2014 Schutter Diagnostic Lab Report

The Schutter Lab receives samples for plant, plant disease, and insect identifications throughout Montana. Most samples are submitted by Montana State University Extension agents, homeowners, farmers, and commercial operators. The diagnostic staff includes Laurie Kerzicnik (Insect Diagnostician), Hilary Parkinson (Plant Identification Diagnostician), and Eva Grimme (Plant Disease Diagnostician). The majority of samples are received in May-September, but the lab is open to receive samples throughout the year. A total of 2104 identifications were conducted in 2014 (Table 1).

Table 1. Total number of identifications performed at the Schutter Diagnostic Lab in 2014.

	# identifications
Plant Disease	896
Insects	717
Plant Identification	491
Total	**2104**

Preliminary estimate of the economic impact of the Schutter Diagnostic Lab in 2014 is $1.7 million over an area covering approximately half a million acres based on 170 responses to a survey. This is only direct economic impacts on samples.

2014 Schutter Diagnostic Lab Impacts

- Insect and spider sample submissions to the Schutter Lab more than doubled from 2013, indicating that awareness has increased about these services.
- A wood-boring beetle was diagnosed from some lumber from a builder in Laurel, MT. The identification was necessary for the builder to receive compensation for treatment from his lumber provider.
- Awareness was increased and fear was decreased about the brown recluse spider and a case in Three Forks, MT through several media interviews and press releases. Approximately 92 additional emails, phone calls and spider identifications were received in the Schutter Lab.
- Four of the noxious weeds received were high priority species, and identification and recommendations enabled client's to meet state-wide objectives of eradication, particularly important for the two cases of rush skeletonweed (Beaverhead and Ravalli Counties) which can spread long distance via windborne seed if not controlled.
- Sixteen plants were submitted to determine if they were toxic to people, ten of which were. Most would have caused moderate stomach upset, but one, an immature poison hemlock assumed to be a carrot, would have been fatal. This highlights the important impact of plant identification on human health.
- Dr. Barry Jacobsen identified mycotoxin-producing fungi on alfalfa hay, corn and wheat seeds which could have caused severe detrimental effects on livestock if used as feed.
- Seven growers from Chouteau County said they would re-evaluate the use of fungicide on dryland wheat. Economic impact was $42,000 due to an estimation of growers not using fungicides
- Wheat streak mosaic virus samples increased from 3 in 2013 to 46 in 2014, reflecting its relevance statewide and need for active research to identify a miticide to control the mite vectoring the disease.

Quotes from Schutter Diagnostic Lab Clients

-"It is imperative to have a Diagnostics lab to provide accurate identification of insects and diseases. A misidentification can have huge ramifications regarding management recommendations. In my job, we have too little time to spend identifying unusual insects and diseases. When we find a disease or insect that is out of the ordinary, it is hugely helpful to have a lab to send samples to for a proper diagnosis."

-"It has been a great tool to use to help growers find answers. They do an outstanding job."

-"The lab is very useful to farmers as well as gardeners. Having a diagnostic lab that can give accurate information to gardeners can often help in preventing the spreading of diseases to commercial areas. Also, having a third party to help with chemical damage in crop areas is helpful. Having the lab located on the campus of a land grant university is helpful to everybody in the state, from homeowners with yards to farmers."

-"The Schutter Diagnostic lab has provided our organization with fast and accurate plant identification. These services have assisted us and our customers with plant identification saving us valuable time."

Contents

2014 Plant Identification Summary

Diagnostic Staff:
Hilary Parkinson- Plant Identification Diagnostician and Research Associate
Extension Specialists:
Dr. Fabian Menalled-Small grain crops; Dr. Jane Mangold-Rangeland

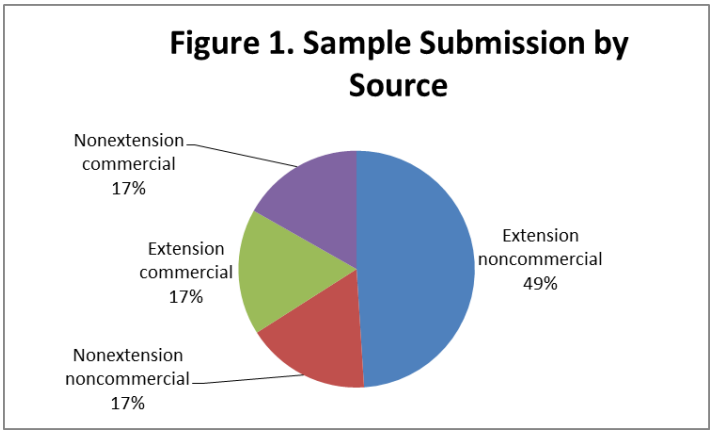
Total Samples and Sample Source

In 2014, 491 samples were submitted to the Schutter Diagnostic Lab for plant identification, a 10% decrease compared to 2013 submissions (547). Samples came from 47 Montana counties (84%, Table 1), and one county in Idaho. The highest submissions were from Gallatin and Silver Bow. Sample submissions were greatest June through August, peaking in August with 97 plants total.

Extension noncommercial was the most common submission type, accounting for nearly 50% of all samples (Figure 1). These samples are typically from residential or small acreage homeowners who take the plant to their agent for identification and need information on how to control the plant in their gardens or pastures, and then agents send the sample in to Schutter. Samples from commercial sources (whether extension or nonextension) accounted for 34% of all submissions. These include farmers, ranchers, consultants, nurseries and representatives from agribusinesses.

Table 1. Plant submissions by county.

Gallatin	153	Yellowstone	12	Fallon	2
Silver Bow	49	Fergus	6	Missoula	3
Ravalli	32	Stillwater	6	Phillips	3
Chouteau	24	Judith Basin	5	Powell	2
Beaverhead	20	Lake	5	Sweet Grass	2
Hill	16	Liberty	6	Valley	2
Teton	15	Park	5	Carbon	1
Toole	11	Pondera	5	Carter	1
Cascade	10	Prairie	5	Golden Valley	1
Deer Lodge	9	Big Horn	4	McCone	1
Meagher	10	Broadwater	4	Petroleum	1
Sanders	9	Lewis And Clark	4	Powder River	1
Wibaux	9	Custer	3	Richland	1
Glacier	8	Musselshell	3	Sheridan	1
Flathead	8	Rosebud	3	Idaho (Ada)	3
Jefferson	7	Daniels	4		



More than 50 of the samples were emailed or texted as pictures, often sent directly from the field. These prompt, same day identifications enable clients, often farmers or consultants, to immediately apply a management strategy when appropriate.

Samples by Status and Type

Sixty two percent or 298 samples were exotic plants representing 181 unique species. The most commonly submitted exotic species were roving bellflower (*Campanula rapunculoides*, 11), bur buttercup (*Ranunculus testiculatus*, 6), field pennycress (*Thlaspi arvense*, 6), and matrimony vine (*Lycium halmifolium*, 5). There were 181 native species, representing 139 unique species. The most common native species were western aster (*Symphyotrichum ascendens*, 5), choke cherry (*Prunus virginiana*, 4), Sandberg's bluegrass (*Poa secunda*, 4), and western virgin's bower (*Clematis ligusticafolia*, 4).

The majority of all samples, whether exotic or native, were forbs (68%), with the next most common growth form being grasses (17%). There were only nine aquatic plants, compared to 23 submitted in 2013, and far below the record number of 80 submitted in 2011. For the first time in four years, no watermilfoil species (native or exotic) were submitted, suggesting that educational efforts, including the extension publication "Biology, Ecology and Management of Eurasian Watermilfoil" and presentations on aquatic plant identification across the state are having an impact.

Twenty seven state-listed noxious weeds were submitted representing 13 unique species (Table 2). This is one more than submitted in 2013. Seven of these samples were new county records. Most notable are the priority 1B species Bohemian knotweed, purple loosestrife and rush skeletonweed. Priority 1B species have a limited presence in Montana. Management criteria requires eradication or containment where present and prevention through education elsewhere. The Bohemian knotweed and purple loosestrife samples were in homeowners' gardens, meaning they are being eradicated, and do not pose a threat of spreading in wildland and riparian areas. The rush skeletonweed samples were by a roadside (Beaverhead) and at a utility station (Ravalli) and were eradicated. All state-listed species include detailed reports on best management practices and links to extension publications when available. Identifying new county records of these high priority species highlights the important role Schutter Lab can play in promoting statewide efforts for Early Detection and Rapid Response (EDRR).

Table 2. State listed noxious weed species submitted to the Schutter Diagnostic Lab. Bold italicized entries are new county records.

Plant	County	Priority
Bohemian Knotweed	***Meagher, Teton***	1B
Canada Thistle	Gallatin, Yellowstone	2B
Cheatgrass	Big Horn, Chouteau, Fergus, Gallatin, Glacier	3
Hoary Alyssum	Gallatin (2), Silver Bow	2A
Knapweed, Diffuse	Gallatin	2B
Knapweed, Spotted	Beaverhead, Silverbow	2B
Oxeye Daisy	Gallatin	2B
Perennial Pepperweed	***Ravalli***	1B
Purple loosestrife	***Gallatin***	1B
Rush Skeletonweed	***Beaverhead , Ravalli***	1B
Sulfur Cinquefoil	Flathead , Jefferson	2B
Tall Buttercup	Gallatin	2A
Toadflax, Dalmatian	Beaverhead, ***Wibaux***, Yellowstone	2B
Toadflax, Yellow	Silver Bow	2B

Submissions to assess potential toxicity to human or animal health

Sixteen plants were submitted to assess whether toxic to people, 10 of which were. The most notable was a plant with carrot like foliage and a white taproot which the client hoped was an edible wild carrot. The plant was an immature poison hemlock of which young plants and roots are most poisonous and vomiting and seizures occur within minutes of eating. This highlights the important impact of plant identification on human health. Seven samples were submitted to determine if toxic to livestock, three of which were. One was not toxic to livestock, but through discussions with the agent on the animal's symptoms and using Schutter Lab's reference books, the more likely source of illness was identified and this forage source was removed from a flock of sheep.

Submissions to assess herbicide injury

In addition to plant identification submissions, 64 samples were examined to assess potential herbicide injury, four more than 2013. Of these samples, 28 were crops (almost all small grains), 18 were landscape plants, and 18 were vegetables.

Schutter lab has been tracking vegetables samples damaged due to compost or soil contaminated with plant growth regulator (PGR) herbicides (e.g. picloram, animopyralid, clopyralid, etc.) for the last four years. When such samples come in, direct calls to the client and detailed reports are made to explain how this occurred, and how to prevent it in the future. These efforts seem to be having an impact as numbers have continued to drop (Table 2), with less than ½ as many samples in 2014 compared to 2011. In 2014, samples came from 4 counties: Hill, Ravalli, Gallatin and Yellowstone, compared to 12 different counties in 2013.

Table 2. Samples with injuries consistent with PGR exposure

2011	25
2012	22
2013	18
2014	12

However, we should be cautious about assuming the numbers in Table 2 are proof that incidences of PGR contaminated compost or manure have declined. It may be that our educational efforts have better informed agents, and that agents are diagnosing the samples on their own, rather than submitting them to Schutter Lab. In 2015, we will submit a letter to all agents asking them to keep track of and report samples suspected of PGR injury and submit these reports to us at the end of the growing season.

Activities to promote plant identification and noxious weed awareness

Nine workshops were presented across Montana in 2014 reaching more than 342 people. Topics included aquatic plant identification, native and exotic thistle identification, distinguishing native plants from state-listed noxious weed look-a-likes, weed seedling identification and grass identification.

Through survey responses, clients expressed interest in educational materials to help them identify grasses. This was particularly apropos following the discovery of medusahead (*Taeniatherum caput-medusae*), an invasive annual grass in Montana in 2013. Two publications were created in 2014 to address this need. "Montana Grasses" is an app for smartphones. Designed for beginners and experts alike, the app will work on iOS and Android devices. The app provides images, species descriptions, range maps and other information. Users can browse the species list or search for specific plants by common or scientific name. The app provides 13 sets of characteristics to help define a search, including overall appearance, seed head, blade width, habitat, elevation and origin (native or introduced). "Grass Identification Basics" (MT201402AG) covers basic grass anatomy, including terms commonly used for grass identification, and guides the user through seven questions to ask about the species to be identified. It will not identify specific grasses but is intended to be used with a favorite field guide, such as the "Montana Grasses" app, or a dichotomous key. It can be accessed on-line at http://store.msuextension.org/.

The diagnostician contributes to the Monthly *Weed* Post, a 2-page bulletin featuring a noxious weed, interesting research or timely issue related to weed management (http://www.msuextension.org/invasiveplantsMangold/extensionsub.html). The plant identification diagnostician also compiles and assists with editing the spring and fall editions of the Montana Integrated Pest Management Bulletin (http://www.pesticides.montana.edu/news/bulletins/), which provides critical pest management and pesticide education articles for Montana homeowners, pesticide applicators, farmers and ranchers. These articles are designed to deliver timely updates from an unbiased perspective that are specific to Montana.

Goals for 2015 are to continue to offer accurate, rapid reports on plant identification and weed management; provide education on weed and native plant identification and promote IPM practices to

manage weeds; finish a thistle identification guide; and revise and print a second edition of the Weed Seedling Identification Guide for Montana and the Northern Great Plains (EB0215).

2014 Insect Identification Summary

Diagnostic Staff:
Laurie Kerzicnik, Insect Identification Diagnostician

Extension Specialists:
Dr. Kevin Wanner, Agricultural Extension Entomologist, MSU

Cooperators/Identification Assistants:
Toby Day, Horticulture Specialist and Montana Master Gardener Coordinator
Cam Lay and Ian Foley, Montana Department of Agriculture
Dr. Bill Grey, Foundation Seed, MSU
Dr. Nina Zidack, Potatoes, MSU
Dr. Michael Ivie, Systematic Entomologist, MSU
Dr. Justin Runyon, Entomologist, US Forest Service
Dr. Casey Delphia, Research Associate/Entomologist, MSU
Ruth O'Neill, Research Associate/Entomologist, MSU

2014 Impacts-Insect Diagnostic Lab

- Insect larvae were identified from a pond surrounding cattle and confirmed that they were not livestock pests that required any treatment.
- Two samples were identified as a bat bug and a swallow bug, respectively, which saved hundreds of dollars of unnecessary bed bug treatment in the home.
- A bostrichid beetle, *Stephanopachys* sp., was diagnosed (with the help of Dr. Michael Ivie, MSU) from some lumber from a builder in Laurel, MT. The positive identification of this wood boring beetle was necessary for the builder to receive compensation for treatment from his lumber provider.
- Carpenter ants were confirmed for four cases. One of these cases came in from a homeowner with carpenter ants located outside his house, and the identification, management, and prevention recommendations saved the surrounding homeowners from future home-invading carpenter ants and damage.
- Insects were identified for a classic guitar collection, and the owner was needing positive identification of potential wood borers for his insurance claim.
- A heavy infestation of a gall wasp, *Callirhytis flavipes*, and woodpecker feeding and damage was confirmed in several bur oaks across the state. Management recommendations saved hundreds of bur oaks from further damage and dieback.
- With the help of Jim Labonte (Oregon Dept. of Agriculture), a bark beetle, *Ips grandicollis*, was identified for a nursery in Billings to confirm that the beetle infestation was not from a supplier in Idaho.
- Bamboo chopsticks were submitted from a Chinese restaurant in Great Falls that had wood-boring insects. As these chopsticks were sold to customers, the identification prevented the restaurant from selling further chopsticks from this batch and avoiding potential liability from holes and wood-boring shavings in the chopsticks.
- I increased awareness to the Schutter Diagnostic Lab through outreach and media (Montana Ag Live appearances, TV and phone interviews) efforts. Insect and spider sample submissions more than doubled from 2013.
- I increased awareness and decreased fear about the brown recluse spider through an MSU press release, two TV interviews, two newspaper interviews, and several other localized news releases. I

received approximately 92 additional emails, phone calls and spider ids from the Three Forks case. ***(Jodie Delay is helping calculate further impacts for this situation)***

Other major accomplishments

- Starting the end of 2013, I have established strong working connections between several state, local, and federal organizations, including Montana Department of Natural Resources and Conservation, APHIS, US Forest Service, MSU Extension (throughout the state), MUCFA (Montana Urban and Community Forestry Association), Gallatin City-County Health Department, and City Foresters. Through outreach efforts and media appearances, I have brought awareness to the services of the Schutter Diagnostic Lab and have streamlined efforts to achieve high quality identifications based on needs addressed throughout the state. Not only are these organizations aware of the services offered, they have expressed their satisfaction with the prompt and efficient service provided.
- An unfortunate death of a 10-yr old boy occurred in Three Forks, MT on 13 October 2014. The boy died from sepsis, but the original wound was said to be caused from a brown recluse spider bite. However, there was no spider or spider bite identified with this diagnosis. As the brown recluse is not native to Montana or any other western state, this prompted an immediate educational and outreach effort to reduce fears about the brown recluse spider and spider bites in general. These outreach efforts involved an MSU press release, two TV interviews, and two newspaper interviews. One of the newspaper interviews resulted in a cover page article on the *Bozeman Daily Chronicle*. This effort added an additional 92 emails, phone calls, and spider identifications. This also brought further awareness to the Schutter Lab and MSU Extension as a resource for accurate and timely information.

Sample Summary

In 2014, a total of 717 arthropod samples were identified (Table 1). Of the identifications conducted, 89% were insects/other arthropods, and 11% were spiders. Five percent of the insect samples submitted were diagnosed as abiotic, which were typically the result of winter injury, environmental stress, or nutrient imbalances.

Table 2. Numbers of insect, spider, and other arthropod samples identified in 2014.

	# Identifications
Insects/Other Arthropods	635
Spiders	78
Total	717

Turf and ornamentals made up 93% of insect samples (Fig. 1), which included the categories household/domestic, trees, vegetables, yard and garden, shrubs/bushes, and other (compost, flowers, firewood, greenhouse, turf, houseplants, lumber, and pasture). Field crops (primarily wheat and alfalfa) accounted for seven percent of insect samples. The highest number of insect and spider samples submitted were in the "household/domestic" category (30%). This was closely followed by insects on trees (27%), which included both deciduous and evergreen trees.

For hosts of samples submitted, the greatest number of tree samples came from deciduous trees, including ash, aspen, birch, cottonwood, poplar, oak, elm, and willow. The evergreen samples were dominated by pine, spruce, and fir. The bush/shrub hosts were juniper, cotoneaster, currant, lilac, rose, and viburnum. The vegetable hosts consisted of pepper, tomato, potato, cucumber, beans, peas, beets, rhubarb, squash, basil, and spinach. The fruit hosts were dominated by apple but also included cherry, grape, pear, plum, raspberry, and strawberry. In addition to wheat and alfalfa, the field crops included beans, barley, wheat, corn, lentil, and canola.

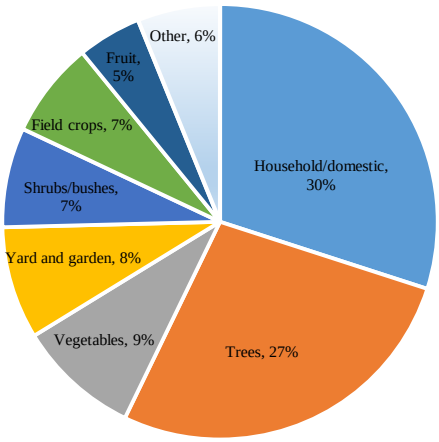


Figure 1. Distribution of insect/other arthropod and spider arthropod samples by host category in 2014.

For the insect/spider/other arthropod samples submitted, six different classes were represented (Appendix A). Within these classes 16 orders, 97 families, and 191 separate species were identified. Some specimens could only be identified to the family level due to quality of the specimen, the difficulty of the identification, or the growth stage of the insect/spider. Some of the samples submitted were dried or very poorly submitted, required expertise from specialists to identify the specimens to species, or only pictures were submitted, which made species-level identification unreliable.

The most common insects/other arthropods submitted were beetles, followed by aphids/scales, and mites (Fig. 2). Overall, aphids, spider mites, eriophyid mites, and thrips were the insects/arthropods most commonly identified on samples submitted and were the most significant biotic issues. Weevils were also commonly submitted as pests of concern in gardens and crops. In the household, dermestid beetles were frequently submitted as an undesired nuisance pest.

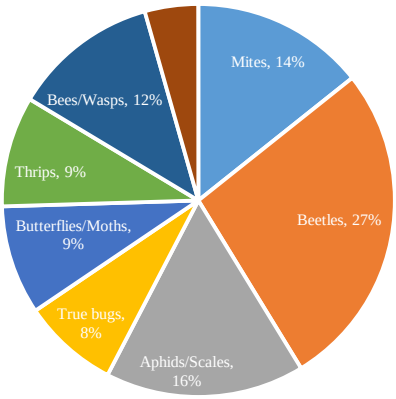


Figure 2. Distribution of insect/other arthropod samples submitted in 2014.

Several galls were submitted with concern for plant damage from gall-forming insects and mites. Some of the most common insects submitted were the poplar vagabond aphid, Cooley spruce gall adelgid, the willow redgall sawfly, and the poplar twiggall fly.

A series of home-invading insects were identified. An invasive root weevil, *Cathormiocerus spinosus*, was very common and submitted by the dozens from households. In addition to this root weevil, three others were common, including the strawberry root weevil, blackvine root weevil, and *Romauldis bifoveolatus*. The dirt-colored seed bug and the conifer seed bugs were common home invaders. The fall of 2014 was a particularly dense year for cluster flies, with several calls and identifications about the fly across the state.

Several moths were identified in the caterpillar stage with concern for feeding damage on field and garden crops. Many butterflies were submitted in both the adult and caterpillar stage mainly for curiosity.

We received bur oak samples in the Schutter Lab that sustained serious woodpecker injury. The tops of the trees were stripped of their bark, and many wasp larvae were situated right underneath the bark. The wasp species is *Callirhytis flavipes*, which has an overwintering stage in chambers under the bark. Although the wasp isn't a new species, the severe woodpecker damage from feeding on the wasps is unprecedented. The wasps produce a small, inconspicuous swelling on the bark. The overwintering wasps appear to emerge shortly after bud break and then lay eggs in/near the leaf midribs, producing an irregular swelling of the leaf in summer. This damage has also been seen in Fort Collins, CO, Madison, WI, and Fargo, ND.

For the spider samples submitted, many individuals were concerned about whether spiders were poisonous or dangerous, fearing they were either the hobo spider or a brown recluse spider. Eighty-three percent of these samples came from household/domestic dwellings while the other 17% were submitted from the yard and garden. Of the spider samples submitted, the majority of the spiders submitted were from the funnel web family (Agelendidae) with concern of whether it was the hobo spider, *Eratigena agrestis* (Fig. 3). Twenty percent of the spiders submitted were crab spiders (Thomisidae and Philodromidae) while 13% were comb-footed spiders (Theridiidae). Orb-weavers (Araneidae), ground spiders (Gnaphosidae), wolf spiders (Lycosidae), and ant mimics (Corinnidae) were commonly submitted. "The "other" spiders were represented by the families Linyphiidae, Anyphaenidae, and Dictynidae, which are harmless and are not of medical importance to humans. Overall, most of the spiders identified were hobo spiders, *Eratigena agrestis* (21%). Although several additional spiders were submitted as suspected brown recluse spiders, *Loxosceles reclusa*, no brown recluse spiders were identified.

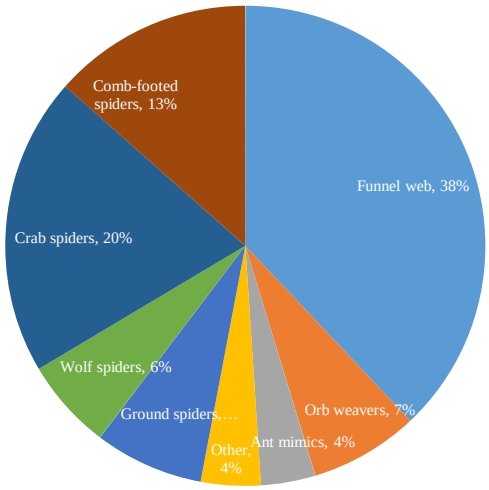


Figure 3. Distribution of spider families from spider samples received in the Schutter Lab in 2014.

County Extension Agents or Extension Specialists submitted 60% of samples and 40% were submitted directly to the diagnostic lab by commercial operators or individuals. Noncommercial clients (primarily homeowners) outnumbered commercial clients (producers, consultants, landscape professionals) 85% to 15%.

Insect samples were submitted by 45 Montana counties (Table 2). Gallatin County submitted over four times as many samples as any other county (226). Some of other larger submissions included the counties of Silver Bow, Ravalli, Carbon, Hill, Missoula, Cascade, Choteau, Park, Flathead, and Lake.

Table 3. Insect, spider, and other arthropod identifications by county in 2014.

County	# samples	County	# samples
Beaverhead	3	*Missoula*	23
Big Horn	5	*Musselshell*	17
Blaine	1	*Park*	20
Broadwater	3	*Pondera*	15
Carbon	28	*Powell*	5
Cascade	22	*Ravalli*	33
Chouteau	21	*Richland*	2
Coconino	1	*Roosevelt*	4
Custer	5	*Rosebud*	3
Daniels	4	*Sanders*	8
Deer Lodge	6	*Sheridan*	2
Fergus	6	*Silver Bow*	51
Flathead	18	*Stillwater*	10
Gallatin	226	*Sweet Grass*	10
Garfield	1	*Teton*	11
Glacier	11	*Toole*	9
Hill	25	*Valley*	5
Jefferson	12	*Wibaux*	4
Judith Basin	8	*Yellowstone*	14
Lake	17		
Lewis and Clark	9		
Liberty	12		
Lincoln	12		
Madison	9		
Mccone	1		
Meagher	5		

Outreach/Education/Media Efforts to Increase Urban Entomology and IPM Knowledge

Talks

I was involved in several talks for 2014. I was an invited speaker for seven talks throughout the state, which included the following:

- *Spiders and garden spiders in Montana*. 3 March 2014. Gallatin Valley Gardener's Club. Bozeman, MT.
- *Insects and diseases of woody ornamentals*. 15 March 2014. Wyoming Farmer's Market and Master Gardener Annual Conference. Sheridan, WY.

- *Spiders as biological control agents in agriculture*. 21 March 2014. Agricultural Research Service's Northern Plains Agricultural Research Laboratory 2014 Winter BrownBagger Series. Sidney, MT.
- *Spiders as beneficial predators*. 21 March 2014. Sidney High School, Advanced Biology Class. Sidney, MT.
- *Spiders and insects*. 21 March 2014. Rau Elementary School. 4-6 graders. Sidney, MT.
- *Insect and spider diversity*. 28 May 2014. Home school group. Bozeman, MT.
- *Garden insects and spiders in the Gallatin Valley*. 16 June 2014. West Yellowstone Gardener's Club. Yellowstone, MT.

I also instructed on insects for several Master Gardener insect sections throughout the state for both Level 1 and Level 2 trainings, which included the following:

- *Identification of insects*. 18 February 2014. Polson Master Gardeners, Level 1. Polson, MT.
- *Identification of insects*. 21 April 2014. Gallatin Master Gardeners, Level 1. Museum of the Rockies, Bozeman, MT.
- *Identification of insects*. 6 November 2014. Lewis and Clark County Master Gardeners, Level 2. Helena, MT.

Other talks:

- *Garden insects and management*. Montana State University Extension Annual Conference. 23 October 2014. Bozeman, MT.

Workshops

I was part of two workshops this year for urban insects. The first was a greenhouse pest workshop that was organized by Gallatin County's Extension agent, Emily Lockard, which was requested by greenhouse operators and managers to learn more about pest management and proper greenhouse pesticide application techniques.

The second workshop/set of workshops was on the Emerald Ash borer. Although we don't have the Emerald ash borer (EAB) in Montana yet, we headed out to Sidney, Miles City, Glasgow, and Lewistown to do workshops and educational outreach to prepare for its arrival. Among the other workshop participants were Ian Foley (MT Dept. of Ag), Shayne Galford (APHIS), and Patrick Plantenberg (MUCFA). Extension agents, city foresters, and community members attended the workshops. The workshop covered topics such as "What's at stake for Montana ash?", EAB biology and other ash pests, a tree planting demonstration, destructive branch sampling, Montana's EAB response plan, regulatory actions, and treatment. Montana, compared to other states, has a significant percentage of ash in many of its communities. Great Falls, Bozeman, and Helena have over 50% ash in their urban communities. Early detection is difficult with this pest, and it is often present for several years before it is discovered. Montana communities have to be proactive in preparing for the arrival of this pest, including diversifying tree plantings, keeping ash trees healthy, and developing a response plan for their community prior to the arrival of EAB. Tree inventories are also a crucial component in assessing future management costs.

The specific workshops and dates were the following:

- *Insect pest management in greenhouses*. 6 March 2014. Greenhouse Pest Workshop. Bozeman, MT.
- *Emerald ash borer biology and related insects*. EAB Roadshow. 17 September 2014. Sidney, MT.
- *Emerald ash borer biology and related insects*. EAB Roadshow. 18 September 2014. Miles City, MT.
- *Emerald ash borer biology and related insects*. EAB Roadshow. 24 September 2014. Glasgow, MT.
- *Emerald ash borer biology and related insects*. EAB Roadshow. 25 September 2014. Lewistown, MT.

Media

I was a panelist on Montana Ag Live five times in 2014 (April 27, May 11, Sep 14, Oct 5, Oct 19), answering citizen-based questions on urban insects. I also had several interviews regarding the brown recluse spider case, which included the following:

- Interview, Channel KBZK, Channel 7, Bozeman. 14 October 2014. Brown recluse spider biology, ecology, and distribution.
- Interview, Channel KTVM, Bozeman. 14 October 2014. Brown recluse spider biology, ecology, and distribution.
- Phone Interview, *Great Falls Tribune*. 14 October 2014. Brown recluse spider biology, ecology and distribution.
- Phone Interview and article, *Bozeman Daily Chronicle*. 14 October 2014. Brown recluse spider biology, ecology, and distribution.

Grants and Awards

M. Burrows, T. Day, ***L. Kerzicnik***, J. Mangold, F. Menalled, C. Tharp, K. Wanner. 2014-2017. Montana State University's Extension Implementation Plan for Integrated Pest Management. USDA-CPPMC. $420,000

L. Kerzicnik, T.R. Day. 2014-2017. Enhancement of urban IPM education. Specialty Crop Block Grant Program, Montana Department of Agriculture. $89,700 (Not funded)

Training

Elateridae (Coleoptera: Elateridae) identification. 11-13 March 2014. Montana State University. Bozeman, MT.

Forest Insect and Disease Identification and Management Training. 24-26 June 2014. Kalispell, MT.

Identification of weevils (Coleoptera: Curculionidae). 5-13 August 2014. American Museum of Natural History. Portal, AZ.

Publications

With the assistance of Toby Day, I published a MontGuide for education and outreach concerning the Japanese beetle. It is an invasive pest that is established in a small area outside of Billings, MT. As this beetle is established in many states, the fear of its establishment throughout Montana is eminent. Also, several infested nursery stock shipments were received from a nursery in Minnesota, which resulted in many trapped Japanese beetles throughout the state. They are still not established in the areas trapped, but the concern is evident.

L. Kerzicnik, T Day. 2014. Japanese Beetle. Montguide MT201404AG. Montana State University Extension.

Other Activities

- National Plant Diagnostic Network Program Planning Committee, March 2016 meeting
- Coordinator, WERA-1017 Meeting, 7-8 July 2014. Bozeman, MT.
- MSU Extension, "Ask an Expert"

Special Thanks

I am dependent on the expertise, assistance, and management recommendations of many others to complete my work and diagnoses. Dr. Mike Ivie has identified many significant beetles to species and has been essential with training, guidance, and many recommendations. Dr. Justin Runyon has identified

several difficult flies to species. Dr. Casey Delphia has been instrumental in identifying many bees and recommendations in the Apidae family. Ruth O'Neill identified and verified several agricultural insects (especially when I was on medical leave). Toby Day has also provided expertise for many identifications and recommendations and has filled in/corrected my errors on Montana Ag Live! I couldn't do my identifications nor could I survive without the people mentioned above. Many thanks for your help and support.

2014 Plant Disease Summary

Diagnostic Staff:
Eva Grimme, Plant Disease Diagnostician
Linnea Skoglund, Plant Disease Diagnostician

Extension Specialists:
Dr. Mary Burrows, Plant Pathologist, field crops except row crops
Dr. Barry Jacobsen, Plant Pathologist, row crops (sugar beets, potatoes, dry beans), mycotoxins
Toby Day, Extension Horticulture Specialist

Cooperators:
Dr. Cathy Cripps, Mushroom Identifications
Dr. Bill Grey, Foundation seed
Dr. Mareike Johnston, Plant Pathologist

Total Disease Identification and Sample Source

In 2014, the Schutter Diagnostic Lab made 896 disease identifications, a similar number as in 2013 (892). Samples were mainly submitted from 48 counties in Montana (99.7%, Table 1). Four samples where submitted from out of state: one each from Nebraska and Colorado, two samples from Wyoming. The highest submissions were from Gallatin County and Yellowstone County. Sample submissions were greatest in June and July with an average of 220 samples per month. In addition, a total of 58 mushroom identifications were made by Dr. Cathy Cripps.

Table 1. Disease identifications by county in 2014.

Gallatin	205	Valley	14	Richland	6
Yellowstone	85	Judith Basin	13	Madison	5
Chouteau	64	Missoula	13	Meagher	5
Hill	53	Liberty	12	Custer	4
Ravalli	39	Carbon	11	Fallon	4
Pondera	34	Glacier	11	Prairie	4
Cascade	32	Lewis and Clark	10	Blaine	3
Park	30	Sheridan	9	Golden Valley	3
Flathead	25	Beaverhead	8	Roosevelt	3
Big Horn	21	Broadwater	8	Sanders	3
Silver Bow	20	Musselshell	8	Petroleum	2
Teton	20	Phillips	8	Powder River	2
Lake	18	Stillwater	8	Powell	2
Fergus	14	Sweet Grass	8	Wibaux	2
McCone	14	Daniels	6	Dawson	2
Toole	14	Jefferson	6	Garfield	1

Samples were mainly submitted by extension agents (47%; Figure 1) and nonextension commercial sources (31%). Commercial samples, extension and nonextension combined, accounted for 43% of the

samples. The highest number of samples came from homeowners (32%), grower/farmers (14%), crop consultans (11%), and arborists (5%). Other submitters include researchers, agents/educators, and companies.

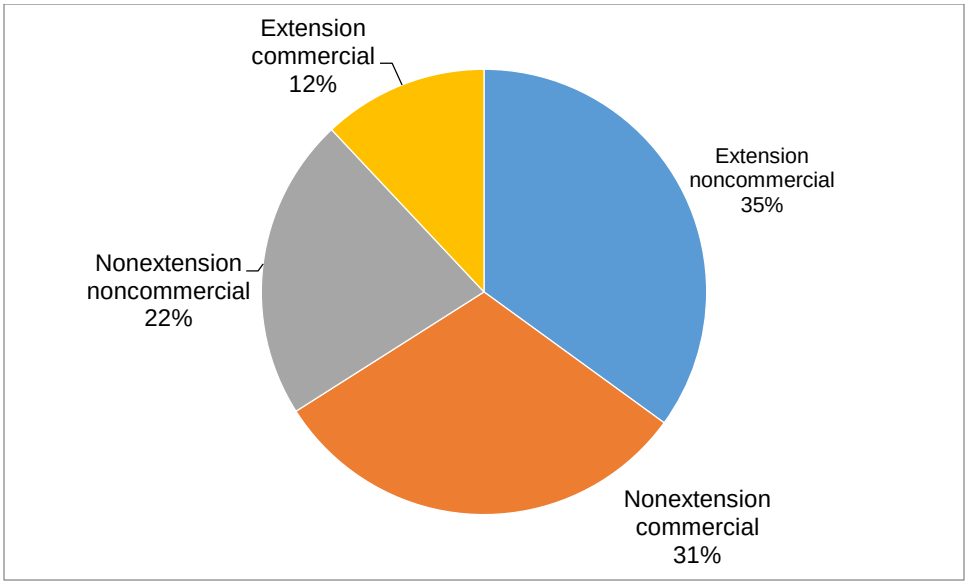


Figure 1. Sample submission by source.

Turf samples accounted for 4% and ornamental samples, including deciduous and evergreen woody ornamentals, accounted for 41% of the total samples submitted to the Schutter Diagnostic Lab (Figure 2). This is a slight increase in sample numbers compared to 2013. Small grains, primarily wheat, accounted for 24% of disease samples, similar to the sample number submitted in previous years.

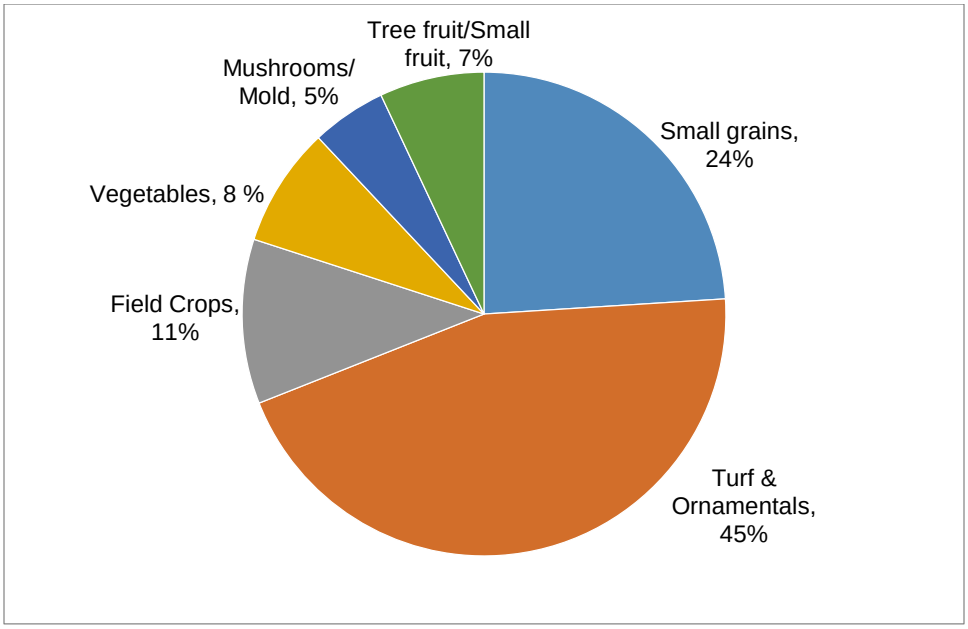


Figure 2. Distribution of disease samples by host category

Additional Activities

We continued to test lentil, pea, and chickpea seed for Ascochyta blight. We processed 302 samples of lentil, pea, and chickpea seed for Ascochyta blight fungi in 2014. We processed 182 samples from January to May (2013 harvest) and 120 samples from August to December (2014 harvest). Growers depend on the results in order to make decisions on seed treatments and preventative foliar fungicide applications if necessary to minimize Ascochyta blight.

The Schutter Diagnostic Laboratory collected isolates from routine Ascochyta seed tests for fungicide resistance testing. Fungicide resistance will be a key issue for growers and may impact multiple fungal diseases. In 2013-2014, 223 seed samples of pea, 54 samples of lentil, and 35 samples of chickpea were received by the SDL for testing. Of these, 4 chickpea Ascochyta isolates (11%) were resistant to pyraclostrobin (Headline); one was resistant to fluxapyroxad (Xemium); and one was resistant to boscalid (Endura). One isolate from chickpea was resistant to all three fungicides. In addition, one isolate from pea was resistant to Headline. These results are proportional to the intensity of fungicide use on chickpea vs. pea crops. We are also screening for resistance to the fungicide prothiconazole (Proline); methods are in the final stages of vetting. In 2014-15 we have received 120 samples so far (82 pea, 23 lentil, 15 chickpea) and are currently collecting fungal isolates for fungicide resistance testing.

We continued to assist the Montana Department of Agriculture CAPS surveys by processing and analyzing 125 samples with ELISA for Plum Pox Virus monitoring. Plum Pox Virus (PPV) is a federally regulated virus of fruit trees.

Dr. Skoglund coordinated the webinar series of the Greater Plains Diagnostic Network (GPDN) on topics including challenges of detecting invasive species, Wheat Blast, Goss's wilt of corn, Brown Marmorated Stink Bug, Rose Rosette Virus, Diaporthe species infecting sunflowers. The series consisted of eight presentations during January to March and was attended by 177 individuals. The complete list and recordings of the seminars can be found at the GDPN website www.gdpn.org.

We set up a new Urban Alert system to address common and acute plant diseases, insects and invasive weeds in the urban setting. To date we have 76 subscribers. Dr. Laurie Kerzicnik has recently posted an alert on the brown recluse spider.

Outreach

"Schutter Diagnostic Lab services", Montana Grain Growers Association, Tour.
(September 19, 2014).

Presentation: "Plant Diseases and Abiotic Disorders". Montana State University Extension Annual Conference. October 23, 2014.

"Ag appreciation tours of Schutter Diagnostic-Lab", College of Agriculture, MSU, tour, Gallatin County, External to Montana State University, 25 participants. (November 7, 2014).

"MSU Schutter Diagnostic Lab Services", Northern Pulse Growers Association, Continuing Education, Cascade County, Both, 275 participants. (December 5, 2014).

Certifications

Dr. Eva Grimme completed the Plum Pox Virus ELISA proficiency test and continued as a USDA/APHIS PPQ certified diagnostician to screen for PPV.

Publication

Lonergan, E., J. Pasche, L. Skoglund, M. Burrows. 2014. Sensitivity of Ascochyta species infecting pea, lentil, and chickpea to boscalid, fluxapyroxad, and prothioconazole. Plant Disease (accepted).

Goals for 2015 are to continue to educate extension agents and clients on plant diseases, to raise awareness of IPM practices to control plant diseases, accurate and timely identification of plant diseases and abiotic factors influencing plant health; to continue with the National Plant Diagnostic Network STAR-D accreditation process.

Impacts - Plant Disease Diagnostic Lab

Preliminary estimate of the economic impact of the SDL in 2014 is $1.7 million based on 170 responses to a survey. This is only direct economic impacts on samples.

Dr. Barry Jacobsen identified mycotoxin-producing fungi on alfalfa hay, corn and wheat seeds. These mycotoxins could have caused severe detrimental effects on livestock if used as feed.

In 2013 we had 3 samples of wheat streak mosaic virus submitted to the lab; in 2014, 46 samples. This is reflective of a large problem in the state with this disease which has been facilitated by widespread hail in fall 2013. Concern is high in 2014 and other viruses may be involved in a disease complex. Research has been active to identify a possible acaricide to control the vector Wheat curl mite via funding from the USDA.

Fusarium head blight (scab) was identified in dryland winter wheat along the Hi-Line for the first time in 2014. This has been a problem in irrigated spring wheat and barley throughout the state but this is the first case of dryland disease issues. One widely planted winter wheat variety (Judee) seems to be particularly susceptible and weather conditions were very conducive. Grain was docked for quality. Educational efforts in 2014-2015 will highlight the importance of management of this important disease.

Due to a presentation in Chouteau County, seven growers said they would re-evaluate the use of fungicide on dryland wheat. Economic impact was $42,000 due to an estimation of growers not using fungicides (2,000A/grower, $3/treatment - not sprayed @ tillering when no economic benefit observable = $6,000 x 7 growers).

Dr. Cathy Cripps identified 58 mushrooms with 65% categorized as “not edible” and 19% as “poisonous”.

Appendix A. Feedback from Schutter Diagnostic Lab Clients

- "The rapid and accurate responses from the Schutter Lab give credence and credibility to Montana State University Extension. They make us look great! Thank you so much."
- "A missed diagnosis on our part can cost us thousands of dollars depending on the situation. If we get results that either confirm our suspicions or point us in a different direction can keep us from making a very costly mistake which could potentially be devastating to our business."
- "Excellent response time, this is a great service to producers!"
- "Excellent information, Eva – thank you!"
- "I have recommended your services to others and will nag them next Spring. The need for your services is here."
- "I didn't eat the baby greens which were possibly contaminated with the tiny mushrooms."
- "Greetings - and thank you so much, Eva, for the report on my lawn sample. I'm glad to know the problem is not disease or insect related."
- "They got to the root of our issue. From that point we were able to figure out how to remedy the issue."
- "The identification was tentatively made then also sent to other labs for further diagnosis. I would not have known who to contact for further information, so I am very appreciative to the Schutter Lab for taking the lead for making further contacts."
- "The lab helps me solve many problems on grower fields. The lab is my source for verification of diseases and plant concerns."
- "Thank you for sending that back so quickly! I really appreciate it."
- Wow! Laurie what good service. Thanks for the quick info on our trees. You folks all do good work at MSU." *Pat, in reference to treatment for an aphid issue on his ash trees*
- "Thank you so much, Laurie, for all your helpful information." *Brenda, homeowner, in reference to codling moth treatment in her apple trees*
- "Really appreciate your prompt response on this issue!" *Aaron, homeowner, in reference to wasp issues on his bur oak tree*
- "I looked up some pictures and that is exactly what I had plus I have seen this before –thanks another mystery solved!" *Sandy, Missoula County Extension Plant Clinic*
- "Hi Laurie, Thank you for your prompt response! I am glad to hear you didn't find anything in the sample." *Debbie, in response to a bed bug question in her camper*
- "Thanks for your help, Laurie. You've been great. I will be on the lookout with our spruce trees and take your suggestions. I haven't seen any bugs emerging in the house for about a week so hopefully we are done with that part." *Mary, homeowner, in response to the zebra beetle emerging from her rustic fir table*
- "You guys are great! Thank you for the quick reply!" *Mark, pest control operator*
- "Hello, Thank you for your prompt and most informative response to my request about my ant problem. What I am seeing was in sync with much that you explained about their behavior. I appreciate your time and expertise." *Carol, homeowner, in response to a question about carpenter ants in the home*
- "You are awesome! You work fast, and I truly do appreciate it. Thank you so much for identifying the little critter that emerged from my pergola. It gives me great peace of mind to know that I don't have a major infestation problem and that my pergola is not in danger of being slowly eaten away. Thanks so much." *Vonda, homeowner, in response to an wood-boring beetle identified from her pergola*

- “Thanks, Laurie. I really appreciate your help. You offer a tremendous service to our industry and the traveling public.” *David, hotel owner, in response to a bed bug question and identification*
- “Laurie, your diagnosis and report are extremely helpful going forward. I can’t tell you how much I appreciate your work.” *Annemarie, homeowner, in response to a severe carpet beetle infestation*
- “Thank you so much for diagnosing my apple tree and aspens. I feel more hopeful about my aspens.” *Holly, in response to insect identifications for her aspen and apple trees*
- “Laurie, received your attachment. Thank you! I never would have guessed knapweed root weevil. Great. I had no idea the root weevil was this large. I will treat them with great respect. Thanks again!” *Jerry, in response to a root weevil identification*
- “Thanks for being a strong professional advocate. This is as tough an issue as you’ll ever have I’m sure! *Jodie, Communications Specialist, MSU, in response to outreach efforts concerning the brown recluse spider*
- “Thanks, Laurie! I think you're so knowledgeable and helpful!! I forwarded your reply to my daughter's friend, Kammi, and she was pleased with your answer.” *Amy, homeowner, in response to a spider identification*
- “Great info! Martin was in Bozeman removing the floor from Heritage Christian after that man set fire to it. The wound is improving but I will encourage him to seek more attention. Thank you Lauren! You do awesome work for our state!” *Lynn, homeowner, in response to a necrotic wound question*
- “Hey all, I just wanted to pass on to you a conversation I had with an Extension agent in Montana and how pleased she was with the service she received (and is receiving) from the Schutter Diagnostic Lab. She mention by name: Eva, Laurie, and Hilary. She was also very happy that she now has positive reports with recommendations that she is happy to send to her clients. I know that this has been a very busy season, and Eva and Laurie are new (which can make the situation daunting), but the quality coming from the lab is great! In my opinion the agents are our biggest clients and supporters and they are happy with the service they are receiving. This was very refreshing for me to hear. BTW, while I was typing this, I talked to another agent on the phone who said ‘the Schutter Diagnostic Lab has been a godsend.’ Keep up the great work!” *Toby Day, Horticulture Specialist, relaying some comments he received about the Schutter Diagnostic Lab services*

Appendix B. Insects, other arthropods, and spiders identified in 2014.

Class	Order	Family	Species
Gastropoda			*
Arachnida	**Araneae**	Agelendidae	*Agelenopsis* sp.
			Eratigena agrestis (Walckenaer)
			Tegenaria domestica (Clerck)
		Anyphaenidae	*Anyphaena sp.*
		Araneidae	*Araneus gemmoides* Chamberlin & Ivie
			Argiope aurantia Lucas
			Argiope trifasciata (Forskal)
		Corinnidae	*Castianeira* sp.
		Dictynidae	*Emblyna* sp.
		Gnaphosidae	*Haplodrassus* sp.
			Herpyllus sp.
		Linyphiidae	*
		Lycosidae	*Pardosa* sp.
			Schizocosa sp.
			Rabidosa sp.
		Philodromidae	*Philodromus* sp.
		Theridiidae	*Steatoda borealis* Sundevall
			Steatoda sp.
			Theridion sp.
		Thomisidae	*Misumena vatia* (Clerck)
			Misumenoides formosipes (Walckenaer)
			Xysticus sp.
			Xysticus montanensis Keyserling
	Opiliones	Phalangiidae	*
	Solifugae	Eremobatidae	*Eremobates pallipes* (Say)
(subclass Acari)	**Mesostigmata**	Dermanyssidae	*
(subclass Acari)	**Parasitiformes**	Ixodidae	*Dermacentor andersoni* Stiles
Chilopoda			*Scolopendra polymorpha* Wood
Crustacea	**Isopoda**		*
Diplopoda			*Oxidus gracilis* (Koch)
Insecta	**Coleoptera**	Anobiidae	*Ptinus fur* (L.)
		Bostrichidae	*Lyctus africanus* (F.)
			Lyctus sp.
			Stephanopachys sp.
		Buprestidae	*Agrilus anxius* Gory
			Anthaxia sp.
			Buprestis sp.
			Chalcophora angulicollis (LeConte)
			Chrysobothris femorata (Olivier)
		Byturidae	*Byturus unicolor* (Say)
		Carabidae	*Amara* sp.
			Harpalus sp.
			Pasimachus sp.
		Cerambycidae	*Monochamus clamator* (LeConte)
			Prionus californicus Motschulsky
			Saperda calcarata Say
			Semanotus terminatus Casey
			Stictoleptura canadensis (Olivier)
			Trichocnemis spiculatus LeConte
			Xylotrechus undulates (Say)
		Chrysomelidae	*Amblycerus robiniae* (F.)

Class	Order	Family	Species
			Epitrix cucumeris (Harris)
			Epitrix tuberis Gentner
			Pachybrachis sp.
			Zeugophora scutellaris Suffrian
		Coccinellidae	*Epilachna varivestis* Mulsant
		Curculionidae	*Anthonomus consors* (Dietz)
			Cyphocleonus achates Fahraeus
			Hylesinus sp.
			Hypera postica (Gyllenhal)
			Hypera sp.
			Lixus concavus Say
			Merhynchites bicolor (Fabricius)
			Otiorhynchus ovatus L.
			Otiorhynchus raucus Fabricius
			Otiorhynchus sulcatus (Fabricius)
			Otiorhynchus sp.
			Pissodes strobe (Peck)
			Pityophthorus sp.
			Rhinocyllus conicus Frölich
			Romualdius bifoveolatus (Beck)
			Sitona hispidulus (hispidula) (Fabricius)
			Sitona lineatus F.
			Sitona sp.
			Sphenophorus sp.
			Trachyphloeus sp.
		Dermestidae	*Attagenus* sp.
			Dermestes lardarius L.
			Dermestes sp.
			Trogoderma variabile Ballion
		Elateridae	*Selatosomus* sp.
		Erotylidae	*Dacne* sp.
		Lampyridae	*
		Megalopodidae	*Zeugophora scutellaris* Suffrian
		Meloidae	*Epicauta maculate* (Say)
			Epicauta pennsylvanica (De Geer)
		Melyridae	*
		Ptinidae	*Stegobium paniceum* (L.)
		Scarabaeidae	*Aphodius* sp.
			Phyllophaga sp.
		Staphylinidae	*
		Tenebrionidae	*Tenebrio* sp.
			Tribolium confusum Jacquelin du Val
			Tribolium madens (Charpentier)
			Typhaea stercorea (L.)
			Tribolium sp.
	Diptera	Agromyzidae	*Hexomyza schineri* (Giraud)
		Anthomyiidae	*Delia (Hylemya) platura* (Meigen)
			Pegomya hyoscyami (Panzer)
		Asilidae	*
		Bombyllidae	*Leptocera* sp.
		Calliphoridae	*Pollenia pediculate* (Macquart)
		Cecidomyiidae	*Dasineura gleditschae*
		Chironomidae	*
		Chloropidae	*
		Mycetophilidae	*

Class	Order	Family	Species
		Oestridae	*
		Ptychopteridae	*
		Scathophagidae	*
		Sciaridae	*
		Simuliidae	*
		Tephritidae	*Rhagoletis pomonella* (Walsh)
			Rhagoletis indifferens Curran
		Ulidiidae	*Ceroxys latiuscula* (Loew)
	Hemiptera	Cicadellidae	*Erythroneura vulnerata* Fitch
			Erythroneura ziczac Walsh
			Erythroneura sp.
		Cicadidae	*
		Cimicidae	*Cimex lectularius* L.
			Cimex pilosellus (Horváth)
			Oeciacus vicarius Horváth
		Clastopteridae	*Clastoptera juniperina* Ball
		Coreidae	*Leptoglossus occidentalis* (Heidemann)
		Lygaeidae	*Nysius* sp.
		Membracidae	*
		Miridae	*Tropidosteptes* sp.
			Lopidea sp.
		Pentatomidae	*
		Reduviidae	*
		Rhopalidae	*Boisea rubrolineata* (Barber)
			Boisea (Leptocoris) trivittata (Say)
		Rhyparochromidae	*Rhyparochromus vulgaris* (Schilling)
	Homoptera	Adelgidae	*Adelges cooleyi* (Gillette)
			Pineus sp.
		Aphididae	*Acyrthosiphon pisum* (Harris)
			Aphis craccivora Koch
			Brachycaudus helichrysi (Kaltenbach)
			Chaitophorus populifoliae (Fitch)
			Chaitophorus viminalis Monell
			Chaitophorus sp.
			Cinara juniper (De Geer)
			Cinara sp.
			Cryptomyzus ribis (L.)
			Diuraphis noxia (Mordvilko)
			Eriosoma lanigerum (Hausmann)
			Eriosoma sp.
			Mordvilkoja vagabunda (Walsh)
			Myzus cerasi (F.)
			Myzus persicae (Sulzer)
			Neoceruraphis viburnicola (Gillette)
			Pemphigus populitransversus Riley
			Prociphilus fraxinifolii (Riley)
			Pterocomma smithiae (Monell)
			Rhopalosiphum padi (L.)
			Tuberolachnus salignus (Gmelin)
		Coccidae	*Chionaspis pinifoliae* (Fitch)
			Physokermes hemicryphus (Dalman)
			Physokermes sp.
			Saissetia oleae (Olivier)
		Diaspididae	*Lepidosaphes ulmi* (L.)
		Pseudococcidae	*

Class	Order	Family	Species
		Psyllidae	*
	Hymenoptera	Apidae	*Apis mellifera* L.
			Bombus sp.
		Braconidae	*
		Cimbicidae	*
		Crabronidae	*Stizoides* sp.
		Cynipidae	*Callirhytis* sp.
			Disholcaspis quercusmamma (Walsh)
			Neuroterus floccosus Bass
			Diplolepis rosae (L.)
			Diplolepis sp.
		Formicidae	*Camponotus* sp.
			Formica sp.
			Tetramorium sp.
		Halictidae	*Halictus* sp.
		Ichneumonidae	*Megarhyssa* sp.
		Megachilidae	*
		Mutillidae	*
		Siricidae	*
		Sphecidae	*Pseneo* sp.
		Tenthredinidae	*Caliroa cerasi* L.
			Fenusa pusilla (Lepeletier)
			Nematus ribesii (Scopoli)
			Pontania promixa (Lepeletier)
			Pristiphora aquiligiae (Vollenhoven)
		Vespidae	*Dolichovespula arenaria* (F.)
	Isoptera		*
	Lepidoptera	Alucitidae	*Alucita montana* Barnes & Lindsey
		Arctiidae	*Hyphantria cunea* (Drury)
		Argyresthiidae	*Argyresthia cupressella* Walsingham
		Choreutidae	*Choreutis pariana* (Clerck)
		Eribidae	*Spilosoma virginica* F.
			Hypoprepia miniata (Kirby)
		Gelechiidae	*Sitotroga cerealella* (Olivier)
			Coleotechnites ponderosae Hodges & Stevens
		Gracillariidae	*Phyllocnistis populiella* Chambers
		Hesperiidae	*
		Noctuidae	*Agrotis ipsilon* (Hufnagel)
			Agrotis orthogonia (Hufnagel)
			Andropolia sp.
			Euxoa auxiliaris (Grote)
			Faronta diffusa Walker
			Trichoplusia ni (Hübner)
		Nymphalidae	*Nymphalis antiopa* (L.)
		Papilionidae	*Papilio rutulus* Lucas
		Pieridae	*Colias eurytheme* Boisduval
		Pyralidae	*Acrobasis indigenella* (Zeller)
			Dioryctria amatella (Hulst)
			Plodia interpunctella (Hübner)
		Saturniidae	*Antheraea polyphemus* (Cramer)
			Hyalophora cecropia (L.)
			Hyalophora columbia (Smith)
		Sesiidae	*Podosesia syringae* Harris
		Sphingidae	*Eumorpha achemon* (Drury)
			Hyles lineata (F.)

Class	Order	Family	Species
			Smerinthus cerisyi Kirby
		Tineidae	*Tineola bisselliella* (Hummel)
		Tortricidae	*Cydia pomonella* (L.)
			Choristoneura occidentalis (Walsingham)
			Epinotia sp.
	Neuroptera	Chrysopidae	*
		Mantispidae	*
		Raphidiidae	*
	Orthoptera	Acrididae	*Trimerotropis melanoptera* McNeill
		Prophalangopsidae	*Cyphoderris* sp.
		Rhaphidophoridae	*
	Thysanoptera	Thripidae	*Frankliniella occidentalis* (Pergande)
			Thrips tabaci (Lindeman)