leaf beetle survey, Karnal bunt, and then on the area wide nematode survey.

In addition to the interns, we had the assistance of several part-time workers. Kevin Grzebielski is also from Montana, and joined us for a second year of filling in where needed, including on the plum pox virus survey and the area wide nematode sampling. Kevin also took Karnal bunt samples. Chris Helseth was with us for a short time, concentrating on data management and entry. Christine Norman worked on data entry and management, and Kelly Elder came on the finish data manipulation with the development of drop down menu tables for the various surveys, and repair of the automatic NAPIS entry table program.

The report for 2006 can be found at http://agr.mt.gov/weedpest/caps/caps_06.asp.

Cereal Leaf Beetle *Oulema melanopus*

Cereal leaf beetle (CLB), pictured below, is a quarantine pest of forages and cereal grains. It is commonly found on small grains, particularly oats, barley, and spring wheat. The adults and immatures feed on the developing plants, at times causing extreme defoliation.



Adult cereal leaf beetle.
Approximate length 1/8 to 1/4 inch long.

During 2007, as in the past, routine surveys were conducted for CLB. Up to 5 samples were taken in each of the 32 surveyed counties, with a sample consisting of two sets of 50 sweeps with a 15-inch sweep net. When choosing fields to sample, preference was given to spring planted grains.

Cereal leaf beetles were found in 10 Montana counties during the 2007 sampling season. Counties that had been found positive for CLB in the past were not necessarily sampled during 2007. In total, 48 of Montana's 56 counties have had CLB detections since the discovery of the pest in the 1980's.

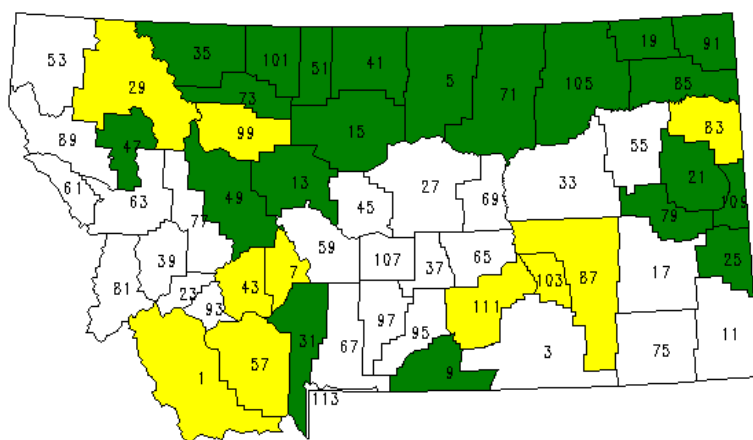
There were no noted range expansions for this pest during 2007.



Larval Cereal Leaf Beetles and Light Feeding Damage.

Counties Sampled for Cereal Leaf Beetle During 2007.

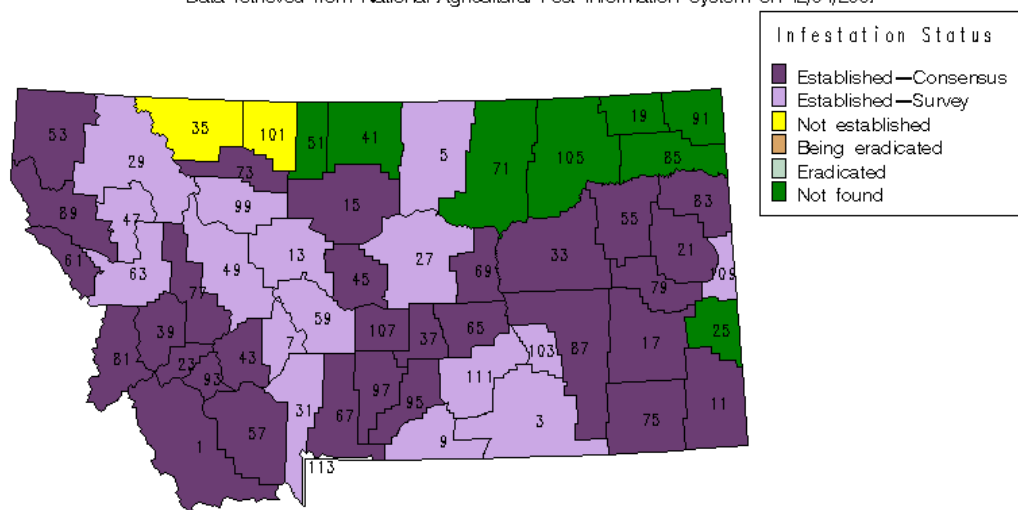
County	No. Pos. Samples/No. Samples	County	No. Pos. Samples/No. Samples
Beaverhead	8/8	Liberty	0/3
Blaine	0/3	Madison	4/5
Broadwater	4/9	Phillips	0/2
Carbon	0/1	Pondera	0/3
Cascade	0/3	Richland	1/11
Chouteau	0/4	Rosebud	½
Daniels	0/3	Roosevelt	0/6
Dawson	0/4	Sheridan	0/3
Fallon	0/4	Teton	1/3
Flathead	1/8	Toole	0/8
Gallatin	0/11	Treasure	1/3
Glacier	0/9	Valley	0/5
Hill	0/5	Wibaux	0/3
Jefferson	1/1	Yellowstone	4/4
Lake	0/6	TOTAL	
Lewis & Clark	0/7		



Counties sampled for cereal leaf beetle during 2008. Colors denote sampling times.

**Reported Status of
CEREAL LEAF BEETLE (CLB) , OULEMA MELANOPUS
in MONTANA**

Data retrieved from National Agricultural Pest Information System on 12/04/2007



The Center for Environmental and Regulatory Information Systems does not certify the accuracy or completeness of the map.
Negative data spans over last 3 years only.

Cereal Leaf Beetle Parasitoids *Tetrastichus julis* & *Anaphes flavipes*

The Cereal leaf beetle has spread across much of Montana during the past two decades. While initial movement was accompanied by severe outbreaks and economic damage, in more recent years the outbreaks have not been as severe. This may be, in part, due to the nature of the newly infested areas, which are generally drier and therefore less hospitable for the beetle immatures. It may also be due to the presence of two parasitoids released by the United States Department of Agriculture, Animal & Plant Health Inspection Service, Plant Protection & Quarantine (USDA APHIS PPQ) to assist in the management of this pest.

The first of these parasitoids to be released and recovered was *Tetrastichus julis*, an internal parasitoid of the CLB larva. The larvae of *T. julis* are maggot-like and bright orange in color. In some samples over 80 percent of the specimens of CLB have contained parasitoids, although this varies not only from place to place but also from day to day in the same place. Data suggest that this parasitoid is capable of movement as rapidly as CLB.

The second parasitoid, *Anaphes flavipes*, is an egg parasitoid. Although the insect has been released at several Montana locations, the exact status has been more difficult to assess. This is due partially to the small size of the insect, and partially because CLB eggs are prone to desiccation, making it more difficult to determine when mortality was due to the parasitoid. After the season was complete, with no detections of *A. flavipes*, a working group on CLB met in Boise, Idaho, and decided that further work with this parasitoid would not be supported, as it is not proving economically realistic.

During the survey, egg and larval samples were taken to gather information on the distribution of these two insects. Egg samples consisted of at least 25 eggs, and larval samples consisted of any larvae found in a sample. Up to 5 samples were taken in each of the 14 surveyed counties, with a sample consisting of two sets of 50 sweeps with a 15-inch sweep net. When choosing fields to sample, preference was given to spring planted grains. No *Anaphes flavipes* were found.

Counties Sampled for Cereal Leaf Beetle Parasitoids During 2006.

County	<i>T. julis</i>	<i>A. flavipes</i>	County	<i>T. julis</i>	<i>A. flavipes</i>
Big Horn	Yes	N/A	Missoula	Yes	No
Blaine	Yes	N/A	Richland	No	N/A
Carbon	Yes	N/A	Sanders	No	No
Dawson	No	N/A	Stillwater	Yes	N/A
Hill	No	N/A	Sweet Grass	Yes	N/A
Gallatin	No	N/A	Teton	Yes	N/A
Lake	Yes	No	Yellowstone	Yes	N/A

Gypsy Moth ***Lymantria dispar* (L)**

Gypsy moth (*Lymantria dispar* (L)) was initially introduced into the eastern U.S. It established rapidly, and became a serious defoliating pest of various deciduous trees. The females oviposit on various surfaces, covering the eggs with hairs or scales. This insect is frequently moved on variety of objects, such as furniture and recreational equipment that have been left outdoors. At the present time there are three varieties of gypsy moth in the United States – the European gypsy moth, which is more prevalent in infested areas in the east, the Asian gypsy moth, which is not quite as common, and the North American gypsy moth, which is a unique variety that has adapted somewhat to North America. Many of the more recent finds have been North American gypsy moths.



In Montana, responsibility for the trapping of gypsy moth is a multi-agency cooperative effort between the USDA APHIS PPQ, The Montana Department of Agriculture (MDA), The Montana Department of Natural Resources & Conservation (DNRC), and the USDA Forest Service (USDA FS). The USDA APHIS PPQ is responsible for trapping in mainly the eastern portion of the state, while the MDA traps mainly in the western part of the state. The DNRC traps in Mineral and Missoula Counties, and the USDA FS traps in a large number of campgrounds, as well as other public areas.

All traps were placed by early June, and checked throughout the summer at two to three week intervals.

There was one detection of gypsy moth in Montana during 2007. The moth was found in a trap located in Glacier National Park. It was identified by PPQ identifiers as a North American gypsy moth, *Lymantria dispar*. As a result, a delimiting survey will be needed in the area next year.

Trapping Summary

County	FS	MDA	PPQ	DNRC	Total
Beaverhead	12	6	28	0	46
Bighorn	6	0	0	0	6
Blaine	2	0	13	0	15
Broadwater	2	0	11	0	13
Carbon	24	0	0	0	24
Carter	2	0	0	0	2
Cascade	6	0	52	0	58
Choteau	2	0	2	0	4
Custer	0	0	4	0	4
Daniels	0	0	1	0	1
Dawson	0	0	4	0	4
Deerlodge	2	5	6	0	13
Fallon	0	0	0	0	0
Fergus	6	0	0	0	6
Flathead	29	39	0	0	68
Gallatin	22	0	50	0	72
Garfield	0	0	1	0	1
Glacier	32	0	25	0	57
Golden Valley	0	0	0	0	0
Granite	22	7	0	6	35
Hill	6	0	5	0	11
Jefferson	4	0	35	0	39
Judith Basin	2	0	0	0	2
Lake	12	28	0	0	40
Lewis & Clark	8	0	70	0	78
Liberty	0	0	0	0	0
Lincoln	20	51	0	0	71
Madison	10	0	44	0	54
McCone	0	0	3	0	3
Meagher	4	0	0	0	4
Mineral	6	11	0	0	17
Missoula	24	16	0	45	85
Musselshell	0	0	0	0	0
Park	22	0	0	0	22
Petroleum	0	0	0	0	0
Phillips	8	0	15	0	23
Pondera	0	0	4	0	4
Powder River	2	0	0	0	2
Powell	4	7	11	0	22
Prairie	0	0	0	0	0
Ravalli	10	11	0	0	21
Richland	0	0	2	0	2
Roosevelt	0	0	7	0	7

Rosebud	6	0	0	0	6
Sanders	6	21	0	0	27
Sheridan	0	0	1	0	1
Silver Bow	4	0	36	0	40
Stillwater	0	0	0	0	0
Sweet Grass	6	0	0	0	6
Teton	0	0	18	0	18
Toole	0	0	0	0	0
Treasure	0	0	0	0	0
Valley	0	0	19	0	19
Wheatland	0	0	0	0	0
Wibaux	0	0	0	0	0
Yellowstone	0	0	35	0	35
Yellowstone National Park	0	0	10	0	10
	333	202	512	51	1098

Honeybee Pests

Tropalaelops clarea

Montana is one of the top honey producers in the United States. However, while the honey (and side products such as beeswax) are important commodities, the most important service provided by Montana's honeybees is pollination in other states during the early spring months (February through May). Over 100,000 hives leave Montana, bound for California, Washington, and Oregon, and almond groves, apple orchards, and numerous other fruit plantings. As a result, pests of honeybees are regarded as serious threats to the industry (which is the tenth largest source of agricultural income in Montana).

In the fall of 2006, it became obvious that a new threat was facing honeybees in the United States. The syndrome, which was characterized by rapid disappearance of worker bees from established, apparently healthy hives, was ultimately named "Colony Collapse Disorder", or CCD. While it was (and remains) a major threat to the industry, it also resulted in a large amount of attention being paid to an industry that, while major in its impact, consists of a very small number of very independent operators. As a result, although threats to the industry can (and do) have a very major impact on the entire U. S. agricultural system, overall, they are not visible to the general public.

Colony Collapse Disorder resulted in news articles in every portion of that industry. This interest in honeybees translated into CAPS interest, which resulted in a Pilot Project for Honeybee Health, embarked upon late in the year.

The objective of this study was to determine if the mite, *Tropalaelops clarea*, was present in honeybee colonies in two states in the U. S. These two states were Montana and Florida. Both states have relatively large numbers of migratory beekeepers, with large numbers of hives, and both states have well-established methods for inspecting those operations (as well as legal authority to do so). A secondary objective was to determine to time and training component of inspecting large numbers of hives and taking samples for laboratory analysis.



Honeybees near Stanford, Montana, and *Varroa* mite (left) versus *Tropalaelops clarea* (another mite) (right).

During the months of September and October, apiary inspectors in Montana gathered 30 samples from apiary sites operated by eleven different beekeepers. Those samples were submitted to the USDA ARS laboratory in Beltsville, Maryland for additional analysis.

Each sample consisted of at least 1,250 bees gathered from the hives as they were inspected. Each hive was opened by the beekeeper. The inspector examined the top cover, the inner cover, and the bees on the top of the frames as the hive was opened, looking for pests and other problems, such as excessive burr comb. The beekeeper then found a frame with brood, and the after checking to make sure the queen was not present, the inspector brushed about 50 bees into a wide-mouth collecting jar (1 liter) half filled with alcohol. If a yard contained less than 25 hives, all the hives were sampled, if possible. In larger yards, from 25 to 30 hives were sampled. The sample was then labeled with the GPS location, the date, the inspector, the number of hives present, and the number of hives opened. In some cases, the sample was further processed in the field, with the alcohol being removed by straining the sample through a filter composed of two layers of paper towel. The paper towel containing the sample was then placed in a zipper-type plastic bag, with the label. The entire plastic bag was then placed in a second plastic bag, so the samples could be shipped to the laboratory in Helena.

At the laboratory in Helena, all samples were placed in plastic 1 liter bottles with 500 mls of ethanol. The sample was then agitated for 1 minute, and strained through a 30 mesh sieve. The bees were put back into the jar, which was labeled and put into the refrigerator for storage. The remaining material was strained through a paper towel filter, and placed, with any other paper towels, into a plastic zipper type bag with a label. These were then stored in the refrigerator until they could be sent to Beltsville for additional processing. At the present time, results from Beltsville are not available.

To prepare for the survey took over 100 hours. Some time was spent attempting to determine which operations would give the best representation of the various types of commercial beekeepers throughout Montana. Additional time was spent interfacing with APHIS PPQ and other groups regarding equipment, and actual protocols. Some additional time (40 hours) was spent making sure the various inspectors knew the protocols that they needed to follow. In total, inspectors spent over 100 hours in the field, with nearly half of that time being spent in transit to the yards. To get to the various yards, the inspectors traveled over 2,300 miles. Additional processing in Helena took nearly 75 hours. At present, it is unknown what time and material will be expended by the USDA ARS laboratory in Beltsville.

This survey did not really result in an accurate representation of what it would take to inspect a statistically representative sample of Montana's bees. However, with proper preparation, inspection of the many types of operations could be achieved over a relatively short inspection schedule. However, because of the current shortage of manpower, such a survey would have to be spread out over a number of years. Currently Montana does inspect all apiary operations on a regular basis.

Karnal Bunt *Tilletia indica*

Karnal bunt (KB) is a fungal disease that affects wheat, durum wheat and triticale. Initially, the disease was discovered near Karnal, India in 1931. It was first detected in the United States in 1996, within the State of Arizona. KB thrives in cool, moist temperatures as the wheat is starting to head out.

Karnal bunt spores are windborne and can spread through the soil. Grain can become by contaminated equipment. In addition, spores have the ability to survive within the soil for several years. Therefore, controlling the transportation of contaminated seed is essential in preventing the spread to major grain production areas. In addition, early detection is essential if any type of control is to be attempted. Montana's participation in the Annual Karnal Bunt Survey is part of the early detection grid set out across the United States.



Bunted Bunted Wheat, on right.

Credits: R. Duran, Washington State University
www.forestryimages.org

Montana's Crop Production for 2005

ITEM	BUSHELS	RANK	% U.S. Total
All Wheat	192,480,000	3	9.1
Winter Wheat	94,500,000	5	6.3
Durum Wheat	16,380,000	2	16.2
Other Spring	81,600,000	2	16.2
Wheat	39,200,000	3	18.5
Barley			

<http://usda.mannlib.cornell.edu/usda/current/CropProdSu/CropProdSu-01-12-2006.txt>

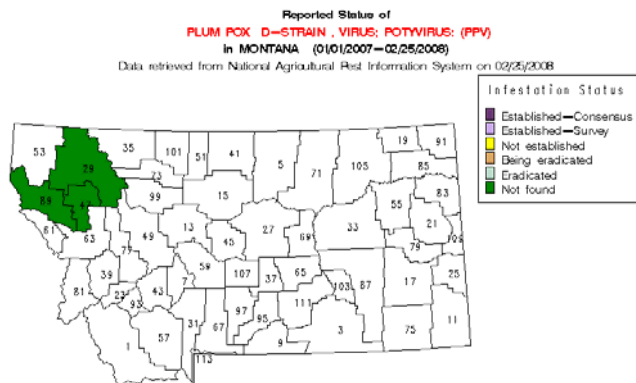
Montana continued to sample for KB during the 2007 harvest. A total of 129 samples were collected in 29 counties throughout Montana. The USDA Laboratory in Olney, Texas conducted the testing. All samples tested negative for the presence of KB. This sampling is critical for wheat growers in Montana. It confirms our wheat is free from KB, ensuring access to export markets.

Plum Pox Virus Survey Plum Pox Virus (PPV), Strain D

Plum pox virus (PPV) is a devastating disease of *Prunus* species. As a result of a finds in the Northeast, additional surveys throughout the United States were necessary to determine if the infections were very local, or if the disease had spread beyond that area. Montana Department of Agriculture interns and other personnel sampled *Prunus* plants in Lake, Sanders, and Flathead Counties, where this virus poses a special threat due to the cherry industry around Flathead Lake, and nurseries in the area that produce various types of *Prunus* for sale throughout Montana and even to Canada.



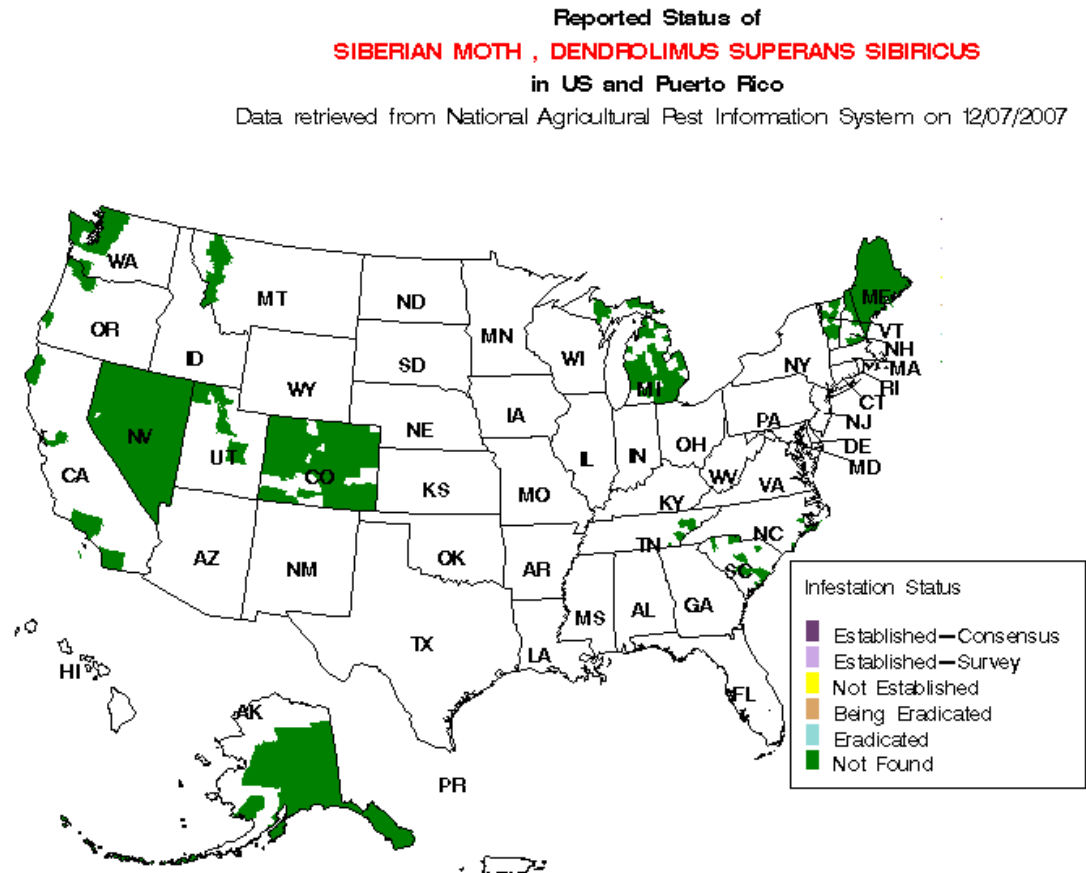
During the survey, 768 samples were taken from the three counties. All samples were tested by the personnel at the Montana State University Diagnostic Laboratory. There were no positive samples.



Exotic Moths Survey
Siberian Moth (*Dendrolimus superans sibericus*)
Summer Fruit Tortrix (*Adoxophyes orana*)
Pacific Fruit Piercing Moth (*Eudocima (Othreis) fullonia*)

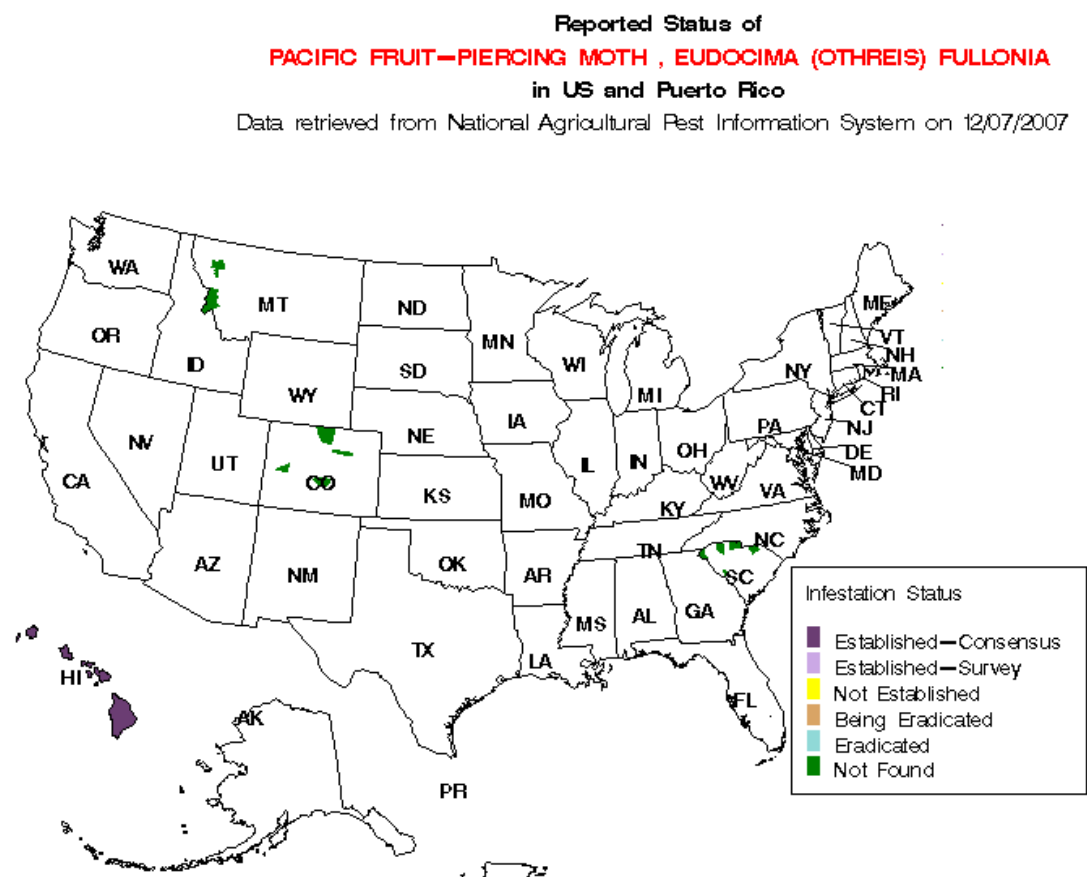
The surveys for these three moths were linked because of sampling location and high risk area linkages. All three moths were considered to have a higher risk of introduction in the western portion of the state, and also to pose a higher risk to the area should they be introduced.

The Siberian moth (*Dendrolimus superans sibericus*), also known as the Siberian silk moth, is a defoliating agent on primarily pines, but also other evergreen trees. In its native range, it is responsible for damage similar to that done by the gypsy moth in outbreak areas of eastern North America. Infestations can lead to slower forest growth, tree death in cases of repeated infestation, and (a potentially large issue in Montana and other western states) unsightly forests that are not attractive for recreation, thus reducing tourism. Trapping for this moth involves green gypsy moth milk carton traps. Due to logistical failures on the part of the supplier, the traps arrived late in the season, so only 59 traps were placed. There were no suspects collected from the traps.



The summer fruit tortrix (*Adoxophyes orana*) can be a serious pest of most fruits, but particularly apples and related fruits. While Montana does not have a large fruit industry, this is a section of the economy that has potential for growth, and is not able to tolerate any additional pests. In addition, this pest feeds on many other plants, including roses and other ornamentals. This survey was to be conducted using tan gypsy moth delta traps with species specific lure. Unfortunately, the lure was not provided until it was too late to put the survey out.

The Pacific fruit piercing moth (*Eudocima (Othreis) fullonia*) is also a potentially serious pest of fruit. While it is doubtful that this pest would ever establish in Montana, the damage done by the adult moth to susceptible fruit can be very severe. Punctures to the fruit not only damage the aesthetic appeal of the product, but can also introduce bacteria, leading to rot. There is no species specific lure available at this time for this moth. The survey was conducted using small black light traps, which were placed overnight in apple orchards with access to electricity (some traps required several 50 foot extension cords). The resulting collection was placed into a one quart re-closable plastic bag, and placed on dry ice. It was held in a freezer until it could be processed. Moths were removed and counted, then examined by the entomology specialist for identification. No suspect moths were found.



Area-Wide Nematode Survey Many Species of Nematodes of Concern in Crops



Central Science Laboratory, Harpenden Archives,
British Crown, www.ipmimages.org

Internal damage to tuber caused by *Ditylenchus destructor*.

Nematodes may cause significant reductions in crop yields, impacting virtually all crops. The nematodes surveyed for are of regulatory significance and could negatively impact our agricultural export markets.

The MDA collected 111 soil samples throughout Big Horn, Carbon, Cascade, Dawson, Gallatin, Lewis & Clark, Pondera, Teton, and Yellowstone Counties. Crops represented in the samples included alfalfa, barley, beans, beets, corn, fallow, pasture, peas, potatoes, and wheat.

Soil was screened for thirty five nematodes species, sixteen species of regulatory concern, and nineteen other plant-parasitic genera, including: *Globodera rostochiensis*, *Globodera pallida*, *Ditylenchus destructor*, *Ditylenchus dipsaci*, *Meloidogyne chitwoodii*, *Meloidogyne falax*, *Meloidogyne hapla*, *Meloidogyne javanica*, *Meloidogyne artiellia*, *Nacobbus aberrans*, *Heterodera glycines*, and *Paratrichodorus* species. There were no nematodes of regulatory concern found in the survey.

While this information is important for Montana farmers in their management schemes, it will also allow Montana crops to be certified as from areas free from some of these organisms, which allows greater access to overseas markets.



Bonsak Hammeraas, Norwegian Institute for Agricultural
and Environmental Research, www.ipmimages.org

**Final Report of the Survey of White Potato Cyst Nematode
*Globodera pallida***

Cooperative Agriculture Pest Survey Contract Number: 07 -30-CAPS-003

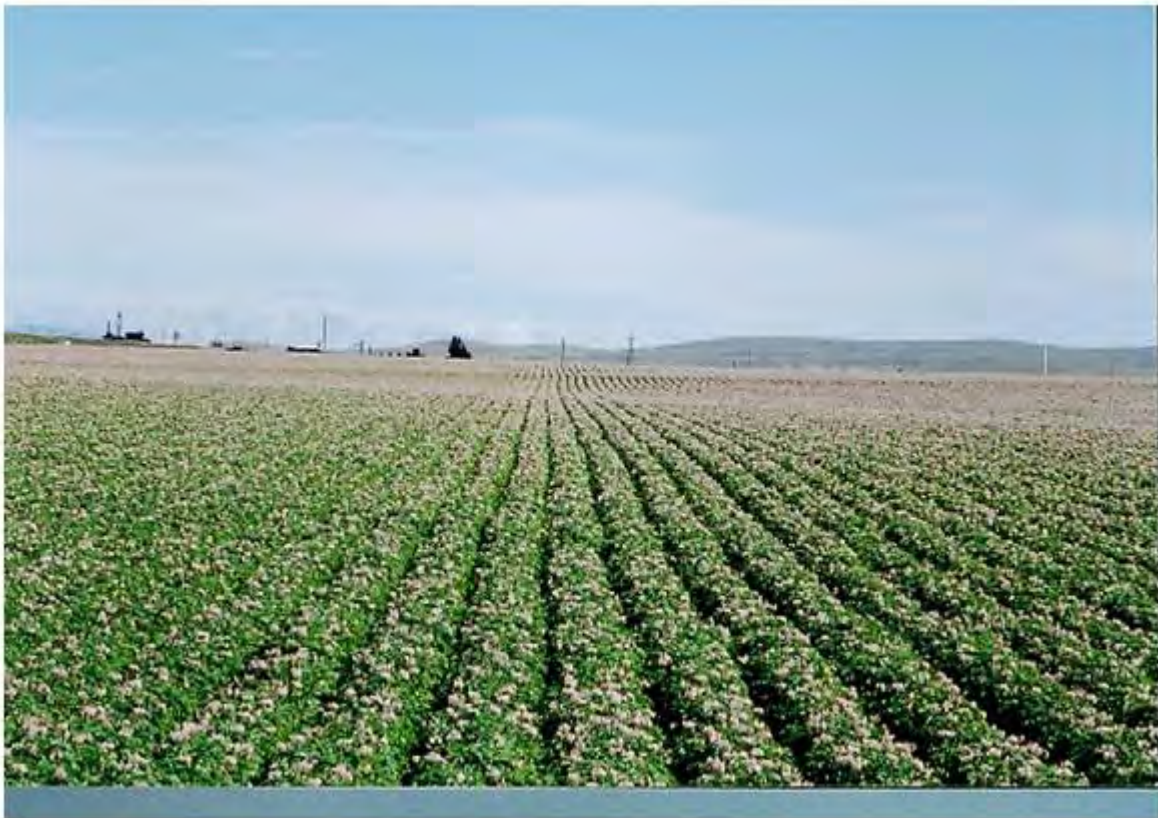
Contact Person: Mike Sun

Mailing Address: P. O. Box 172060 Bozeman, MT 59717-2060

Contact Phone Number: 406 994 3150

A. Plan of Action

Surveys were conducted in those counties with potato crops identified as economically important to Montana's export markets. These counties are Beaverhead, Blaine, Broadwater, Chouteau, Deer Lodge, Flathead, Gallatin, Jefferson, Lake, Madison, and Powell.



Seed potatoes in a field in Montana.

B. Detail

Samples were collected using the APHIS Piler Dirt Sampling Methodology, Field Size vs. Number of Samples. Soil was collected from under processing conveyors in the storage area when potatoes were shipped from storage.

Each sample consisted of 5 pounds of soil. Data collected included Date of collection, Collector, Potato Variety, Seed Generation, and Field Number. Personnel from the Montana State University Potato Laboratory, including Susie Siemsen, Eileen Carpenter, Elaine Nichols and Mike Sun gathered the samples for storage and processing at the MSU campus.



Elaine Nichols, Susie Siemsen, and Eileen Carpenter of the Montana Potato Laboratory.

Susie Siemsen was responsible for data collection and sample security. She compiled a record of all samples collected, as well as their data, which was submitted to the Montana Department of Agriculture.

C. Methods

A total of 2,652 samples were collected.

Eileen Carpenter was responsible for soil processing and cyst extraction. Soil was processed using USDA Soil Extractors.



The USDA soil extraction process at work.

Examination of the samples was done by Mike Sun, PhD. Dr. Sun is trained in Nematology at North Carolina State University, with additional training for this survey at Oregon State University (Dr. Russell Ingham), and at the Cyst Extraction laboratory in Twin Falls and Idaho Falls, ID). The examinations were done using two stereoscopic microscopes, connected to a computer, using Motic Images Plus, Version 2.0 ML, to capture images and record the size of each cyst. Using two systems allowed for rapid processing of the samples.



Dr. Mike Sun is the leader of the Montana State University Potato Laboratory.



D. Results

All Montana seed potato growers took place in this survey. All of the samples (2,652) were examined. No cysts of *Globodera* were found (Table 1).

County	No. Farms Sampled	No. Cellars Sampled	No. Samples	No. Acres Seed Potatoes	No. Suspect Cysts	No. Confirmed Cysts
Beaverhead	3	3	311	949.28	0	0
Blaine	1	1	7	21.95	0	0
Broadwater	4	3	162	997.80	0	0
Chouteau	1	1	61	212.00	0	0
Deer Lodge	1	1	0	219.80	0	0
Flathead	1	1	77	267.96	0	0
Gallatin	26	26	1303	3925.60	0	0
Jefferson*	1	0	0	45.00	0	0
Lake	12	12	581	2107.70	0	0
Madison	7	5	108	727.40	0	0
Madison (Greenhouse)**	-	-	5	-	0	0
Powell*	1	0	37	53.30	0	0
Total	58	53	2652	9527.79	0	0

*Jefferson and Powell County potatoes are stored in Gallatin and Deer Lodge Counties, respectively.

**Five samples were taken from greenhouses in Madison County.

Additional Nematode Notes From the Montana Department of Agriculture

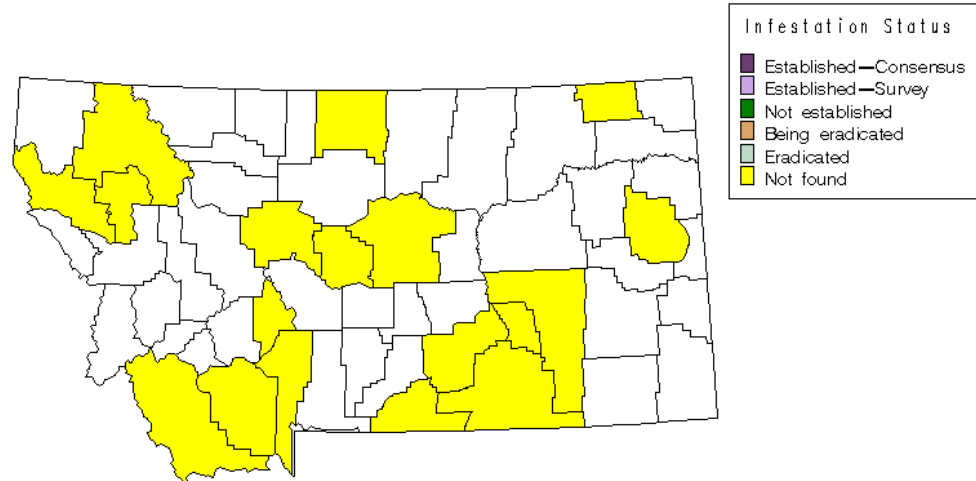
Because *Globodera pallida* is of extreme export significance to Montana farmers, results from the 2006 general nematode sampling (which included *G. pallida*) are included here. These samples were not all from potato fields; instead, they represent the results of sampling in several crops. Also of note here: These same fields were sampled for *Globodera rostochiensis*, another nematode with significant export implications. There were no positive finds for that nematode either. The processing of these samples was done by Dr. Tom Powers, University of Nebraska.

This information allows the Montana Department of Agriculture and the USDA APHIS PPQ to certify that certain crops from Montana are from the areas that have been tested and found free of the nematodes, which makes it easier to export them in many cases.

2006 Nematode Survey Results

County	Samples Collected	Results	
		<i>G. pallida</i>	<i>G. rostochiensis</i>
Beaverhead	8	Negative	Negative
Big Horn	7	Negative	Negative
Broadwater	6	Negative	Negative
Cascade	1	Negative	Negative
Carbon	16	Negative	Negative
Daniels	10	Negative	Negative
Dawson	4	Negative	Negative
Fergus	3	Negative	Negative
Flathead	3	Negative	Negative
Gallatin	23	Negative	Negative
Hill	3	Negative	Negative
Judith Basin	1	Negative	Negative
Lake	9	Negative	Negative
Lewis and Clark	1	Negative	Negative
Madison	1	Negative	Negative
Rosebud	2	Negative	Negative
Sanders	2	Negative	Negative
Treasure	2	Negative	Negative
Yellowstone	8	Negative	Negative
Total	110		

Data retrieved from National Agricultural Pest Information System on 03/14/2007



The Center for Environmental and Regulatory Information Systems does not certify the accuracy or completeness of the map.
Negative data spans over last 3 years only.

Montana Department of Agriculture 2007 Pest Survey: Final Report

Walter Scherer

Montana Department of Agriculture Intern

August 1, 2007

Introduction

Montana's big sky, countless rivers and open lands attract millions of visitors each year. These people come from around the country and world to spend time in this beautiful landscape. With so many visitors from out of state, the potential for the introduction and spread of invasive insects is not uncommon. The insects can be spread through the transportation of egg mass, larvae or the insect itself. Hitchhiking on vehicles, campers, bikes, camping chairs, firewood, etc... are all pathways in which these insects can be spread. An introduction of an exotic insect can be devastating to the ecosystem, tree nurseries and for the esthetics of the natural surroundings. Often eradication of these invasive pests can be labor intensive and cost the state thousands of dollars.

This summer my internship was setting insect traps for the state's Cooperative Agricultural Pest Survey program (CAPS). Throughout the summer fellow intern Alissa Rafferty and I set over two hundred sticky Pheromone traps for *Rhyacionia buoliana* (European pine shoot moth or EPSM) and *Lymantria dispar* (gypsy moth or GM). As well as trapping for these two moths, we also set 60 traps for *Dendrolimus superans sibiricus* Tschetverikov (Siberian Silk Moth or SSM) and trapped for *Eudocima materna* (Fruit-piercing Moth or FPM) using a black light trap. The GM and EPSM traps use a pheromone, which lures the moth into the trap and catches it on the sticky side of the trap. All traps were set in coniferous trees along roadsides. Trapping was done in ten counties west of the continental divide excluding Deer Lodge, Silver Bow, and Madison.



Fig 1: Male EPSM. www.acgov.org

EPSM is a pest for a majority of all coniferous species, especially the Austrian, red and Scotch pine trees. The feeding larvae cause damage after the eggs have hatched. Damage to trees can include; distorted growth, damage or death of buds and shoots, and needle damage. The surviving buds will end up growing into a witches broom shape or an S curve (as seen in Fig. 2). The damage caused by these trees can greatly affect nursery stock because the shape and size of the infected tree is changed.



Figure 2: S shaped damage caused by EPSM. www.pierroton.inra.fr

EPSM was first introduced onto Long Island New York in 1914. The importation of infested nursery stock from Holland is most likely where the pest came from. The repeated importation of these infested trees led to the spread of the pest into nine states within a year. Today EPSM is distributed in the northeastern states west to Minnesota as well as Oregon, Washington and southern Canada. Pine nurseries as well as Christmas tree plantations are most commonly affected. EPSM has been found in Montana but with no major populations. The CAPS program is necessary to survey for and detect EPSM in the state.

Methods

For the first month of our CAPS internship, Alissa and I worked on a labor-intensive Plum Pox Virus (PPV) survey in Sanders and Lake Counties. Because of this, we were only able to set traps for one day a week for the first month, which limited our trapping. We were each able to place 206 insect traps for EPSM and GM. We also were able to set out 59 modified milk carton traps for SSM. All three of the traps were placed in the same vicinity of each other, per site.

Traps were assembled prior to heading out for a day of trapping. This saved time, energy and patience. The EPSM traps are not as convenient to make in a Ford Taurus as the floor of a hotel room.

We trapped along major roads in all but three counties west of the continental divide. All EPSM traps were placed in *Pinus* trees, which was sometimes limited because of the lack of vegetation. The wire extension was wrapped around the branch, and if not secure, a zip tie was added to secure the trap. Traps were set every 2-4 miles to the best of our abilities, and marked on a state atlas for our record. Each trap was baited using a small pheromone which was placed in the middle of the sticky part of the trap.

A data sheet accompanied every trap. Trap number (ex. MTEPSM200WDS001), date,

county, GPS location, as well as a verbal description and hand drawn map were produced for each and every trap. GPS coordinates were taken and saved using the hand held GPS unit. Coordinates were downloaded weekly and sent to the CAPS coordinator for recording.

Because of the limited time in the beginning of the summer to set traps, we were unable to check a majority of the traps that we set. EPSM traps in Missoula, Lake, Flathead, and Mineral counties were checked, replaced, and sent to the state entomologist Dr. Patricia Denke for analysis.

Results

Of the traps we were able to check in our time with the state, no EPSM were found. Ironically enough one of the EPSM traps did catch a Japanese Beatle, which was, located North of Finley Point on the east side of Flathead Lake. This freak occurrence warned the state about a potential out-break of another invasive insect that can be potentially devastating to the ecosystem. An intensive trapping scheme was placed in that area within two days of the identification.

Conclusions

I have been waiting for an opportunity to work out west since I first visited Glacier National Park a couple years ago. This internship not only gave me excellent fieldwork experience but it gave me an excuse to live in Missoula for an entire summer. The benefit of this job is that you truly see every county and road west of the continental divide. From Libby all the way down to Beaverhead. The scenery west of the mountains is truly breathtaking wherever you go. I am completely comfortable traveling anywhere in the state, and the best part is by the end of the summer I didn't need a map to get there. I learned to be flexible and to improvise. A lot of the time, especially in the beginning of the summer when I had questions and no cell phone service, I had to deal with my problems on my own. I learned a lot along the way and here are some of my thoughts for the next year's interns. If you are that person please read it, because it will happen to you.

Things/mistakes I made that you shouldn't next year.

If you have as bad a sense of direction as I do, look at your map before you start to drive. Know what general directions you are suppose to be going. Heck, buy a compass; it will really make a difference.

If you don't already have a nice pair of polarized glasses, get a pair. It will be the best investment you will make. Many times you are driving in early morning and dusk with tough sunlight, combine that with the bug guts on your windshield, and you won't be able to see a thing.

Take time in the morning to make sure you have ALL the potential items that you might need for the week. If you think you might need it, you probably will. Don't forget your GPS because you can't do anything without it, I learned that the hard way.

Stay organized! Use the “Mobile” office they give you. Make sure you keep any and all receipts. Have a place for everything in the car and keep it there, especially sharpies and pens.

An awesome thing about this job is that you make your own hours! If you’re not a morning person get up at 10am and work late. Definitely work 10-hour days/4days a week. This gives you a lot of opportunity to go play in the outdoors for three days and not just two.

Always gas up at any place you can. Even if you think you have enough gas, think again. Many times you will drive for 100 miles with nothing. If you are traveling to Libby, fuel up in Kalispell. We rolled into Libby on fumes one time...wasn’t a fun experience.

If you are spending time in Plains, MT, stay at the Dew Duck Inn (have to make reservations in advance though). It is significantly nicer than the Crossroads Inn. Bengies and Stage Line Pizza is the best food in Plains. Good ice cream at the Circle. Subway is about the only place for lunch.

83 is the easiest road to trap on. 90 was the least convenient. I would try to avoid major highways for safety and trapping convenience. Find roads that travel through national forests because they have nice trees.

Be careful while setting traps, it may not appear dangerous but it can be. I ran into a tree branch and punctured my scalp and broke a piece of wood off under the skin. Seeley-swan medical center did a great job giving me stitches.

Always bring a couple bottles of water, towel and bathing suit. You never know.

Always wear pants no matter how hot it is out. The one day I didn’t I was cut up and had rashes for days. I would also recommend wearing a hat as well.

As tedious as this job may seem at times, you have to remember that it does mean a lot to the state. These traps are important to put out every summer to protect the state’s natural resources. I am honored to have been apart of the CAPS internship and had a blast doing it. My job felt like a vacation most of the time and I can’t wait to come back and live in Montana.

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Montana Department of Agriculture 2007 Pest Survey
Internship Final Report
Alissa Rafferty
August 2, 2007

INTRODUCTION

As an intern for the Montana State Department of Agriculture I have spent the summer conducting and monitoring several plant pest surveys throughout the state, west of the continental divide. Working as a team, both fellow intern Walter Scherer and I conducted surveys for one plant virus, and four plant pest species. Two of these species were exotic moths known as the Siberian silk moth (SSM), and the fruit piercing moth (FPM), while the other two plant pests were the gypsy moth (GM) and the European pine shoot moth (EPSM)

All of these plant pests pose a serious threat to Montana's vital agricultural and nursery industries, as well as the natural ecosystems and landscapes they inhabit. I was a part of the cooperative agricultural pest survey (CAPS), a combined effort between federal and state agencies to detect early introductions and infestations of pest species by placing and monitoring insect traps in areas of risk throughout the state. As each pest differs in both history and habitat, different survey methods of the four pest species were carried out under the department's guidelines.

Since the majority of our survey time revolved around the GM and EPSM, my main objective in this report will be to highlight the GM material, while providing a general overview of the plant virus survey and the two exotic moth surveys we also conducted. Since Walter and I were able to work as a pair, his report will cover the EPSM information.

GYPSY MOTH:

In areas where GM populations can reach high densities, these insects can severely damage natural ecosystems by completely defoliating host trees. During the actual moth stage the insect causes little harm, but the survival of future generations can be deadly as the larvae are responsible for destroying several tree species. Gypsy Moths have defoliated up to 13 million acres of trees in one season as thousands of eggs hatch each year. These moths generally occur in temperate, natural, and artificial forests primary among deciduous trees and shrubs. Unlike European regions, GM in North America has no natural predators and can thus survive in high numbers and be very difficult to eradicate. Since this pest is most often introduced by human transportation and recreation activities, regulation and early detection is important in preventing the spread of such an infestation. It is important for residents to be familiar with such pests and inspect outdoor household items when traveling across the state or country. Although the GM was first found in the eastern United States, the spread of this pest is a possibility, as it has caused isolated incidences in the west before.



Figure 1. Gypsy moth adult male and female, and larvae.
wihort.uwex.edu/Phenology/GypsyMoth

PLUM POX VIRUS:

The plant virus survey I took part in involved five weeks of leaf sampling in Plains, as well as various cherry orchards in Lake County. The goal of this project was to provide a thorough and representative sample of the entire area in order to test the plants for the virus known as plum pox. This virus can be detrimental to *Prunus* species and is thus very threatening to Montana's nursery industries. It is crucial to certify particular nurseries virus-free before their products are shipped across the country and internationally.

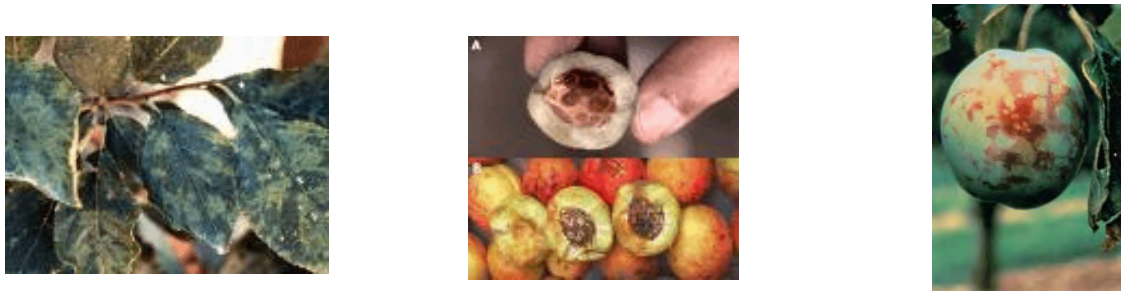


Figure 2. *Prunus* trees and fruit infected with plum pox virus.
www.ipm.msu.edu/plumpox.htm

EXOTIC MOTHS:

The exotic moth trapping involved the use of a black light that was set in cherry and apple orchards overnight to catch any suspicious moths and pests in the area. The other trap known as the modified milk carton was placed near the GM and EPSM locations. Although these exotic moths are not in western Montana, the potential introduction from foreign countries would be very harmful to the state's fruit, lumber, and nursery industries.

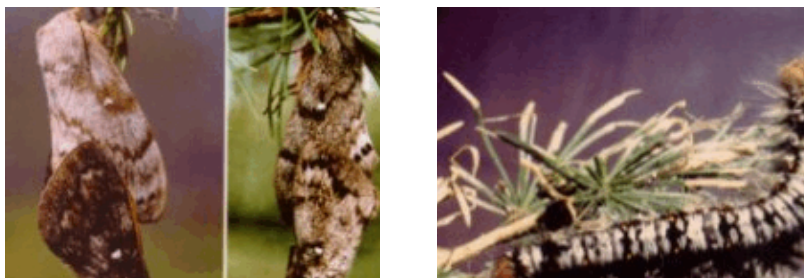


Figure 3. Siberian silk moths and larvae.
www.inspection.gc.ca/.../surv/data/densupe.shtml



Figure 4. Fruit piercing moth.

www2.dpi.qld.gov.au/horticulture/5541.html

METHODS

Our primary procedure for the GM survey involved constructing 205 cardboard traps with unique pheromone strips inside intended to attract the adult males. Traps were placed between two to five miles apart where possible, depending on the surrounding area and tree species. Traps were placed in deciduous trees and shrubs, while resorting to coniferous trees when deciduous were inaccessible.

The counties surveyed west of the continental divide included Lincoln, Flathead, Sanders, Lake, Mineral, Missoula, Powell, Ravalli, Granite, Deer Lodge, and Beaverhead. Certain areas that are at a higher risk or more appropriate for trapping were trapped more heavily than others. For example the Flathead, Lincoln, and Lake County regions were trapped much more heavily than the southern counties such as Deer Lodge and Beaverhead.

The traps that have been checked thus far include Flathead, Lake, Mineral, Missoula, and Ravalli Counties. All EPSM and suspect gypsy moth traps were sent for the state entomologist for a more thorough examining process. With Walter and I working as a team we were able to place the GM and EPSM traps in relatively the same locations, while also setting the Siberian Silk Moth traps nearby.

We completed a total of 59 SSM traps, and conducted the black light trapping in 10 different orchards.

RESULTS

In traps that have been checked thus far, we have found no GM or EPSM. There was however a different pest known as the Japanese beetle that was found in an EPSM trap located in Lake County. This finding has led to immediate action and surveillance of the area along with further trapping for this pest.

The leaf samples for the plant virus also turned out negative allowing for the transportation of nursery stock across the border into Canada.

Although black light traps that were placed in various orchards certainly caught a lot of insects, none of them were found to be harmful to the orchards' operations.

The Siberian Silk Moth traps that were placed along side the GM and EPSM have yet to be checked but a follow up is in the planning.

CONCLUSION

Although it may seem that after a summer of work we came up empty handed, the fact that we didn't find any of the target moths we were specifically trapping for is very good news for the state's forests and industries. By keeping an intensive trapping and monitoring system in place we can ensure that the health and prosperity of these important systems will be protected for future generations against pest infestations. The Japanese beetle finding is the only alarming news of the summer, and with further investigations this will hopefully turn out to be only an isolated case.

My personal experience with this internship over the summer has been very exciting and enjoyable. Coming out West from the East coast for my first time was an incredible experience in itself, and having the opportunity to travel all over the western half of the state was fantastic. The flexible scheduling the department allowed us enabled us to enjoy the areas we traveled and plan our own trips accordingly.

Below are a few things we learned over the course of the summer that may be helpful to future interns:

- It is often difficult to predict which roads will be good for trapping but there didn't seem to be as much of a problem in the northern counties as there was in the south. Use a map and try to hit all the roads located in national forests.
- If you are going to be spending a month in Plains, Montana, choose the Dew Duck Inn over the Crossroads despite what you may think of the name.
- Although usually impossible to find on busy highways like interstate 90, the use of pull offs on the side of the road make trapping much safer and smoother as you search for a site.
- Speaking of safety, try to avoid colliding with a tree as Walter did because hospitals and medical centers can be hard to find in western Montana and you may be forced to sit in a waiting room for hours.
- If at all possible, spend a few days constructing traps prior to setting them as it will save a lot of frustration, time, and space for the car rides.
- If you have the choice, work in the cherry orchards along Flathead Lake, particularly the organic orchards where you won't have to worry about chemicals. It is also best if you work near harvest time when the fruit is ripe, around mid July.
- Use the odometer at each stop so you know exactly how far apart the traps are. This makes returning to them for a follow up much easier than driving 30mph on the highway aimlessly searching for your trap.
- Finally, if you're going to travel as a pair as we did, make sure you like the person as you will be spending the entire summer together, often trapped in the same car. Despite the potential for an extremely long summer, luckily for us this didn't seem to be a problem. As this was my first time out here, it is much appreciated that the department allowed us to pair up and work as we did. We had a wonderful summer exploring Montana and learning all about the state's beautiful natural, cultural, and agricultural landscapes. This certainly won't be my last summer spent enjoying the wonderful state of Montana!

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Montana 2007

Cereal Leaf Beetles

INTRODUCTION

As I took the first step and applied for this position, I found myself to be very unprepared for what was going to be expected of me. I had known some of what was required, but not all of the details.

Upon waking up Monday morning, I found myself to be anxious, excited, and nervous all at the same time. When I arrived at work, I was introduced to everyone. The people that I met were very friendly and willing to help in anyway that they could. They all said that if I have any questions don't be afraid to ask. This is because they wanted to make sure that I understand what I would be doing, and to clarify any doubts or concerns.

As the day continued to go by, my supervisor reiterated that if I had any questions to make sure that I don't hesitate to ask. This made me feel more comfortable, and assisted in easing my anxiety. It was very important for me to ask questions, as it made it easier to understand the technical aspects of my position and the responsibilities I would be performing.

I have learned the process and procedures for developing a published scientific report based on my work this summer, and determining scientific conclusions based on observed and determined facts.

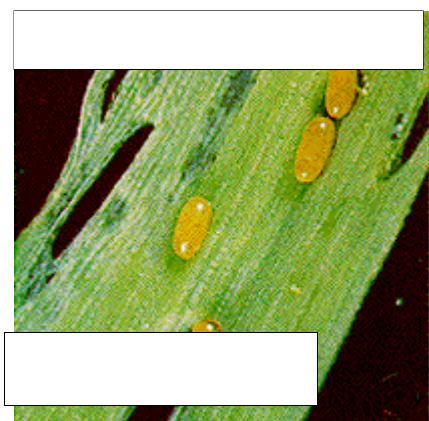
The Cereal Leaf Beetle (CLB), *Oulema melanopus* is a dangerous pest that consumes many

different grain plants such as wheat, barley, oats, corn and other small grains. Their favorite is oats and barley and they choose the spring planted grains over the winter planted grains.

The CLB has become a serious pest of small grains in the Mid-Atlantic region of the United States. (5) The beetles had originally come from Europe and Asia. It was first found in Michigan in 1962; from there it spread to the other neighboring states. Once it was found, a large-scale eradication program was conducted by the U.S. Department of Agriculture (USDA) and cooperating states from 1963 to 1969. It was unsuccessful. (1)

From 1964 to 1970, USDA's Agricultural Research Service imported some of the CLB's natural enemies to keep the beetles from spreading further. By the early 1970's there were four species of natural enemies that were found and established in Michigan and Indiana. As a result of this program, the natural enemies CLB's were spread, with the parasitoids being released in many sites, and the CLB populations had decreased substantially (Footnote #1).

CEREAL LEAF BEETLE BIOLOGY



The eggs of a CLB are yellowish when they are first laid and they darken before hatching. I was astonished to see how small they were in comparison to the beetle. The eggs are laid on the upper surface of the plant leaf, and are about the size of a pinhead. (figure1).

The larval stage is the most damaging stage of this particular insect; even though the adults will feed on the plants also. They graze on the upper leaf surface as they feed. The smaller larvae will feed mostly between the leaf veins, this results' in long, narrow slits in the leaves. The larvae have a black head and

yellow body and sometimes the yellow color is not always visible. This is because they often cover themselves with their own fecal material, which can be rubbed off onto your clothing or your skin. (figure2)

The eggs will normally hatch in 5 days the larvae feed on the leaves for about 10 days; at which time they will move into the soil to pupate, emerging as beetles in 2 to 3 weeks. After feeding for about 2 weeks or so on cereal crops, the adult beetles will go into summer hibernation. Later on they will seek out shelter to pass the winter.

I often had a hard time trying to find the larvae, due to their habit of covering themselves in their own fecal material; this appeared like droplets of dark colored mud. I put one of the larvae into a glass vial it still looked like mud.

Adult CLB's are $3/16^{\text{th}}$ of an inch long and they have a metallic blue head and wing covers, with a red pronotum (neck) and orange-yellow legs. (2) (Figure 6)

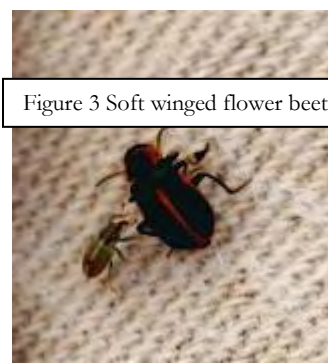


Figure 3 Soft winged flower beetle.

There are several look-a-likes to CLB adults. A beetle called the soft winged flower beetle is a beetle that looks very similar to the CLB but it has a black dot on its head. (Figure 3)

Another look-a-like is called a long horned beetle. They look similar and this can be confusing, but if you look carefully you will notice that they are thinner. They are also longer than the CLB's. These beetles don't have the blue iridescence on their bodies. (Figure 4).



Photo by April Wabeke

Figure 6 Cereal Leaf Beetle Adult



Credited to Conrad Berube

grasses.

Damage from CLB's is very apparent, as the tips of the leaves of the plants turn a whitish color, from where the beetle had consumed the chlorophyll.

"The beetles consume the chlorophyll containing mesophyll cells, leaving the translucent lower leaf cuticle intact."(1). (figure 5)

Extensive damage caused by these insects looks frosted. These particular beetles do not like hot temperatures and they preferred cool moist areas. CLB's not only like wheat, barley, oats, and new corn shoots, but they are also found on rye, millet, rice, and many other types of wild



Figure 5 Leaf Damage

Credited to Conrad Berube

BIOCONTROL

There are four species of natural enemies of CLB that help control them in most of their range. All are parasitic Hymenoptera which are distant cousins to ants, honeybees, and wasps. One particular species, called *Anaphes flavipes* injects its eggs into the CLB eggs.

"When the parasite's eggs hatch, the young develop within the beetle eggs, devouring them as they grow." (1)

The other three species are *Diapars temporalis*, *Lemophagus curtus*, and *Tetrastichus julis*; they lay their eggs within the developing CLB larvae. After their eggs hatch, the parasitoid feed within the CLB larvae, destroying them. They are called parasitoids because they totally destroy their host. Some people even call them predators! (1)

METHODS

The best way to catch these insects is to use a sweep net. To catch these beetles, sweep along the edge of the field, using wide sweeping motions encompassing about 180 degrees in each sweep. This provides a wider angle to catch more beetles. As the sweeping motion is being continued, walk along the edge of the field; one motion to the left is considered one sweep, and then come back to the right for the second sweep. Keep doing this until you get to 100 sweeps; make sure to keep track of how many sweeps you have done! Once this task is done put them into a bag with some of

their food, and store them in a cooler place or the refrigerator.

As I was out in the field trying to locate the beetles by myself, I was uncertain as to exactly what the beetles would look like. While pictures are useful, they are not always helpful because they are not usually taken in the best conditions. The pictures may not always reflect what you are faced with while in the field. Some of the pictures may also become unclear and blurry, or were enlarged and became distorted. This may cause one to think that the insects are actually much larger than they really are. But when I finally found my first CLB larvae, I had to call the Entomologist and send a picture to find out if I had found what I was actually looking for. It was determined that it was exactly what I was supposed to be looking for. I was very proud and excited that I had been successful in locating larvae of the CLB!!!

I continued my search for these beetles, which was often very difficult. This was due to the lack of locating any beetles or larvae. It was as though I was not being observant enough. Then I came to an oat field in Flathead County MT. When I bent down to take a look at the leaves, I found some CLB eggs.

RESULTS

This job has taught me many skills that will be useful in life, increasing my knowledge and appreciation of basic scientific processes like insect identification and collection of samples. This included, identifying the site to take the sample, the collection of samples, recording the sample date, and labeling the samples correctly. It has also broadened my knowledge of the potential regulatory impact of my findings. This survey will be used to assist in determining where there are infestations of CLB's in the State of Montana. The results of my findings will determine if and when there will be a response to control this pest.

An additional benefit of this job was to increase my mapping skills. This included identifying, on paper, specific sites where the samples were collected; including as much detail as possible, allowing someone else to potentially follow up based on my findings.

A third benefit was to increase my scientific knowledge of computerized mapping systems including GPS software and hardware to record sample site locations. This will assist others in follow up if other actions are required. This will result in saving time relocating the areas that might be treated or re-visited for follow up surveys.

I have also learned to double check and ensure that I have appropriate materials and supplies that are necessary for a successful survey of the fields, where to park the car while sampling, for safety purposes and ease of entering the fields, with a clear egress from the fields, and determining that the GPS unit is properly charged and functioning. This has assisted in planning ahead.

As I worked on this survey, I had to rely on myself a great deal. I had to travel long distances in areas that were totally unfamiliar to me. I truly enjoyed traveling once I got used to it. I would have to find some fields that I thought were susceptible to CLB's. Once I had finished for the day, I had to find my way back into town. Finding my way around by myself proved to me that I was able to accomplish something that I had at first thought impossible.

As I continued my search for the CLB; I discovered that they liked the younger plants more than they liked the older, taller plants. As I was out trying to find these beetles, I started to know

what the damage looked like. When there was more humidity, I was able to find a lot more of the CLB larvae and adults. As I continued doing this survey I also observed that there seemed to be some damage on some other crops as well. I was able to determine, through close observation that they appeared to like the young corn as well.

We found *T.julis* in CLB larvae. In Madison and Beaverhead counties a total of 94 of the *T. julis* were found inside 19 CLB larvae. In Yellowstone County there was a total of 50 *T. julis* larvae found in 35 CLB larvae. In Broadwater County, there were 12 *T. julis* larvae found inside 2 CLB larvae.

There have been a total of 29 counties in Montana that were tested for CLB adults and larva and only 5 counties had tested positive, they were Madison, Broadwater, Beaverhead, Yellowstone, and Treasure counties. In Madison and Beaverhead counties there were 16 adult CLB found and 19 larvae found. In Broadwater County MT only 2 CLB larvae were found, in Yellowstone County only 35 CLB larvae were found, and in Treasure county 2 CLB larvae were found.

Table 1 : Summary of results of cereal leaf beetle sampling in 5 Montana counties

County	Cereal leaf beetle adults	Cereal leaf beetle larvae
Beaverhead	16	19
Broadwater	0	2
Madison	16	19
Yellowstone	0	35
Treasure	0	2
Total	32	77

CONCLUSION

It has been determined that there has been a problem with the CLB, and the damage that it does to the crops in Montana, since it was first discovered in 1998. However, we have to constantly ask these questions about the dynamics of CLB in Montana's cereal crops and the regions that they grow in. Are the CLB populations increasing? Are these populations approaching densities that may cause a loss of crops? Are CLB moving into new counties or onto new hosts? Because this insect has quarantine significance, these are vital questions.

Based on the samples that were obtained this year, I have concluded that they have not increased significantly in fact, the CLB numbers that are currently available for this year (2007) are far below the threshold that would be needed to cause economic loss to the farmers.

Weather plays a very important role in the prevalence of CLB's, and as this year was very hot and dry, it affected the numbers of CLB's. This was determined by obtaining a report from the MSU extension service, which stated in their Degree Day Predictions, "The base temperature for CLB is 44.6 degrees F, the lowest temperature at which biological activity of this insect occurs." This same report states that based on temperature calculations in Montana and careful observation of adult cereal leaf beetle, activity typically begins when 176 degree days have been accumulated.

(Degree Day formula that is used: (daily minimum temp+daily maximum temp)/2}-44.6=degree day.

Degree days since Jan. 1 (44.6 degree F)	CLB Stage	Monitoring Comments
176	Early Adult Activity	Monitor for Adult Activity
253	First Egg Lay	Monitor for eggs and larvae

"The first CLB eggs have been found when 253 degree days have accumulated. The calendar date will vary with temperatures and locations around the state." (4) The combination of a lower temperature about 9.0 degrees Celsius and also having warm spring weather enhances CLB's drastically. This then results in a more rapid destruction to the flag leaves by the fourth instar larvae stage, during at which time anthesis and milk development is going on. (5)

When considering the economic thresholds, consider the market price and costs of controls when making treatment decisions. Before the flag leaf emerges, treatment is warranted when plant samples average three (3) or more eggs and/or larvae per plant (tillering stages). Once a flag leaf is present the threshold drops to one (1) or more larva per flag leaf.

"Pest management recommends prescribed insecticide application when infestations of one (1) larvae per flag leaf were encountered in winter wheat or two (2) per flag leaf in oats and barley." (5)

By trying to eradicate the CLB, delaying the treatment until at least 25% of the eggs have hatched and the larvae have emerged before making a spray application. By doing this it ensures that conditions are more favorable for egg hatch and a larval population to decrease in size. CLB larvae are the target population that would be sprayed with insecticide, killing most of them off. (4)

"Pesticide applications to control the CLB have increased each year in Montana, from 1990 to 1997. Since that time, cereal leaf beetle populations have only reached economic levels in localized regions. Monitoring will help you decided whether cereal leaf beetle treatment is warranted." (4)

Consult the high plains IPM guide on the web at <http://highplainsipm.org> or for more information on chemical control, contact your local MSU Extension agent.

When checking for these beetles I was approached by several farmers who would inquire about CLB pesticides. Some of them had stated to me, that there were pesticides that had been tried and were not effective for eradicating CLB's. They then requested from me, any possible solutions

that would be useful in eradicating the CLB's. I informed them that parasitoids, (other insects that were "enemies" to the CLB) were the only solution for the time being.

When I first began this job, I had no idea whatsoever what a Cereal Leaf Beetle was, let alone what one looked like. However, while performing my job duties, I finally observed what the CLB was and I was amazed at how small it was. I learned what amount of damage a CLB was capable of doing. It also taught me that insects that are not kept under control can do massive damage. I understood that there are destructive insects and that they can do damage to plant life and vegetation. However, I didn't really understand the extent of the damage that an evasive insect can do. I have learned so much while performing my job responsibilities; I can't put it all down in words. Suffice it to say, my experience this summer has and always will be invaluable to me and my future.

I was so happy to receive this opportunity to work for the department of agriculture. I never thought that I would be provided the chance, and now that I have, it will remain a very important part of my resume. I met some very wonderful people who showed me what patience is really all about. They were wonderful to work with, and I hope that I will have a chance to do so again. Thank you very much, for such a wonderful opportunity. I was also very excited to travel to places that I had never been to before.

This report respectfully submitted by:

April L. Wabeke
Junior, Biology Studies
Montana State University-Northern

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**Biological Control Concepts of IWM Strategies Youth
Library and Activity Kit
4W1698 MSU Index**

**Carla Hoopes
Montana State University**

Department of Land Resources and Environmental Sciences

The National Invasive Species Integrated Weed Management (IWM) Library and the IWM Activity Kit prototype was demonstrated in Bozeman at the Statewide Noxious Weed Awareness and Education Campaign September 18, 2007 general membership meeting. The library contains the best of the best existing noxious weed educational publications, nationally generated curriculum, and media for public outreach. The activity kit is designed for youth groups, range camps, outdoor science exploration, and engaging discovery of what's in a kid's world. The kit allows the kid to become the scientist...a knowledgeable weed scientist. The kit engages kids in understanding the basic foundational premise of biological control as part of an integrated weed management strategy for a systems based land management plan. The kit interactively assists the kid in fun discovery of five types of biological control agents, why and where they come from, life cycles, and host specificity.

Will Harmon is a professional writer and works with the University of Montana Public Policy Research Institute when he is not writing other publications for entities such as Montana Department of Natural Resources and Conservation's TIPS for Fighting Weeds on Small Acreage in Montana. Will completed four publication updates during this reporting period. Two updates are collaborative works with Bret Olson and Carla Hoopes on the What's So Dangerous about the Impacts of Noxious Weeds on the Ecology and Economy of Montana and a new What's So Dangerous about the Impacts of Noxious Weeds on the Ecology and Economy of the Region. Will updated regional noxious weed economic impacts and added Aquatic Nuisance Species basic identification and ecological and economic impacts. Will's third update is a regional publication collaborating with the Greater Yellowstone Coordinating Committee and Amy Lerch of Teton County Wyoming Weed and Pest. The update combines regional noxious weed and Aquatic Nuisance Species impacts, and Why Should We Care about Noxious Weed information provided by researchers, biologists, curriculum committees, and educators to complete the writing for the IWM Activity Kit interactive publication "What's In Your World?" In addition to the writing for the What's In Your World? publication that is housed in a journalists' style pouch with pockets for a journal, ruler, pencil, jeweler's loop, flexible tweezers for collecting live insects, flash cards, audio track CD, and game pieces, Will wrote twenty or so interesting facts for each of six weeds listed as noxious in Montana. The interesting facts were then adapted for audio plays. Stephanie Campbell and Joel Jahnke of Montana State University Media and Theatre Arts created characters for the scripts and recorded them at Peak Recording and Sound. The recorded audio scripts serve as example of what students at camp or in a science discovery workshop could recreate from text scripts included in the kit. Tom Barrett is known as one of five voices preferred by public audiences and works for entities such as National Geographic on documentaries. Tom and Stephanie recorded the audio track of the premier publication "What's in Your World?" to enhance drive time science learning. The audio book is similar to what you would experience listening to a "Harry Potter" story about invasive weeds from a kid scientist perspective.

The CDs for interesting facts and audio plays plus the audio book is part of the National Invasive Species IWM Library. Case Logic Inc. custom designed the journalist's pouch for the age group and intended use. The durable case has zippered pocket for the journal, two separated pockets for the flash cards and the publication, an interior bag for the jeweler's loop with lanyard is tethered inside the pouch so that it is never lost. An aspirator for sucking bugs into collection canisters is also included in the kit with instructions how to identify and safely collect biological control insects. The publication was strategically developed to complement the TIPS for Fighting Weeds on Small Acreages in Montana and add the biological control concepts that are missing from the TIPS publication. The publication is turned upside down on occasion where kid scientists are guided through activities, safety cautions, and games included in the kit and library. Each engaging page leads the young student to the National Invasive Species Library where they will learn more detail about weed identification, prevention, integrating weed management strategies, seeking resources such as the county weed coordinator when they have questions, and learning what non-land managers can do when recreating on public land. Case Logic Inc. custom designed a catalog container for the companion National Invasive Species Library.

During the past four years participants met on many occasions to develop concise information about engaging youth audiences in outdoor science exploration and naturalist-type awareness of noxious weeds and what an individual can do about stopping spread. The project dove-tails and completes similar work that went into the TIPS for Fighting Weeds on Small Acreages in Montana. The audience for the TIPS publication is land managers wanting to understand the many ways there are to manage weeds. The TIPS publication leads this audience to more professional thinking before asking questions and making decisions about managing weeds. The primary content of the TIPS publication is basic noxious weed management on small acreage understanding, weed identification, inventory, and methods of management primarily chemical control, and where to find resources.

When you look into the World around you,
pretty weeds
are about to meet their match!

The Statewide Noxious Weed Awareness and Education Campaign is looking for youth educators to "test drive" the new "What's In Your World?" education program.

All we ask is for your willingness to attend an orientation workshop, put on a real-world field trip, use the activity kit and contribute constructive feedback by August 2008.

We'll want to know a little about you.

are you a youth organization, weed or conservation district, possibly an outdoor science school?

how many kids ages 8-14 will participate?

what is the date of your proposed outdoor field trip (must be after June 1, 2008)

That's not all!
Are you ready
to work with
youth audiences
in the great
outdoors?



22 illustrated
bio-control
agents are
ready for
your T-shirt
awareness
projects.

Contact choopes@montana.edu to get your "BIO" CD.

Minimal fees apply to cover CD and shipping (\$17.50).

Commercial vendors will be asked for a large contribution to support statewide noxious weed education efforts.

DVD's and CD's

Weed Audio Plays
with Scripts
For Youth
Performances

Sweeping Your World
With An
Insect Net
Training
Video

Alien Invasion
Plants on
the Move
K-12
Curriculum



24-page
Naturalist - Weed Scientist
Self-Paced Guide
emphasizing
six priority weeds
and integrated
methods of
management

ADDs for the first time
biological control concepts

BIOLOGICAL CONTROL
FLASH CARDS



GAMES and INTERESTING FACTS
about NOXIOUS WEEDS



CONTACT
Carla Hoopes
Program Coordinator
Statewide Noxious
Weed Awareness
and Education
Campaign
for details
406-994-5683
choopes@montana.edu
or log onto
weedawareness.org

Pulling
together
Special Noxious Weeds

The IWM Activity Kit publication adds the biological control component to the work that brought together the TIPS publication. It is written for youth audiences, range camps, and outdoor science workshops and exploration.

Science teachers, biologists, and agency educators came together to help develop content in age appropriate context used in both the Activity Kit and the 2008 Montana Noxious Weed Education Calendar: Todd Breitenfeldt, Carol Hatfield, Mia Whitfield, Gloria Weisgerber, Marijka Wessner, Maureen Connor, Tom Barbouletos, Lis Herbertson, Alan Knudsen, Will Lanier, Jim Larson, Tonda Moon, Carol Randall, Dwight Scarbrough, Nancy Sturdevant, Kevin Suzuki, Janet Valle, Paul Wick, and Dan Williams.

Montana State University (MSU), Oregon State University (OSU, and USDA Agriculture Research Station (APHIS) researchers came together to guarantee the accuracy and appropriateness of the content: Jeff Littlefield (MSU), Eric Coombs (ODA); and Rich Hansen (APHIS).

Photographers contributed high resolution images for use in the calendar: Rich Hansen and Robert D. Richard (APHIS), K. Weller (ARS); Joe M. DiTomaso (University of California); Marc Murell; Allison Fox; Linda Wilson; Bill Reeves; Drake Barton (Montana Native Plant Society); Mary Ellen Hart; Jed Fisher (Flathead County Weed District); R. L. Johnson; US Geological Survey; Brian Ostwald (Carbon County Weed District); Monica Pokorny and Dan Gustafson (Montana State University); Eric Coombs (OSU); Montana Fish, Wildlife and Parks; Steve Dewey (Utah State University); Tammy Wang (University of California Berkeley); and Jason Goeckler (Kansas Wildlife and Parks).

New volunteers reviewed the content and provided editorial comments on more than one occasion during the review process: Larry Beneker (Bureau of Indian Affairs); Joe Merenz (APHIS Plant Protection Quarantine); Dave Burch (Montana Department of Agriculture); Justun Juelfs (Montana Department of Transportation); Dan Dobler (Montana Department of Natural Resources and Conservation); Joe Weigand (Montana Fish, Wildlife and Parks); Eileen Ryce (Montana Aquatic Nuisance Species Coordinator); Janet Clark (Center for Invasive Plant Management); Jeff Littlefield and Monica Pokorny (Montana State University); Margie Edsall (Montana Weed Control Association and Madison County Weed District); and Christina Evans (Lewis and Clark Conservation District). Mike Kippenhan is an entomologist by interest and training, and a graphic designer by profession working with new technologies at Montana State University's Creative Research Lab. We were fortunate enough to contract with him to give creative direction to the numerous and diverse input we received from all of the participants who see a critical need for this product. Mike led the project through its development to the prototype that was demonstrated on September 18 in Bozeman. Elliott Kennerson is a former copy editor for the New York Times and Masters candidate for Montana State University Science and Natural History Filmmaking program. Elliott produced educational message points in film on DVD for the National Invasive Species Library. He also filmed a public insect collection day during July in Choteau at the Buzzy Breen Insect Collection Day for the Rocky Mountain Front Weed Round Table. The film was adapted to a training video on DVD for the National Invasive Species Library to help kids better understand why and how to successfully introduce and collect insects on noxious weed infestations. Joe Merenz of USDA APHIS Plant Protection Quarantine continued to lead the overall project and coordinate with Carla Hoopes and Janet Valle of the State and Private Forestry Regions 1 and 4. Joe and Gary Adams coordinated funding through USDA Animal and Plant Health Inspection Service Plant Protection Quarantine cooperative

cost-share program administered by the Montana Department of Agriculture. The funding was provided to produce the flash cards that are a premier component of the IWM Activity Kit and National Invasive Species Library.

Problems Encountered

Some delay was encountered when we were asked by Dave Burch of the Montana Department of Agriculture (MDA) and Marijka Wessner of the Montana Weed Control Association Education Committee in fall 2006 to stop work and wait for the Missoula County Weed District Know Weeds Curriculum project to catch up with the IWM Activity Kit project. Dave Burch informed us that MDA would not extend the grant period for the IWM Activity Kit project beyond September 30, 2007.

Once we received confirmation that project deadline would not be extended even though we were asked to wait for the Know Weeds curriculum project to catch up, we resumed work on the project with approval from Dave Burch. The Know Weeds curriculum developer, Sarah Millar, resigned her job in spring 2007 and the new curriculum coordinator was still not hired by September 18 when we demonstrated the kit. We anticipate that the two projects will nicely complement each other and Carla Hoopes will continue to serve on the Know Weeds project advisory committee.

Evaluation of Success: (Report on steps taken to evaluate the success of the project, include photos)

Success is measured by three means: 1) the number of youth leaders willing to test this product; 2) new participants in the distribution of the kits; and, 3) new diverse funding resources for weed education products.

At the September 18, 2007 demonstration of the prototype, six youth educators volunteered to preview the IWM Activity Kit and respond within ten days with comments. Their comments were included in the final version of the "What's in Your World?" publication, the premier product that accompanies the National Invasive Species IWM Library. The complete product will be distributed to Todd Breitenfeldt and biological control insectary program educators in Montana and Idaho to test the products in their science programs. Melissa Griffiths and the Madison Valley Ranchlands Group, and the Greater Yellowstone Coordinating Committee Weed Subcommittee will engage their youth educators in testing the Kit. We anticipate five hundred youth educators from agencies, local organizations, watershed and stakeholder groups will test market the product. Each youth educator will receive a National Invasive Species IWM Library and Journalist's pouch with as many "What's In Your World" publications as they have youth in their program.

The second measure of success is new participants in the distribution of the kits. After the September 18 demonstration, Lindy Garner and the US Fish and Wildlife Service indicated that they will sponsor a Region 6 challenge cost-share agreement proposal to help meet their noxious weed education goal of getting youth back outside learning and caring for the environment. Jim Olivarez indicated that this product also meets US Forest Service noxious weed educational goals and overall Forest Service goals to get kids camping again. US Fish and Wildlife Service challenge cost-share proposal is expected to cover the production cost of the library container and journalist's pouches.

The third measure of success is new diverse funding resources for weed education products. The pouch is designed for the kid to use to explore the world around them, learn how to identify noxious weeds, and how to identify and collect biological control insects ... all the while taking notes in the journal and referring to the National Invasive Species IWM Library as

directed by the "What's in Your World?" publication. The pouch contains biological control flash cards that were developed under a matching grant by the USDA APHIS Plant Protection Quarantine. The pouch also contains a journal, pencil, ruler, flexible tweezers, jeweler's loop in a bag tethered inside the pouch, and aspirator that will be provided by the Whitehall Biological Noxious Weed Control Project.

Each of the components to the kit is funded by a different sponsor. Contributors to the National Invasive Species IWM Library are as follows: Aquatic Nuisance Species Task Force, California Invasive Plant Council, Center for Invasive Plant Management, Federal Interagency Committee for Management of Noxious and Exotic Weeds, Greater Yellowstone Coordinating Committee Weed Subcommittee, Lewis and Clark Conservation District, Lewis and Clark Interpretive Center, Madison Valley Ranchlands Group, Montana Association of Conservation Districts, Montana Stockgrowers Association, Association of Grazing Districts, Montana Trail Vehicle Riders Association, Montana County Weed Districts, Montana Department of Agriculture, Montana Fish, Wildlife and Parks, Montana Department of Natural Resources and Conservation, Montana Department of Transportation, Montana Farm Bureau Federation, Montana Native Plant Society, Montana State University College of Agriculture Departments of Land Resources and Environmental Sciences, Seed Testing Lab, and 4-H Foundation, Montana State University College of Arts and Architecture Departments of Media and Theatre Arts, KSUM TV / Montana PBS, Science and Natural History Filmmaking, and MSU Extension Service, National Invasive Species Council, National Off-Highway Vehicle Conservation Council, University of Nevada Cooperative Extension, Oregon Department of Agriculture, Ponderosa Snow Warriors, Rocky Mountain Elk Foundation, Rocky Mountain Front Weed Round Table, Salmon-Challis National Forest, The Nature Conservancy, Townsend Schools Bugs and Weeds Project, USDA Animal and Health Inspection Service Plant Protection Quarantine, Forest Service Northern Region and State and Private Forestry, Natural Resources Conservation Service, Geological Survey, USDI Army Corps of Engineers, Bureau of Indian Affairs, Bureau of Land Management, Bureau of Reclamation, Fish and Wildlife Service, Partners for Fish and Wildlife, National Park Service, University of Montana Public Policy Research Institute, Western Area Weed Council, Whitehall Biological Noxious Weed Control Project, and Wyoming Weed and Pest.

Activities for the Next Reporting Period: (Include acres to be treated/grazed, biocontrol releases, meetings, etc.) Product tests by youth educators during the coming year will provide feedback to the final production of the product and an annotated version of the premier publication "What's in Your World?"

A distribution list will be confirmed and orders for kits and libraries will be secured. Six youth educators and county weed district education coordinators will meet to discuss project coordination and costs in order to develop a strategy for sustaining this project once the initial phase of testing is complete.

It is anticipated that contributions secured through future orders from youth educators will allow this project to become self-sustainable.

The flash cards are going through their final edit at the time of this report. Printer bids are solicited. The printed cards will be assembled into the Journalist's Weed Scientist pouches during this period and complete by the project end date December 30, 2007.

Final Report
Project Title: Biological Control of Field Bindweed Survey
Cooperator Name: Jeffrey Littlefield - Montana State University
Agreement # 07-8572-0810-CA

Introduction:

Field bindweed, *Convolvulus arvensis* L. (Convolvulaceae) is one of the most aggressive, perennial weeds of grain producing areas of the northern Great Plains of North America. Although field bindweed is a persistent weed of croplands, it also occurs in pastures, gardens, roadsides, right-a-ways and vacant land. Field bindweed has been identified as a target species for biological control by APHIS. To control this weed biologically, the gall mite, *Aceria malherbae* Nuzzaci (Acari: Eriophyidae) (one of only two agents approved by APHIS for field release) has been released in the United States. Although the mite has been successfully established at three locations in Montana, the establishment and spread of the mite at other sites is not currently known. Successful biological control would provide an alternative management strategy for field bindweed.



Field bindweed infestation in a hay field near Huntley, MT.

Plan of Action:

Objective - Previous release sites of *Aceria malherbae* will be inspected for successful establishment of the mite.

Approach - Sites of *Aceria malherbae* were inspected from mid-August to mid-September. Percent mite infestation was determined at each site (see below). If mite galls were observed, visual inspections of adjacent field bindweed infestations were made parallel and perpendicular to the prevailing winds until mites or field bindweed could no longer be located. A more general survey along major roads was also conducted in eastern Montana.



USDA ARS photo archives, Bugwood.org
An adult field bindweed mite, magnified.

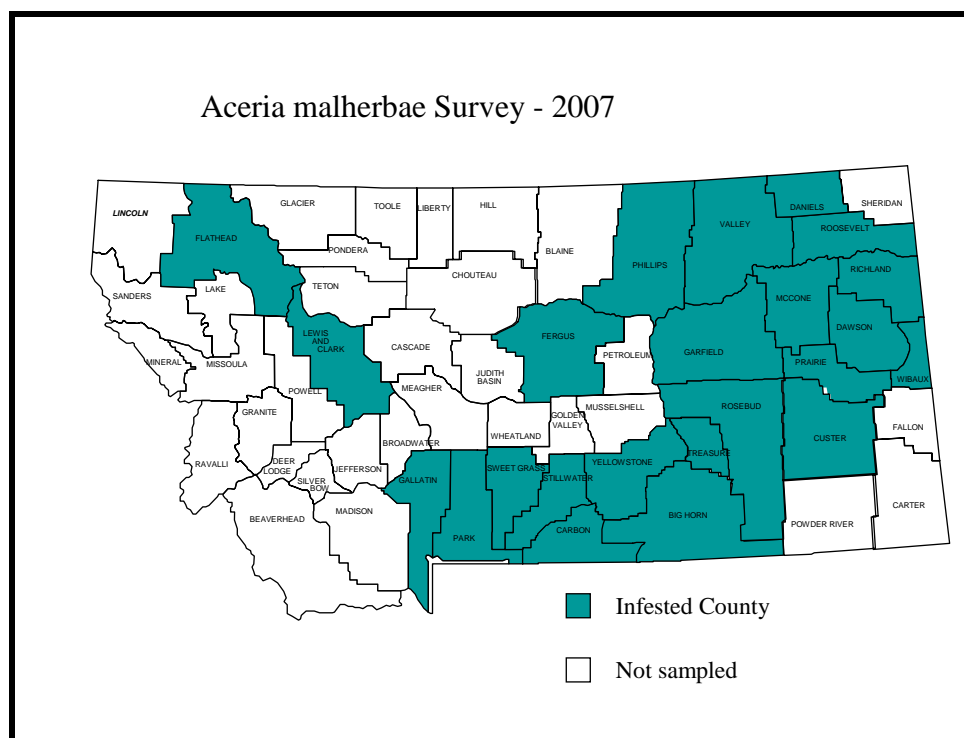
Microhabitats at selected *Aceria malherbae* release sites were characterized as to site/environmental conditions, plant productivity, soil conditions, and current or past land utilization. Sites were characterized as to elevation, aspect, average precipitation, and mean temperatures (if available). Field bindweed density, plant composition, percent cover and biomass were estimated for each sampling unit. Ten 1/4 m² quadrates were sampled along a 50 m transect extending through the center of the release site. From these quadrates, field bindweed density (i.e. number of stems) and number of infested stems were determined, and all plant material was clipped, bagged, and dried to determine biomass (g). Plants were separated as to field bindweed, grasses and forbs to determine species composition. Percent cover at each sampling unit was visually estimated. Physical properties and nutrient quality of the soil were also determined. Soil compaction was measured using bulk density estimates. Soil from upper horizon (A) was sampled using a manual soil corer. Two representative samples were collected from each site and combined and sub-sampled for soil analysis: % organic matter, sand, silt and clay, soluble salts, pH, and various minerals/micronutrients. All laboratory work, with the exception of the soil analyses, was conducted on the MSU campus.

Results:

Geographic Location In Which The Project Took Place - The geographic range of the survey was expanded to include the following Montana counties: Big Horn, Carbon, Custer, Daniels, Dawson, Fergus, Flathead, Gallatin, Garfield, Lewis & Clark, McCone, Park, Phillips, Prairie, Richland, Roosevelt, Rosebud, Stillwater, Sweetgrass, Treasure, Valley, Wibaux, and Yellowstone (Table 1). Due to budget and time restrictions surveys were not conducted in Hill, Judith Basin, and Teton Counties. Except for Teton County, these releases were made in 2006 and therefore were of lower priority.

Previous releases of the mite occurred in Fergus, Flathead, Gallatin, Hill, Judith Basin, Lewis & Clark, McCone, Park, Phillips, Richland, Roosevelt, Teton, and Yellowstone. Infested field bindweed sites were located at all of these counties (Hill, Judith Basin and Teton not sampled), although not all sites had the mite present.

The remaining counties- Big Horn, Carbon, Custer, Daniels, Dawson, Garfield, Prairie, Rosebud, Stillwater, Sweetgrass, Treasure, Valley, and Wibaux - represent counties where the mite was not known to previously occur.



Mite populations tended to be quite variable. Most field bindweed sites in eastern Montana were infested with mites. In general only a few plants were infested at each site, but occasionally heavy pockets of the mites were observed, e.g. sites near Vida (McCone Co.) or Opheim (Valley Co.). Many of the sites visited in Yellowstone Co. had significant infestations of *Aceria malherbae*. In contrast, sites located in the western portions of the state (e.g., Flathead, Gallatin, Lewis & Clark and Park Counties) had low levels of infestations despite the mites being established for a period of ten years at some sites (i.e. Flathead and Gallatin Counties). At these

sites only an occasional plant was infested, with only one or two leaf galls observed. These sites occur at relatively higher elevations and receive more rainfall.

The majority of the sites sampled were along roadsides or vacant land, where disturbance (other than mowing) is minimal. Mites were also located in highly disturbed sites such as hay land, pastures and cultivated/ fallow fields. Plant cover at infested sites was characterized by moderate grass cover or open ground. Bindweed cover ranged from 6-25% and the presence of other forbs was low (less than 5%). Infested sites were generally more open and drier habitats. Soil conditions at high versus low mite infestations did not vary greatly. Soil texture was thought to be a key characteristic in the ability of the mite to overwinter, but the soil texture ranged from sandy loams to heavy clay soils; and reflected more the location of the particular site.

Conclusions:



Young leaves of field bindweed galled and twisted by the field bindweed gall mite.

Aceria malherbae is well established within the state of Montana. Although many counties were not sampled, the mite appears to be widespread in eastern portions of the state. It is thought that the mite has a wider distribution than what is indicated by the survey. The mite may have also dispersed into surrounding states such as North Dakota and Wyoming, or the Canadian province of Saskatchewan. The sources of the mite are not known. Although releases were made in the eastern part of the state (e.g. McCone, Roosevelt, and Richland Counties) many of these sites were subsequently destroyed due to cultivation, did not apparently establish or until recently did not appear to have spread. The wide spread distribution of *Aceria malherbae* may indicate that the mite may be wind dispersed to a greater extent than was previously thought (perhaps originating from Yellowstone Co.). Despite the mite being widespread, its current impact on field bindweed appears to be low in many places. Yellowstone County appears to have the highest density of *Aceria malherbae* compared with other Montanan counties. Perhaps with time, the mite may reach comparative levels.

Table 1. *Aceria malherbae* sample locations - Montana 2007

County	Location	Latitude	Longitude	Presence	Mite Level	Elevation
Big Horn	Hardin	N 45 44.537	W 107 36.606	Y	1	2855
Carbon	Bridger	N 45 15.838	W 108 52.736	Y	3	3745
Carbon	Edgar	N 45 27.843	W 108 51.791	Y	1	3487
Custer	Diamond Ring Ranch	N 46 36.989	W 105 32.309	Y	3	2367
Daniels	Scobey	N 48 47.083	W 105 25.095	Y	1	2475
Dawson	East of Prairie Co. line - rest stop	N 46 53.968	W 105 01.165	Y	1	2252
Dawson	West of Wibaux Co. line	N 47 02.779	W 104 23.508	Y	1	2614
Fergus	191 & Birdwell Rd	N 47 28.876	W 108 45.083	Y	1	3079
Fergus	Bohemian Corner	N 47 21.387	W 108 48.294	Y	1	3246
Fergus	North of Roy	N 47 27.479	W 108 52.097	Y	1	3117
Fergus	North of Roy	N 47 27.102	W 108 53.243	Y	1	3129
Fergus	North of Roy	N 47 26.778	W 108 53.251	Y	1	3115
Fergus	North of Roy	N 47 29.086	W 108 53.312	Y	1	3073
Fergus	North of Roy	N 47 28.080	W 108 53.360	N	-	3100
Fergus	North of Roy	N 47 24.890	W 108 54.596	Y	1	3191
Fergus	North of Roy - Release 1994/95	N 47 26.634	W 108 54.395	Y	2	3138
Fergus	Roy	N 47 26.418	W 108 54.400	N	-	3479
Flathead	Kalispell	N 48 12.455	W 114 19.626	Y	1	2979
Gallatin	Belgrade	N 45 46.311	W 111 10.116	Y?	1	4468
Gallatin	Bozeman	N 45 41.300	W 111 02.563	N	-	4777
Gallatin	Bozeman	N 45 41.335	W 111 02.625	N	-	4777
Gallatin	Bozeman - MSU	N 45 40.199	W 111 03.308	Y	1	4840
Gallatin	Bozeman - MSU	N 45 40.272	W 111 03.318	N		4849
Gallatin	Manhattan	N 45 51.392	W 111 19.873	N	-	4260
Gallatin	Manhattan	N 45 51.455	W 111 20.067	N	-	4270
Gallatin	Springhill	N 45 52.494	W 111 03.721	N	-	4744
Gallatin	Springhill	N 45 52.138	W 111 03.641	N	-	4643
Gallatin	Springhill	N 45 51.639	W 111 03.715	N	-	4623
Garfield	Rest Stop - Garfield/ McCone Line	N 47 19.508	W 106 10.263	Y	1	2468
Lewis & Clark	East Helena	N 46 35.271	W 111 55.053	Y	1	4261
McCone	North of Vida - Near Jct 13 & 201	N 47 53.850	W 105 23.636	Y	2	2418
Park	East of Livingston - Mission Rd	N 45 42.859	W 110 24.012	N	-	4359
Park	East of Livingston - Yellowstone River	N 45 42.993	W 110 27.967	N	-	4422
Park	East of Springdale Fishing Access	N 45 42.088	W 110 15.665	Y	1	4303
Park	Livingston - Release	N 45 42.243	W 110 31.834	Y	1	4579
Park	Springdale Exit - I 90	N 45 44.294	W 110 12.875	Y	1	4162
Phillips	CMR - Release 2001	N 47 36.368	W 108 30.228	Y	1	2277
Phillips	CMR - Release 2006	N 47 36.524	W 108 30.226	Y	2	2270

Phillips	CMR - Release 2006	N 47 36.585	W 108 30.285	Y	1	2274
Prairie	Terry	N 46 47.462	W 105 18.193	Y	1	2304
Prairie	Terry	N 46 47.095	W 105 18.158	Y	1	2284
Richland	Crane - Seven Sisters WMA	N 47 34.437	W 104 14.966	Y	1	1990
Richland	Savage - Elk Island WMA Rd	N 47 27.844	W 104 20.518	Y	1	1992
Richland	West of Lambert - Release	N 47 49.128	W 104 49.332	Y	1	2434
Roosevelt	North of Wolf Point - Rt 13	N 48 29.225	W 105 25.846	Y	2	2416
Rosebud	East of Rosebud	N 46 15.685	W 106 16.814	Y	3	2530
Rosebud	Hathaway	N 46 16.565	W 106 11.760	Y	1	2487
Rosebud	West of Forsyth	N 46 15.616	W 107 08.287	Y	1	2697
Stillwater	Columbus	N 45 38.590	W 109 14.895	Y	3	3606
Stillwater	East of Columbus - Molt Rd	N 45 37.781	W 109 12.029	Y	1	3805
Stillwater	Park City	N 45 38.187	W 108 54.916	Y	1	3400
Stillwater	West of Columbus - Springtime Rd	N 45 42.097	W 109 23.298	Y	1	3707
Stillwater	West of Park City	N 45 36.784	W 109 00.475	Y	1	3432
Sweetgrass	Big Timber	N 45 49.611	W 109 58.420	N	-	4036
Sweetgrass	Greycliff - Pelican Fishing Access	N 45 45.476	W 109 46.216	Y	1	3896
Sweetgrass	Reed Point	N 45 42.341	W 109 32.475	Y	2	3760
Treasure	West of Hysham	N 46 13.031	W 107 15.039	Y	1	2895
Valley	East of Opheim	N 48 51.191	W 106 23.511	Y	3	3250
Wibaux	East of Dawson Co. line	N 47 08.576	W 104 18.414	Y	1	2840
Wibaux	West of ND state line	N 47 56.427	W 104 04.405	Y	1	2826
Yellowstone	Billings - River Front Park	N 45 44.477	W 108 32.400	Y	2	3176
Yellowstone	Billings - Zoo Ave.	N 45 44.068	W 108 36.609	Y	2	3268
Yellowstone	Custer	N 46 07.765	W 107 33.436	Y	1	2740
Yellowstone	East of Billings - 190 & 94	N 45 48.998	W 108 24.801	Y	2	3134
Yellowstone	East of Laurel	N 45 41.026	W 108 42.340	Y	1	3280
Yellowstone	Huntley - East of Museum	N 45 55.907	W 108 13.669	Y	3	3008
Yellowstone	Huntley - Museum	N 45 55.630	W 108 14.324	Y	2	3033
Yellowstone	Huntley - Release (?)	N 45 53.203	W 108 18.726	Y	1	3039
Yellowstone	Huntley - River	N 45 53.328	W 108 18.819	Y	1	3065
Yellowstone	Pompey's Piller	N 45 59.229	W 108 00.283	Y	1	2897
Yellowstone	Pompey's Piller - Visitor Center	N 45 59.621	W 107 59.963	N	-	2905
Yellowstone	South of Huntley - Hogan Rd	N 45 49.202	W 108 17.366	Y	1	3160
Yellowstone	South of Huntley - Shadow Canyon	N 45 50.707	W 108 17.847	Y	1	3130
Yellowstone	South of Laurel - BLM release 2003	N 45 38.540	W 108 44.884	Y	1	3274
Yellowstone	Worden	N 45 57.594	W 108 09.728	Y	3	3050
Yellowstone	West of Huntley	N 45 52.445	W 108 19.857	Y	1	3133
Yellowstone	West of Custer	N 46 03.793	W 107 42.527	Y	3	2968

European Pine Shoot Moth
Rhyacoinia buoliana
Quarantine Support Survey

Montana has had a quarantine for the European pine shoot moth (EPSM) since prior to 1962. This insect is a pest in production of lumber, nursery trees and Christmas trees that are long-needled pines. Feeding by the larval stage in the growing tips causes death of leaders, resulting in trees with Y-shaped trunks, or other deformities, which are aesthetically unpleasing (lowering value in nursery and Christmas tree trade) or are not usable for major lumber markets, due to a need for additional work to salvage cuttable trunks.



Adult European pine shoot moth, collected on a wing trap baited with species-specific pheromone and placed in a tree in Kalispell, MT (2006), during routine quarantine support surveillance.

The insect itself is very small. The wingspan of the typical adult is under ¼ inch. However, the adult is very brightly colored, with an orange and silver patterning on the wings. There are a number of native pine shoot moths with similar coloration, so identification is dependent on dissection of the male genitalia. The larvae initially feed in the tips of the branches in the new year's growth, webbing the needles together for protection. Older larvae move to the needle sheath, and mine into individual needles, after which they move on to the needle buds. They overwinter as larvae. Larvae emerge to feed again in the spring. This spring feeding is the most damaging, as it involves large larvae feeding on new foliage. The larvae pupate in the needle foliage in the tunnels and webbing they created while feeding. Moths emerge in mid-summer.

Monitoring for the EPSM is done using wing traps and species specific pheromones. These pheromones are attractive to the male moths, but female moths can also be caught in the traps.

The majority of the area of concern for EPSM is in the western portion of the state, west of the continental divide. This area is trapped each year for the presence of EPSM.



Wing trap for monitoring European pine shoot moths.



Locations of European pine shoot moth traps throughout western Montana for routine surveillance in support of the quarantine.

During 2007, two hundred and six EPSM traps were placed in Montana for routine surveillance in support of the quarantine. Additional traps were placed in delimiting surveys in three towns: Baker (second year of trapping in response to an uncertified movement of Christmas trees), Kalispell (delimiting survey in response to discovery of two moths in the same trap during 2006), and Great Falls (delimiting survey in response to discovery of uncertified tree introduction from a known infested area).

No suspect EPSM were found during this survey.

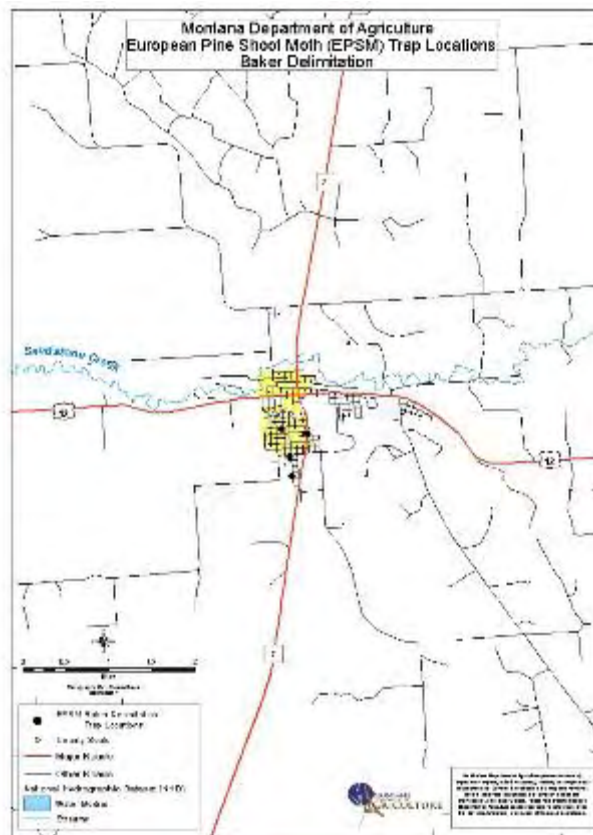
References

<http://www.entomology.umn.edu/cues/Web/130EuropeanPineShootMoth.pdf>
<http://www.forestpests.org/northeast/europineshoot.html> - Aug 31, 2004

European Pine Shoot Moth
Rhyacionia buoliana
Baker Delimiting Survey – Second Year

During the 2005 Christmas holiday season, the Montana Department of Agriculture was notified by the USDA APHIS PPQ that a shipment of Christmas trees from an uncertified nursery in a quarantined state known to be infested with European pine shoot moth (EPSM) was brought into the state, and distributed in the area of Baker, Montana (Fallon County). This area is in far eastern Montana, and there are few host trees in the immediate vicinity. However, all host trees in the area are of very high value to the community, which is contained in a relatively small area (less than 1 mile square). The town was trapped at a density of 35 traps throughout the community in the first year. Although a moth resembling EPSM was found during this trapping, the species could not be definitely determined (it was a female moth). The closest identification was to a native shoot moth, so it was decided to continue to the delimiting survey, but concentrating in the area where that moth was taken, and also in the area where the trees were most likely to have been distributed from.

During 2007, five traps were placed in close proximity to the area described above (a lot near the high school). Again, no moths were collected from these traps. Further trapping in Baker will not be conducted.



Placement of traps for the second year of trapping in Baker, Montana following shipment of an uncertified group of Christmas trees from a known EPSM infested area.

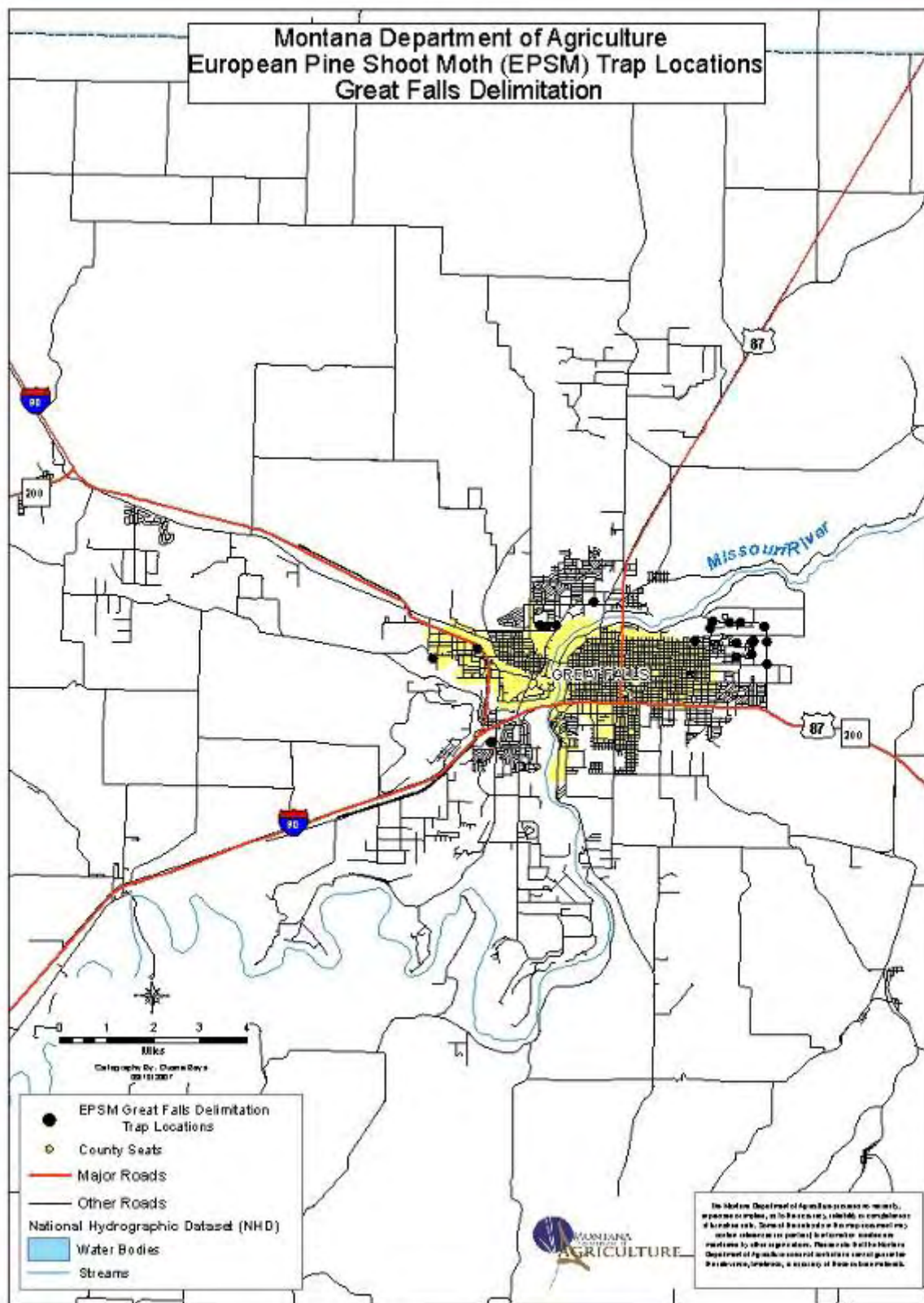
European Pine Shoot Moth
Rhyacionia buoliana
Great Falls Delimiting Survey

An inadvertent introduction of Austrian pine from an infested area, without documentation of freedom from infestation by European pine shoot moth (EPSM) led to a delimitation survey in Great Falls. The pines were brought from a nursery in Oregon by a landscape company. While the nursery generally treated for various insects, there was no proof that the trees had been treated in such a way as to mitigate the danger of introduction of EPSM. In addition, the nursery had recently been the site of a positive EPSM catch on a pheromone trap.



Austrian pines that were imported to Montana without the proper certification, on their way to being destroyed.

A total of 28 traps were placed throughout the Great Falls area, primarily in the area of the holding yard where the suspect trees had been held. In addition to the delimitation survey, the landscape company was required to destroy all of the trees from the Oregon source. No EPSM were found in the traps. Additional traps will be run during the 2008 trapping season, directly around the holding yard.



Trapping sites in the Great Falls area for European pine shoot moth, 2007. Each black dot is a single pheromone trap.

European Pine Shoot Moth
Rhyacionia buoliana
Kalispell Delimiting Survey

During the survey activities of 2006, a trap containing two suspect moths was collected in the town of Kalispell. The moths were subsequently identified as European pine shoot moth (EPSM) by identifiers at the USDA ARS facility in Beltsville, Maryland. As a result of this find, a delimitation survey was required in the area directly surrounding the trap site.

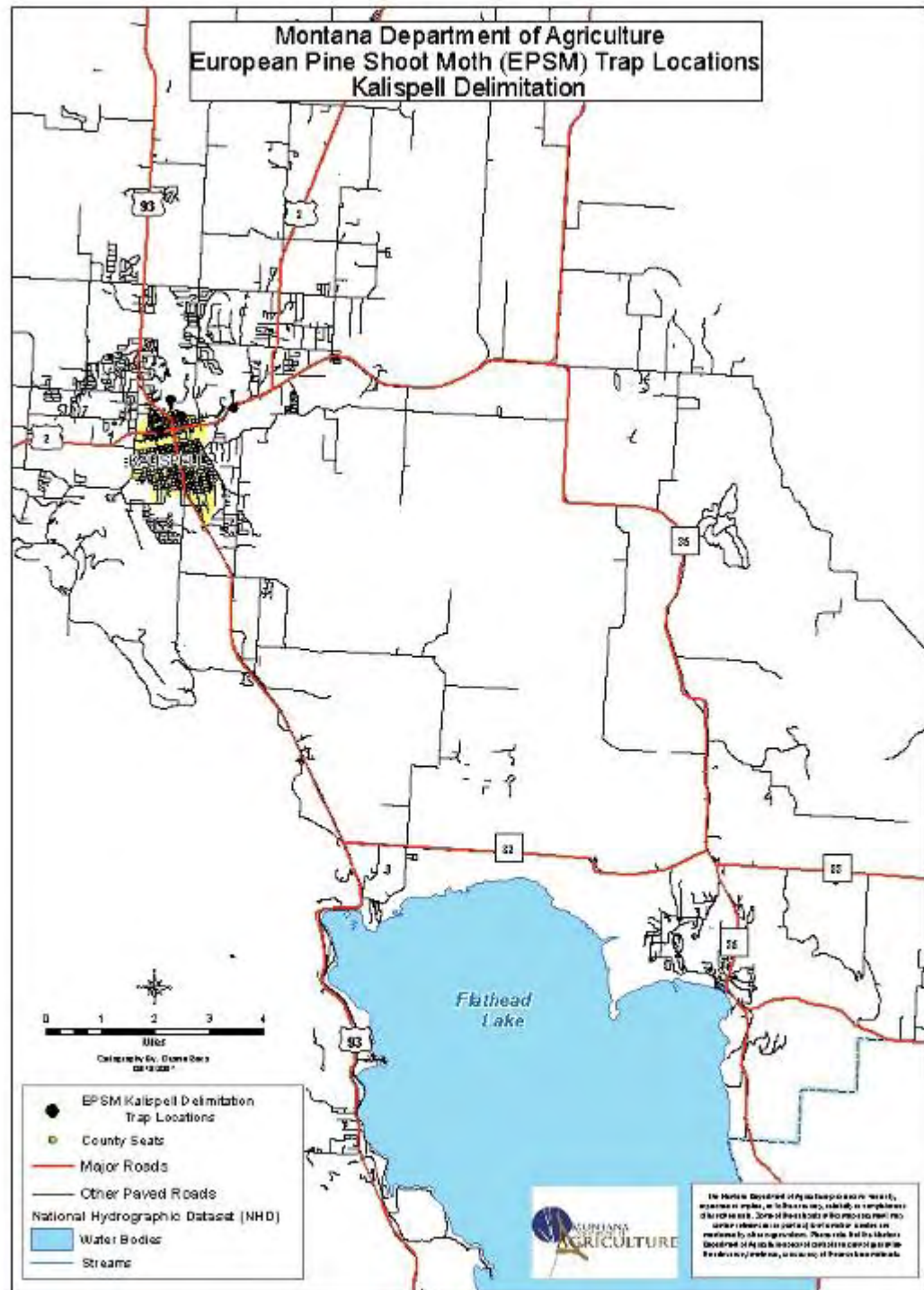
During 2006, immediately after the find, additional investigation of the area revealed that while it contained several groups (and species) of pines, none appeared to have any damage. The actual trap was in a small grove of Ponderosa pine that was directly along a hiway. The trees were not planted, but were naturally occurring as part of the vegetation in the area. The area directly south of the trees was an automobile dealership, and the other areas were primarily housing.

Interviews with the people in the area, and with personnel at nearby nurseries indicated that there had been no problems with insects in the trees in the area. However, the parking lot of the automobile dealership does serve as an overnight stop for various types of trucks including lumber and nursery trucks, and has been known to be the location of Christmas tree sales.

In 2007, four extra traps were put in the general area of the positive trap.



Adult European pine shoot moth, magnified. Photo by Eric LaGasa, Washington State Department of Agriculture.



Japanese Beetle
Popillia japonica
State-wide Activities



Japanese beetle found in Billings, Montana. Montana Department of Agriculture photo.

Japanese beetle (JB) was first reported in Montana in 2001, in Billings. Ongoing trapping since then has yielded additional beetles, all in the vicinity of the Billings airport until 2007. The USDA APHIS PPQ conducts surveillance at the airports, while the Montana Department of Agriculture (MDA) conducts surveillance at selected high-risk nurseries and plant retailers. Traps placed as part of special efforts are not reported on in this narrative.

During 2007, the MDA trapped for JB at 73 locations in nine counties. Represented in these locations are nurseries, sod farms, and “big box” stores.

County	Number of Traps	Number of Positives
Broadwater	1	0
Cascade	19	0
Flathead	19	0
Gallatin	6	0
Jefferson	1	0
Missoula	12	0
Park	2	0
Ravalli	12	0
Sheridan	1	0
Total	73	0

No JB were found in any of these traps. In addition to placing the traps, MDA personnel also spoke with employees of the establishments, and in some cases, left literature regarding the beetle for distribution to the general public.

Status Report
Japanese Beetle Trapping
Lake County, Montana
August 2007

The trapping was initiated by the discovery of a beetle on a European Pine Shoot Moth trap from a location in Lake County, Montana. The location of the trap was 47.81198 N, 114.02048 W. This location corresponded to a tree just to the west of MT Hiway 35, on the lakeside of a pullout. The trap was located in a pine tree.



Trap location for European Pine Shoot Moth trap that was found with Japanese beetle in it. Note location of water and steep terrain.

The pullout is used by a wide variety of people, and is large enough to accommodate several cars and RVs at the same time. There are chokecherries and other minimally acceptable hosts in the area. In addition, there is a day-use area about 0.25 miles north of the pull-out, which is landscaped with a wide variety of roses. The trap location was not located near any commercial cherry orchards. This portion of the hiway is located less than 20 feet from the lake on the west side, and the slope on the east side is very steep. (In several areas, there are rock fall barriers on the east side).

Trapping began on Tuesday, 31 July 2007. Initial reconnaissance of the area by Patricia M. Denke (Entomologist, Montana Department of Agriculture) and Chris Helseth (Montana Department of Agriculture) allowed final planning to be done, taking into account terrain and unique elements of the area to determine endpoints and trap density.



Trapping area, with "Point 73" represented as a yellow dot, and the ends of the trapping area as black lines.

A strategy and instruction meeting was held at the Flathead Lake Inn in Polson Montana, beginning at 3:00 pm. In attendance were Patricia M. Denke, Chris Helseth, Dan Poff (Montana Department of Agriculture Field Inspector, District A), Dawn Bales (Montana Department of Agriculture Field Inspector), and Chris Herron (Montana Department of Agriculture Field Inspector District A-North).

The survey was planned to start at 7:00 am the morning of 1 August 2007. The north end of the survey was roughly the Yellow Bay area, the south end, the turnout for the Montana Pines RV Park. This is a distance of roughly 10 miles. Traps were to be placed within the area, primarily along the roads. Present were Patricia M. Denke, Chris Helseth, Dan Poff, and Dawn Bales. Two teams were formed- Denke & Helseth, Poff & Bales. The teams worked from a central point, the location where the beetle was found (referred to as "Point 73", after the number on the EPSM trap, throughout the survey). At noon, the two teams met, conferred, and exchanged information. The teams met again at the end of the day at the Glacier Fresh Cherry Packing Plant.

Each trap was labeled with two labels. One indicated that the trap was a Japanese Beetle trap, belonging to the Montana Department of Agriculture, with the trap number. The other had information about websites to get additional information regarding the beetles, and contact information for the Montana Department of Agriculture.

At the end of 1 August 2007, there were approximately 77 traps in place in the survey area.

On 2 August 2007, Patricia M. Denke, Chris Helseth, and Dawn Bales were immediately present. The teams put up a few traps, until the arrival of Sean Mulla in Polson with approximately 50 additional traps. Sean Mulla as a single person team was assigned to place

traps in Polson, particularly at nurseries and orchards. Dawn Bales continued as a single person team, working off the east side of the hiway. Denke and Helseth worked off the west side of the hiway. The general method at this point was to try to fill in any empty spots on the map on the GPS unit used by the team. At 1:00, the teams met for final status reports. Sean Mulla was given all remaining traps for additional placement or transfer to storage in Missoula

At the end of the delimitation placement, there were traps in nearly every pullout along Flathead Lake, as well as in most of the orchards.

This survey was relatively intense, requiring a total of at least 45 hours in the field. During this time, the personnel on this assignment were unable to carry out their regular duties. Additional time was spent in Helena with preparation, as well as resolution. Checking the traps commenced next week, on 7 August 2007.

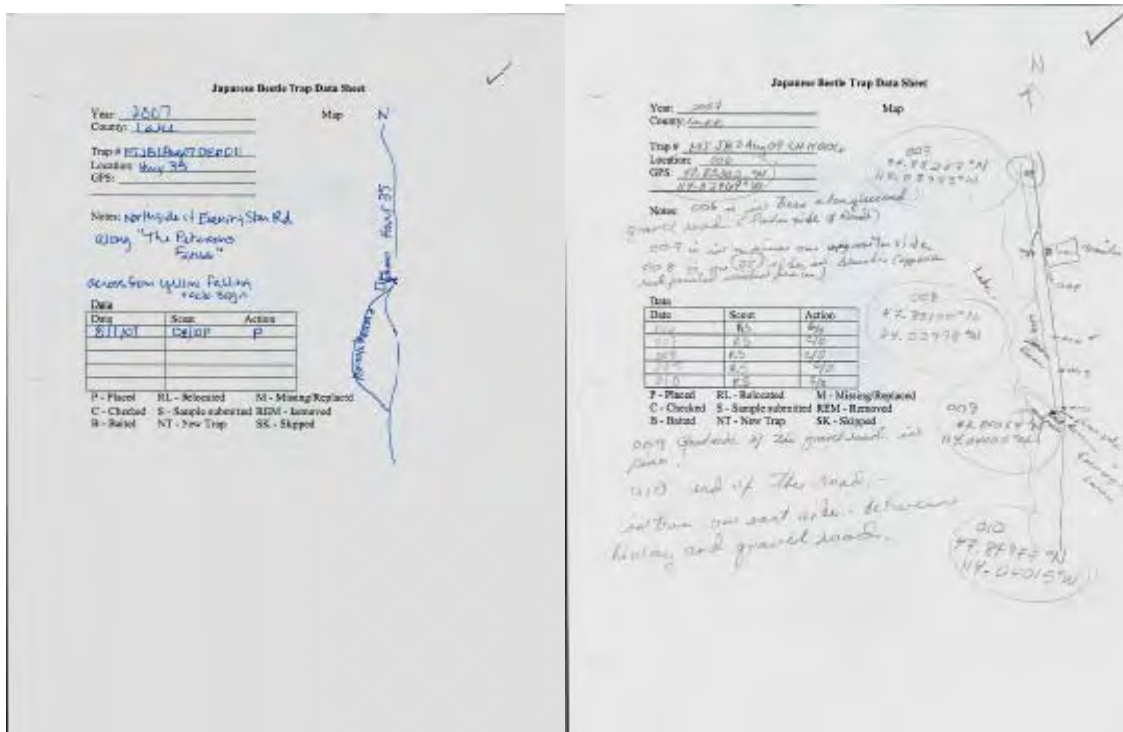
Hours spent by MDA personnel on Lake County delimitation survey. All reported hours here are minimum.

Name	Days	Hours (Set Up Survey)	Hours (Checking Traps)	Hours (Final)
Dawn Bales	1.5	12	-	12
Patricia M. Denke	3	24	10	34
Chris Helseth	2.5	20	-	20
Chris Herron	-	-	8	8
Sean Mulla	1	8	8	16
Dan Poff	1	8	-	8
Ryan Solberg	-	-	10	10
Total	9	45	36	81

Trap Status

7 August 2007

Checking of the traps was carried out by Patricia M. Denke, Entomologist, Montana Department of Agriculture, and Ryan Solberg, Field Specialist, Montana Department of Agriculture. Traps were located either through the use of maps generated the previous week during trap setting, or via GPS data recorded on the maps.



Maps showing location of Japanese beetle traps along Montana Hiway 35 in Western Montana, on the east side of Flathead Lake, during 2007.

Traps in Kalispell set by Chris Herron (Montana Department of Agriculture, Field Specialist) were checked by Chris Herron. Traps set in Polson by Sean Mulla (Montana Department of Agriculture, Field Specialist) were checked by Sean Mulla. Total time spent checking traps was 10 hours by Denke and Solberg, 8 hours by Herron and 8 hours by Mulla for a total of 36 hours spent checking traps. No Japanese beetle suspects were found.

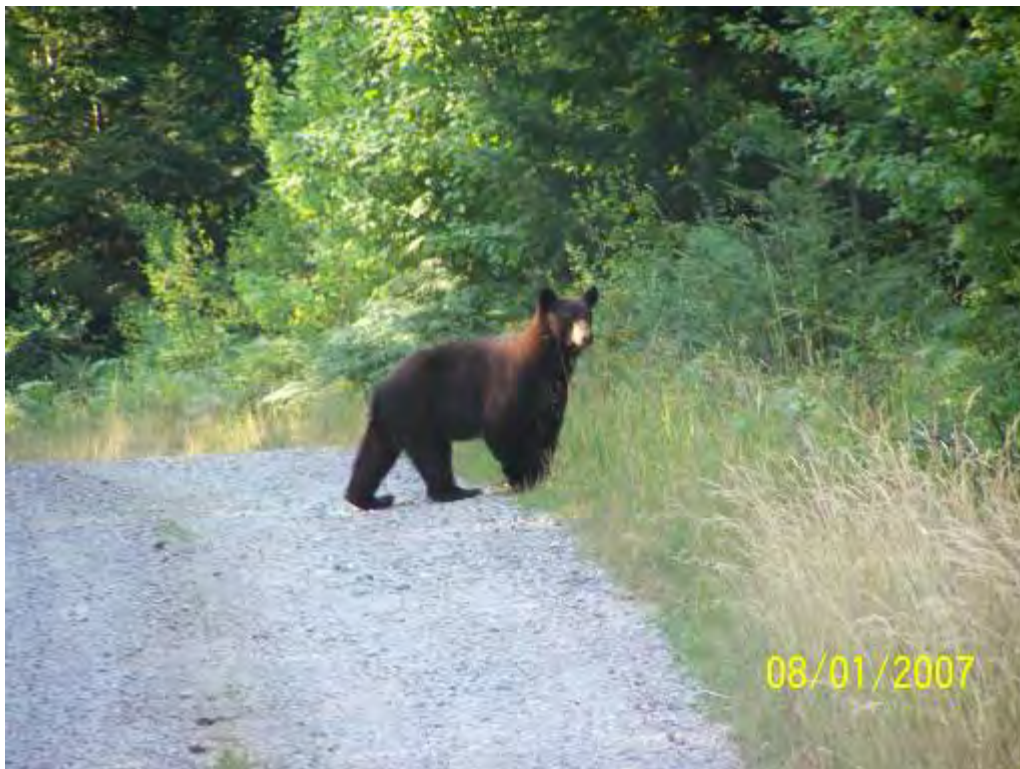
All traps were located.

Final Trap Status

All 81 traps were checked and removed in mid to late September. There were no additional JB collected in Lake County. Trap removal required more than 36 hours. The primary insects found in the traps were butterflies, wasps, and assorted bees.



Japanese beetle traps in the field during 2007, on the east side of Flathead Lake. Note steep terrain to the east of the trap in second photo.



Not a Japanese beetle.

Status Report
Japanese Beetle Trapping
Billings, Montana
2007

Over forty Japanese beetle (JB) were found in Billings, MT, in traps baited with both male sex pheromone and floral scent lures during 2005 during a delimiting survey. Treatment of turfgrass and other irrigated areas within a one-mile radius circle of land commenced that fall. All treatments were on a voluntary basis. Roughly half of the land within the circle is extremely dry (less than 6 inches of precipitation per year, primarily in the form of snow), and about half of that land is actually part of the “Rimrocks” proper, a series of sandstone cliffs ranging from 5 to over 50 feet high.



Looking north from Rocky Mountain College (west of Montana State University-Billings) at the Rimrocks.
The trap in the foreground is roughly ¼ mile from the Rimrocks.

Within the circle there are about 650 properties. A large portion of this land is owned by Montana State University-Billings. Other major landowners include the City of Billings, and the airport, both of which were notified of the beetle finds, and appropriate courses of action. The airport added white grub control to their regular landscaping maintenance. At this time, the city was unable to include treatments of their land due to budget constraints. Due to budget constraints the Montana Department of Agriculture (MDA) was no longer able to monitor beetles. However, Billings homeowners in the area responded to a call for assistance, and over 100 homeowners obtained free JB traps and lures from the MDA and the USDA APHIS PPQ. A majority of these later reported the results of their efforts.

During 2006, fewer beetles were found in the area (29 total). The city was able to add treatment of their properties, which included a water holding facility surrounded by a large amount of lawn and irrigated landscaping as well as a park.

During the first year of treatments (fall 2005), the University treated only formal lawns and landscaping. They also volunteered to trap their facilities, and added traps when JB were found in traps. Due to the location of positive traps, during the fall of 2006 all University properties were treated with Merit WS 75, including a large number of rental properties. The University trapped the same locations in 2007 as they trapped in 2006. While some homeowners no longer participated in the survey, the essential area, on the north-west corner of the University property and in the area of Ryniker Drive, was still being trapped. This area has yielded over 90% of the JB collected in Billings in all the years it has been found there.

During 2007, there were 19 JB found on the University property and one additional beetle found on a nearby private property. All of these areas were treated for JB in the fall of 2007.



A “suspect” Japanese beetle from Billings, submitted to the Extension Service for confirmation. Amy Granpre photo.

Not all insects submitted as suspect JB were positive. In fact, some that very closely matched the description (green metallic and copper/metallic, with digging legs) were submitted.

The current program will continue, although community interest is waning. A community education campaign about not only insect pests (including JB, emerald ash borer, and mosquitoes) but also weeds and integrated pest management, is being tentatively planned for the spring of 2008.

**Japanese Beetle Trapping
USDA APHIS PPQ
MONTANA AIRPORTS
2007**

The USDA APHIS PPQ traps for Japanese beetles at selected high risk airports within the state. Based on airport size, and number of flights from infested areas, traps are placed around the perimeter of the airports, and in any landscaping that might increase risk of JB infestation.

During 2007, the USDA APHIS PPQ placed and monitored 66 traps at seven airports. These were Billings (29 traps), Bozeman (5 traps), Butte (5 traps), Great Falls (12 traps), Helena (5 traps), Missoula (6 traps), and Kalispell (4 traps).

There were no detections of JB during the 2007 season in traps monitored by the USDA APHIS PPQ.

