Schutter Diagnostic Laboratory_Impacts & Outcomes_2015

The Schutter Diagnostic Laboratory (SDL) at Montana State University (MSU) is provided as a service to the citizens of Montana through MSU and MSU Extension to provide plant pest identification. The SDL conducted a total of 2841 plant disease, insect, and plant identification diagnoses in 2015. The SDL is clearly valued by its clients in the state and across the region who use this service, and clients consistently describe the SDL and personnel as invaluable, necessary, professional, responsive, helpful, accurate, and timely. In addition, the acreage and dollars impacted and saved are significant. An estimate of the economic impact of the SDL in 2015 is over $2 million based on 489 responses to a survey. This number reflects direct economic impacts of diagnoses.

Quantitative Impacts:

- The SDL performed over 2,800 diagnoses on disease, insect, and plant identification samples from clients in 11 states and 55 Montana counties. Estimated economic value of recommendations was $2 million.
- One client stated that a diagnosis of Fusarium Head Blight saved millions of dollars of malt barley potentially at risk.
- "The samples identified the problem as frost and drought so we saved the cost of fungicide application which saved approximately 35,000 dollars."
- A record high of 89 samples were submitted for diagnosis of wheat streak mosaic virus in 2015. Respondents to a survey (30 of 58 contacts) indicated the disease affected 159,310 acres and yields ranged from 25-150% of expected, with a mean of 85%. At an average yield of 45 bu/a and a price of $6/bu, this represents an estimated loss of $6.45 mil on those acres. Respondents increased their knowledge of wheat viruses (96%), and efforts to eliminate the green bridge for disease management increased in 92% of respondents. The majority (76%) reported that acres affected by viruses decreased due to SDL services.
- A solid phase immunoassay is currently being developed by engineering students at MSU. We expect to distribute up to 10,000 to faculty and agricultural professionals including Extension agents in multiple states and Canada for diagnosis in spring of 2016.
- A grower did not spray fungicide on a wheat crop with physiological spotting and saved $50,000 in applications costs with no observed loss in yield.
- The SDL helped to save thousands of dollars in the hospitality industry through identification and education of bed bugs and other pests.

Qualitative Impacts:

- 91.1% of clients rated service as "highly valuable."
- The work of the lab allows growers to have increased knowledge about pests and treatment options making them more productive. Over 77% of respondents found the pest recommendation they received from the lab very useful or somewhat useful.

- The SDL provides a valuable resource where land managers can get accurate information about suspected problematic plants. For example, 22 specimens of state-listed noxious weeds were identified through the lab this year.
- 93% of survey respondents reported that information from diagnostic reports influenced their management decisions.
- Staff published 7 refereed publications, 13 educational publications and articles, and provided over 50 workshops and presentations on topics relevant to plant pest identification and integrated pest management in urban and agricultural settings.

Quotes from clients:

- "SDL's services is key to helping community members understand their local flora, associated diseases and potential treatments. Priceless."
- "Schutter Diagnostic Lab has been a major influence on my ability to serve the public in my area. My horticultural assistant and myself use Schutter on a regular basis for both plant and insect information. The quality of our work would be greatly diminished if it were not for Schutter Lab".
- "The services of this lab greatly enhance my ability to serve the clientele in my county. Without the lab, many counties with faculty that don't have the expertise the lab provides would have to turn away clients or spend an inordinate amount of time on samples clients bring in to offices."
- "I consider you guys the final authority." - *Small business owner*"
- "I learn, in trying to figure it out we needed to grow cultures from it and I was kept in the loop…SDL is a valuable asset to Montanans." - *Greenhouse manager and master gardener*.
- "The staff in this lab, currently, are AWESOME! Samples are processed in a timely manner, reports are friendly, easy to understand, useful, and most often provide management recommendations, which is highly valuable."
- "Identification allowed me to avoid an unnecessary pest management application."
- "This is an invaluable service to Montana residents."
- "The Schutter Diagnostic Lab has been extremely valuable to me as a homeowner with acreage and a Master Gardener. It has helped me manage plant diseases and insect infestations with the safest, least toxic treatments. It is great to know that the lab is protecting the environment with good, sound, scientific data."
- "Having this lab available to the community is invaluable. All their knowledge and expertise allowed me peace of mind in knowing that I am doing everything possible to figure out the problem and find a solution. Thanks to everyone who helped me out. You guys rock!"
- "I cannot say enough about the lab. It is such a valuable resource for the community. It helps eliminate the guess work when trying to diagnose biotic/abiotic issues."
- "Outstanding service to our county."
- "My contacts at Schutter have helped provide me with a more confident position with which to make decisions with regards to my crop management."

Contents

Introduction

The Schutter Diagnostic Laboratory (SDL) at Montana State University is provided as a service to the citizens of Montana through Montana State University (MSU) and MSU Extension to provide plant pest identification. Services of the SDL include identification of plant diseases, insect, insect damage, weeds and other plants, abiotic problems and mushrooms. Additional goals are to minimize pesticide use by accurately identifying plant pests and providing science based options for management. Most samples are submitted by Montana State University Extension agents, homeowners, farmers, and commercial operators. The diagnostic staff includes Laurie Kerzicnik (Insect Diagnostician), Noelle Orloff (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 2841 diagnoses were conducted in 2015 from 55 counties in Montana and an additional 11 states (Table 1).

Table 1. Total number of diagnoses performed at the Schutter Diagnostic Lab in 2015.

	Number of Diagnoses
Plant Disease	1205
Insects	1007
Plant and Mushroom Identification	563
Herbicide Injury	66
Total	**2841**

An estimate of the economic impact of the SDL in 2015 is over $2 million based on 489 responses to a survey. This number reflects direct economic impacts on samples.

People:

- Hired a plant identification diagnostician, Noelle Orloff, MS. Mrs. Orloff received her master's degree in Land Resources and Environmental Sciences at Montana State University, where she focused on invasive plant ecology.
- Hired Edward Barge, MS, as research assistant for the summer. Mr. Barge is a trained mycologist and expertly identified mushroom samples. He also recorded a webinar about mushroom identification in Montana, which is the first one available online (http://msuextensionconnect.org/p4vgnx9ldek/?launcher=false&fcsContent=true&pbMode=normal)

2015 Plant Identification Lab Summary

Diagnostic Staff

January-April: Hilary Parkinson- Plant Identification Diagnostician and Research Associate
May-December: Noelle Orloff- Plant Identification Diagnostician and Associate IPM Specialist
Ed Barge- Schutter Lab Technician

Extension Specialists

Dr. Fabian Menalled and Dr. Jane Mangold

Total Samples and Sample Source

In 2015, the Schutter Diagnostic Lab processed 508 specimens for plant identification, a number similar to 2014 (491). Samples came from 49 of 56 Montana counties (93%), one county in Arizona, one county in Idaho, and one province of Canada. The highest submission numbers were from Gallatin, Ravalli, and Silver Bow Counties with 140, 44, and 29 sample submissions, respectively. Submissions were greatest in June and July with 114 samples each of those months.

Noncommercial sources (homeowners, small acreage landowners) accounted for 84% of submissions. Extension noncommercial was the most common submission type, accounting for over 60% of all samples (Figure 1). These samples are typically from residential or small acreage homeowners who take a plant to their county Extension agent for identification and need information on how to control the plant in their gardens or pastures. Agents send the sample in to Schutter if they are not sure of the identity of the specimen. Nonextension noncommercial samples accounted for about a quarter of submissions. Samples from commercial sources (whether extension or nonextension) accounted for 16% of all submissions. These include farmers, ranchers, consultants, nurseries and representatives from agribusinesses.

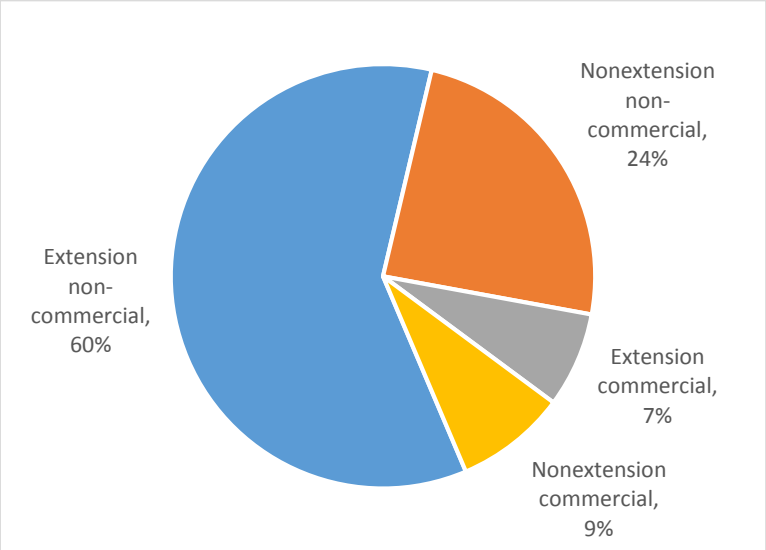

Figure 1. Sample submission by source.

More than 40 samples were emailed or texted as pictures, often sent directly from the field. Prompt, same day electronic identifications enable clients to immediately apply a management strategy when appropriate. They also alleviate costs and time spent on shipping physical samples.

In addition to plants the Schutter Lab also identifies mushroom specimens. In 2015 Dr. Cathy Cripps and Ed Barge received 55 mushroom samples, similar to the number received in 2014 (58). These specimens were of 37 different species. Ninety six percent of these samples were from noncommercial sources, and were found in many cases in lawns, gardens, or natural areas. Clients are often interested in edibility or toxicity of mushrooms, and proper identification is vital for these types of questions.

Samples by Status and Type

Forty seven percent or 235 samples were exotic plants representing 145 unique species. The most commonly submitted exotic species were field cottonrose (*Logfia arvensis*, 8), catchweed (*Asperugo procumbens*, 6), hoary alyssum (*Berteroa incana*, 6), and quackgrass (*Elytrigian repens*, 6). 174 specimens were native plants, representing 141 unique species. The most common native species were horseweed (*Conyza canadensis*, 7), sixweeks fescue (*Vulpia octoflora*, 4), and Rocky Mountain bee plant (*Cleome serrulata*, 3).

Twenty two state-listed noxious weeds were submitted representing ten unique species (Table 2). This is five fewer than were submitted in 2014. All of the noxious weeds submitted were priority 2A or 2B species, meaning that they are either common or abundant in Montana. We also received specimens suspected of being high priority noxious weeds that were not. For example, two specimens suspected to be Montana's newest noxious weed, common reed (*Phragmites australis* spp. *Australis*) were submitted to the lab and both of these samples were identified as the native subspecies (*P. australis* spp. *Americanus*). Two specimens were submitted that were suspected of being priority 1B species scotch broom (*Cytisus scoparium*), but neither specimen was of that species. The Schutter Lab provides a valuable resource where land managers can get accurate information about suspected problematic plants.

Table 2. State listed noxious weed species submitted to the Schutter Lab in 2015.

Species	**County**	**Priority**
Blueweed	Ravalli	2A
Canada thistle	Gallatin	2A
Common tansy	Gallatin, Powder River	2B
Eurasian watermilfoil	Gallatin	2A
Hoary alyssum	Flathead, Gallatin, Silver Bow	2B
Houndstongue	Gallatin, Glacier	2B
Oxeye daisy	Gallatin	2B
Russian knapweed	Garfield	2B
Spotted knapweed	Silver Bow	2B
St. John's Wort	Big Horn	2B
Tall buttercup	Gallatin	2A

Activities to promote plant identification and noxious weed awareness

We provided eleven workshops or interactive trainings in 2015 that reached 348 participants. These trainings covered topics including plant morphology, noxious weed identification, grass identification, use of a dichotomous key, and identification of common or important cropland and rangeland weeds.

Through responses to past trainings, it was clear that a thistle identification publication that helped differentiate native versus weedy thistles was of interest to clients. The diagnostician developed and published, "Guide to exotic thistles of Montana, and how to differentiate from native thistles" (EB0221). This guide promotes the maintenance of native thistles and educates readers about the importance of verifying whether a thistle is native or exotic before implementing control methods.

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/invasiveplants/monthly_weed_post.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 2016 are to continue to offer accurate, timely reports on plant identification and weed management; provide education on weed and native plant identification and promote IPM practices to manage weeds; finish a factsheet about identification of European common reed; and to use MSU ag alerts more effectively to empower clients to identify plants commonly submitted to the Schutter Lab.

2015 Herbicide Injury Summary

Diagnostic Staff

January-April: Hilary Parkinson- Plant Identification Diagnostician and Research Associate
May-December: Noelle Orloff- Plant Identification Diagnostician and Associate IPM Specialist

Extension Specialists

Dr. Fabian Menalled

Total Samples and Sample Source

Sixty-six samples were submitted to assess potential herbicide injury in 2015, about the same number submitted in 2014 (64). Of these, about half (31) of the samples were submitted from an agricultural setting, while 35 were submitted from urban settings. We suspected herbicide injury to be affecting samples in 68% of these cases.

Since 2011, the Schutter Lab has been tracking vegetable samples damaged by compost or soil contaminated with plant growth regulator (PGR) herbicides (e.g. picloram, aminopyralid, clopyralid, etc). When we receive these samples, we call the client to explain how this can occur, and we send detailed reports about how to prevent it in the future. Numbers of samples showing suspected PGR damage continue to drop each year (Table 3), indicating that educational efforts by the Schutter Lab, MSU Extension agents, and others are having an impact. We received eight samples that we suspected were affected by plant growth regulator herbicide carryover in 2015, and these were from both commercial and non-commercial sources.

Table 3. Number of samples per year with injuries consistent with PGR exposure.

2011	25
2012	22
2013	18
2014	12
2015	8

Of the 31 commercial agricultural samples we received, 16 cases of suspected herbicide injury were from in-crop applications of herbicide that resulted from things like mistakes in tank mixes and interactions between weather events and herbicide applications. We also received three samples of pulse crops that we suspected were affected by herbicide carryover. Most of these cases were in line with warnings on herbicide product labels, such as warnings about frost soon after application or labelled intervals between persistent herbicide application and planting legumes.

2015 Insect Identification Summary

Diagnostic Staff:
Laurie Kerzicnik, Insect Identification Diagnostician

Cooperators/Identification Assistants:
Toby Day, Horticulture Specialist and Montana Master Gardener Coordinator
Cam Lay and Ian Foley, Montana Department of Agriculture
Dr. Michael Ivie, Systematic Entomologist, MSU
Dr. Justin Runyon, Entomologist, US Forest Service
Dr. Casey Delphia, Research Associate/Entomologist, MSU

Impacts

- The work of the lab allows growers to have increased knowledge about pests and treatment options making them more productive. Over 77% of respondents found the pest recommendation they received from the lab very useful or somewhat useful.
- The lab helped to save thousands of dollars in the hospitality industry through identification and education of bed bugs and other pests.
- Two samples were identified as bat bugs, which saved thousands in unnecessary bed bug treatment.
- Awareness of the Schutter Diagnostic Lab was increased through outreach and media efforts (Montana Ag Live appearances, TV and phone interviews, internet blog, Urban Ag Alerts). Insect/spider sample submission increased over 20%.
- Spider awareness was increased and fear decreased in Montana through identifications, reports, and education. Spider submissions tripled in 2015 from last year.

Sample Summary

In 2015, a total of 1007 arthropod diagnoses were conducted (Table 4). Of the identifications, 77% were insects/other arthropods, and 23% were spiders. Two percent of the insect samples submitted were diagnosed as abiotic, which were typically the result of winter injury, environmental stress, or nutrient imbalances.

Table 4. Numbers of insect, spider, and other arthropod diagnoses in 2015.

	# Identifications
Insects/Other Arthropods	775
Spiders	232
Total	1007

Insect samples were submitted by 51 Montana counties. The majority of the samples were submitted from Gallatin County. Other larger submissions included the counties of Silver Bow, Ravalli, Teton, Hill, Yellowstone, Lewis and Clark, and Flathead. County Extension Agents or Extension Specialists submitted 58% of samples, and 42% were submitted directly to the diagnostic lab by commercial operators or individuals. Noncommercial clients (primarily homeowners) outnumbered commercial clients (producers, consultants, landscape professionals), 77% to 23%.

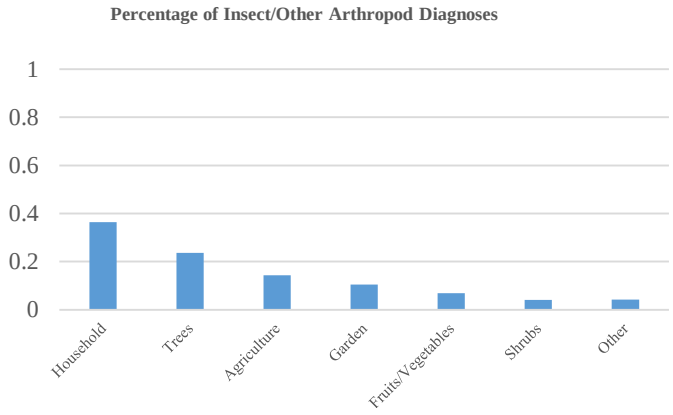

Figure 2. Percentage of insect/other arthropod and spider arthropod diagnoses by host category in 2015.

Of the insect samples, field crops (primarily small grains and alfalfa) accounted for 14% of insect samples and non-agricultural were 86%, which included the categories household/domestic, trees, fruits/vegetables, garden, shrubs/bushes, and other (perennials, greenhouse, and turf). The highest number of insect and spider samples submitted were in the "household/domestic" category (36%) (Fig. 2) followed by insects on trees (24%), which included both deciduous and evergreen trees.

The greatest number of tree samples came from deciduous trees, including apple, ash, aspen, birch, cherry, cottonwood, poplar, oak, elm, and willow. The evergreen samples were dominated by pine, blue spruce, and fir. The bush/shrub hosts were juniper, cotoneaster, currant, lilac, and rose. The vegetable hosts consisted of beans, broccoli, garlic, peas, squash, tomatoes, and potatoes. 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 barley, corn, lentil, and canola.

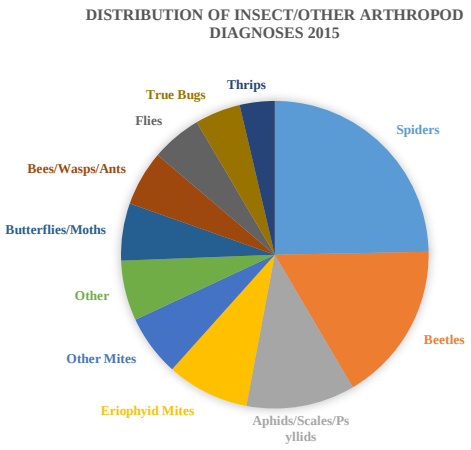

Figure 3. Distribution of insect/other arthropod diagnoses in 2015.

Several groups of insects and spiders were submitted to the Schutter Lab (Fig. 3).

Sap-feeding insects:

Aphid densities were high in early spring and throughout the summer and represented 8% of the arthropod samples submitted to the Schutter Lab. The leafcurl ash aphid was particularly problematic from early June through July. The giant conifer aphid was prevalent on spruce and pine trees from early July through mid-August. Aphid populations were high on apple trees, including the rosy apple aphid, leafcurl plum

aphid, and the apple aphid. The Russian wheat aphid was present in wheat and barley from May through August.

Several species of eriophyid mites were reported in the urban and agricultural environments (about 9% of samples). Some of the common mites and mite issues were wheat curl mite (early May-late June), pearleaf and appleleaf blister mite (May-August), ash purse gall mite, plum finger gall mite, poplar leaf gall mite, and the apple rust mite.

The Banks grass mite and its damage was diagnosed on several wheat samples. The spruce spider mite, a cool-season pest, was present on spruce and pine in early fall and late winter. The two-spotted spider mite is a warm-season pest that was present on many woody ornamental hosts in the summer. Thrips densities were high on barley, wheat, and ryegrass in the summer and were also present on many vegetables. Pine needle scale was reported on pine and spruce in early fall.

Gall makers:

Several galls were submitted with concern for plant damage from gall-forming insects and mites, including the poplar vagabond aphid, the Cooley spruce gall adelgid (April-September), the willow redgall sawfly, and the poplar twiggall fly.

We received several bur oak samples that sustained serious injury from the oak rough bullet gall wasp. Although this is most often considered cosmetic injury, the increased presence of this pest and its galls are of major concern statewide, particularly with nursery operations.

Borers:

White pine weevil damage was very prevalent statewide from June through August on blue spruce trees. Classic damage is represented by the tree leader/terminal showing a “Shepherd’s crook” type wilting or damage. Due to a mild winter, many of the adult weevils successfully overwintered.

Skeletonizers:

Particularly in the northwest part of the state, forest tent caterpillar densities were unusually high, chewing severe amounts of foliage on many different trees and deciduous shrubs. Leaf damage (notching patterns on the leaves) was very common this year on lilac and many other bushes from the lilac weevil and the black vine weevil. Leafrolling caterpillars and noctuid moths expressed damage on many different woody ornamentals.

An outbreak of alder flea beetles and skeletonizing damage on the leaves occurred in Stevensville in July. Similarly, Gallatin County submitted alder flea beetle samples and reported heavy skeletonization of the leaves. Several flea beetles were problematic in garden areas.

Insects in the home:

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 other weevils were common, including the strawberry root weevil, black vine root weevil, and *Romauldis bifoveolatus*. The Western conifer seed bug, garden millipedes, and boxelder bugs were also common home invaders. Carpet beetles were submitted year round with

concern over control and new infestations. Bed bugs samples were submitted from several counties, suggesting a further need for awareness and prevention throughout the state. Field ants were numerous in the early summer and entering homes more frequently. Clover mites were common in the early winter. German cockroaches were reported in four counties throughout the year.

Spiders:

For the spider samples submitted, many individuals were concerned if spiders were harmful. In particular, people were concerned about whether the spiders in their homes were hobo spiders (42% of the spiders submitted). Of those submitted, 24% were actually hobo spiders. Other spiders of concern were those that were suspected to be black widows or brown recluse spiders (5%). These spiders were actually not black widows but were harmless "false widows", *Steatoda* sp. Many cat-faced spiders (Family Araneidae) were submitted for curiosity and for clarification that they are harmless. The spider groups submitted to the Schutter Lab in 2015 were mostly funnel web weavers, followed by ground hunters, orb weavers, ambushers or "sit and wait" spiders, tangle weavers, and other spiders (Fig. 4). These diagnoses were followed with reports, which allowed for many clarifications of misinformation about spiders, particularly about the hobo spider and the brown recluse. We don't have the brown recluse documented in Montana, and the hobo spider is not considered a harmful or dangerous spider.

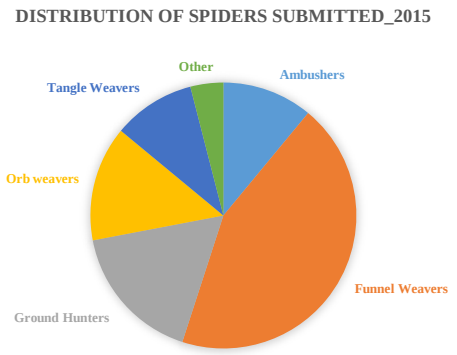

Figure 4. Distribution of spider groups submitted to the Schutter Diagnostic Lab_2015.

Outreach, Education, & Media Efforts to Increase Urban Entomology and IPM Knowledge

Talks

- *Urban insects and IPM*. Montana Department of Agriculture Ornamental and Turf Trainings. 10 Nov 2015. Billings, MT.
- *Urban insects and IPM*. Montana Department of Agriculture Ornamental and Turf Trainings. 6 Nov 2015. Polson, MT.
- *Introduction to insects and urban insect integrated pest management*. Silver Bow County Level II Master Gardeners Class. 4 Nov 2015. Butte, MT.
- *Emerald ash borer*. Montana and Idaho Parks and Recreation Annual Conference. 28 Oct 2015. Bozeman, MT.
- *Mastering urban plant diagnostic issues*. MSU Extension Annual Conference. 21 Oct 2015. Bozeman, MT.
- *Introduction to insects and urban insect integrated pest management*. Gallatin County Level II Master Gardeners Class. 19 Oct 2015. Bozeman, MT.

- *Spiders and the myths surrounding them*. Missoula Insectarium. 17 Oct 2015. Missoula, MT.
- *Spiders and their benefits*. Paxton Elementary 1st Graders. 7 Oct 2015. Missoula, MT.
- *Spiders*. Community School Preschoolers. 7 Oct 2015. Missoula, MT.
- *Introduction to insects and urban insect integrated pest management*. Ravalli County Master Gardeners Class. 7 Oct 2015. Hamilton, MT.
- *Urban insects*. Rocky Mountain Tree School Annual Conference. 28 Sep 2015. Livingston, MT.
- *Urban insects*. Master Gardener Level III training, Montana State University. 21 Aug 2015. Bozeman, MT.
- *Diagnostics and the Schutter Diagnostic Lab at MSU*. Pacific Northwest Economic Region Summit Biannual Conference. 14 Jul 2015. Big Sky, MT.
- *Emerald ash borer*. Pacific Northwest Economic Region Summit Biannual Conference. 13 Jul 2015. Big Sky, MT.
- *Aphids in the urban environment*. Ravalli County Extension. 16 May 2015. Corvallis, MT.
- *Honey bees*. Gallatin Valley Farm Fair Bee Booth. 5 May 2015. Belgrade, MT.
- *Invasive insects/urban insects*. Arbor Day. Bozeman Public Library. 1 May 2015. Bozeman, MT.
- *Extension agent training*. MSU Extension. 29 April 2015. Bozeman, MT.
- *The allure of spiders*. Pecha Kucha. 21 & 22 Apr 2015. Ellen Theater. Bozeman, MT.
- *Insects: who's moving with us?* Montana Mover's Association Annual Conference. 18 Apr 2015. Fairmont Hot Springs, MT.
- *Introduction to insects and urban insect integrated pest management*. Missoula County Gardeners Class. 24 Mar 2015. Missoula, MT.
- *Urban insects and IPM*. Montana Department of Agriculture Ornamental and Turf Trainings. 16 Mar 2015. Helena, MT.
- *Spiders and their benefits*. Bozeman Public Library. 13 Mar 2015. Bozeman, MT.
- *Spiders and their benefits*. Bozeman Public Library. 11 Mar 2015. Bozeman, MT.
- *Introduction to IPM*. Cascade County Level I Master Gardeners. 5 Feb 2015. Great Falls, MT.
- *Spiders: friends or foes*. Association of Montana Turf and Ornamental Professionals. 26 Jan 2015. Fairmont Hot Springs, MT.

Workshops

I was part of five workshops this year to promote awareness for bed bugs and early detection efforts for a potential invasive that has not yet been detected in the state of Montana, the Emerald ash borer. Extension agents, sanitarians, health officials, city foresters, and community members attended the workshops. Montana, compared to other states, has a significant percentage of ash in many of its communities and has to be proactive in preparing for its arrival. Concerning bed bugs, awareness and prevention are critical to prevent infestations of the pest.

- *Bed bugs*. MEHA Conference. 22 Sep 2015. Helena, MT.
- *Emerald ash borer biology and related insects*. EAB Roadshow II. 25 Apr 2015. Helena, MT.
- *Emerald ash borer biology and related insects*. EAB Roadshow II. 13 Apr 2015. Rocky Mountain College. Billings, MT.
- *Emerald ash borer biology and related insects*. EAB Roadshow II. 2 Apr 2015. Kalispell, MT.
- *Emerald ash borer biology and related insects*. EAB Roadshow II. 1 Apr 2015. Missoula, MT.

Media

- Montana Ag Live, Panelist. (Mar 22, Jun 7, Sep 27, and Oct 18).

- *The hobo spider and spiders in Montana*. Livingston Enterprise. Phone Interview and online article. 2 Sep 2015.
- *Sod webworms in Yellowstone County*. Billings Gazette. Phone interview and online article. 2 Sep 2015.
- *Nuisance wasps in Great Falls*. Great Falls Tribune. Phone interview and online article. 11 Aug 2015.
- *Hobo spiders: myths and facts. KBZK*. TV interview. Bozeman, MT. 30 Jul 2015.
- *Schutter Diagnostic Lab Services. Fox News/ABC*. TV interview. Bozeman, MT. 7 Jul 2015.
- *Spider display*. *The benefits of spiders*. Bozeman Public Library. Bozeman, MT. 14 Mar-Apr 15 2015.
- *The benefits of spiders and advertising spider display at the Bozeman Public Library*. *NBC, CBS*. TV interview. Bozeman, MT. 14 Mar 2015.

Urban Ag Alerts

The Urban Ag Alert system is a list serv that is managed by the Schutter Lab at Montana State University Extension in Bozeman, MT and was started in spring 2015. It is intended for extension agents, landscape professionals, arborists, city foresters/managers, and any other people interested in trends in urban pests (both insects and disease), environmental stresses, and other urban-related management issues with woody ornamentals and vegetables.

- 12 articles were distributed to 101 subscribers on trends and issues with insects in the urban environment.

Grants and Awards

L. Kerzicnik. 2015-2018. IPM of Insect Pests of Fruit Trees. Specialty Crop Block Grant Program, Montana Department of Agriculture. $53,000.

Training

- Grant writing workshop I. Montana State University (Elizabeth Bird). 8-11 Jun 2015. Bozeman, MT.
- Grant writing workshop II. Montana State University (Elizabeth Bird). 6-9 Jul 2015. Bozeman, MT.
- Bark beetle identification. Oregon Department of Agriculture. 2-6 Mar 2015. Salem, OR.

Publications

Kerzicnik LM. *The allure of spiders*. Oxford University Press blog (OUP blog). Online publication. Mar 2015.

Other Activities

- National Plant Diagnostic Network Program Planning Committee, March 2016 meeting.
- MSU Extension, “Ask an Expert”

2015 Plant Disease Summary

Diagnostic Staff:
Dr. Eva Grimme, 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
Edward Barge, MS, Research Assistant, Mushroom Identification
Dr. Bill Grey, Foundation seed, Plant Pathologist
Dr. Mareike Johnston, Plant Pathologist

Total Disease Identification and Sample Source

In 2015, the Schutter Diagnostic Lab made 1,205 plant disease diagnoses, an increasing number compared to 896 diagnoses in 2014. Samples were mainly submitted from 50 counties in Montana (Table 1). Four samples where submitted from out of state: one each from North Dakota and Washington, two samples from Wyoming. The highest submissions were from Gallatin County, Chouteau and Yellowstone County. Sample submissions were greatest in June and July with 271 and 228 samples, respectively.

Table 5. Sample submission by county in 2015.

Gallatin	221	Big Horn	13	Valley	7
Chouteau	61	Fergus	13	Daniels	6
Yellowstone	60	Carbon	12	Sweet Grass	6
Pondera	54	Lewis and Clark	12	Carter	5
Ravalli	41	Roosevelt	12	Prairie	5
Liberty	37	Stillwater	12	Sanders	5
Hill	35	Judith Basin	11	Fallon	4
Teton	33	Sheridan	11	Lincoln	4
Cascade	28	Flathead	10	Powder River	4
Toole	27	Missoula	10	Powell	4
Lake	26	Dawson	9	Rosebud	4
Glacier	25	McCone	9	Garfield	3
Park	20	Broadwater	8	Meagher	2
Phillips	20	Custer	8	Wibaux	2
Silver Bow	19	Richland	8	Deer Lodge	1
Beaverhead	14	Jefferson	7	Treasure	1
Blaine	14	Madison	7		

Samples were mainly submitted by extension agents (47%; Figure 1) and nonextension commercial sources (37%). Commercial samples, extension and nonextension combined, accounted for 52% of the samples. The highest number of samples came from homeowners (25%), grower/farmers (16%), crop consultans (10%), agribusiness (7%) and arborists (5%). Other submitters include researchers, agents/educators, and companies.

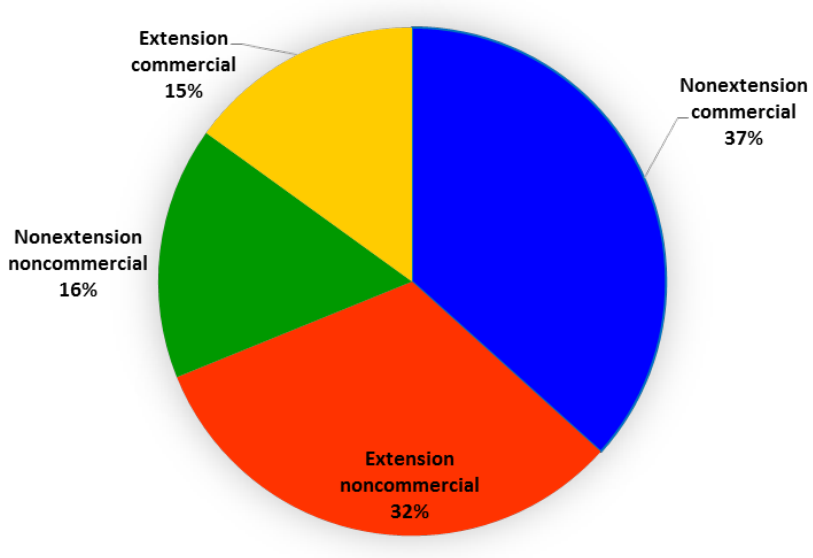

Figure 5. Sample submission by source.

Turf samples accounted for 3% and ornamental samples, including deciduous and evergreen woody ornamentals, accounted for 29% of the total samples submitted to the Schutter Diagnostic Lab (Figure 2). This is a slight decrease in sample numbers compared to 2014. However, small grains samples, primarily wheat, accounted for 34% of disease samples, a 10% increase in sample numbers compared to the previous years.

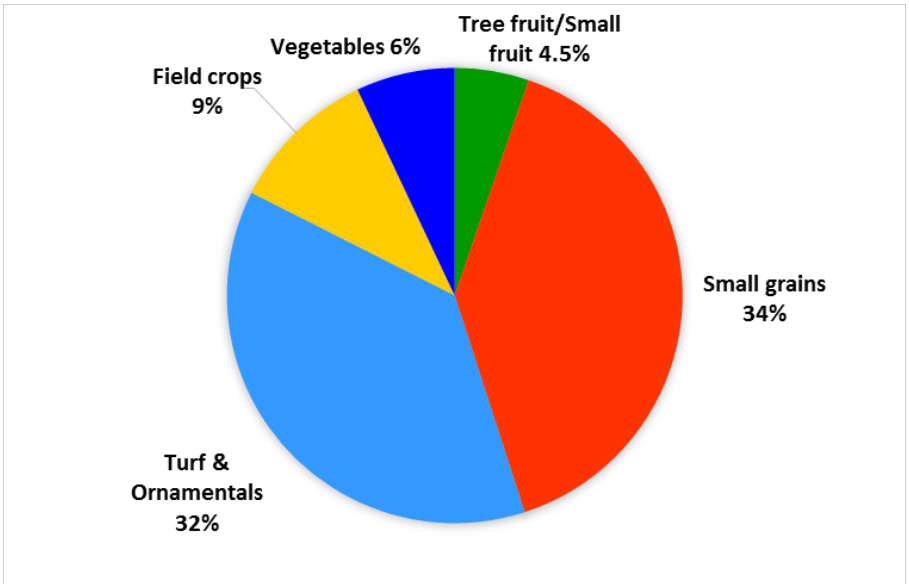

Figure 6. Distribution of disease samples by host category.

In spring, the Schutter Diagnostic Laboratory received a high number of wheat samples with powdery mildew infection. Also, 89 wheat samples where submitted with wheat streak mosaic virus symptoms. In the urban area, we received many anthracnose (caused by different fungi) samples, mainly from green ash and maple trees. Many cherry and chokecherry samples with symptoms of black knot disease were submitted. Also, we observed a high number of oak leaf blister on oak trees. Throughout the year, deciduous and evergreen samples with symptoms of cytospora canker were submitted. During summer we received some apple and pear tree samples with symptoms of fire blight. In late summer, marssonina leaf spot was observed on aspen, poplar and cottonwood trees.

Additional Activities

We continued to test lentil, pea, and chickpea seed for Ascochyta blight. We processed 221 samples of lentil, pea, and chickpea seed for Ascochyta blight fungi from January to May 2015 (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.

We continued to assist the Montana Department of Agriculture CAPS surveys by processing and analyzing 120 samples with ELISA for Plum Pox Virus monitoring. Plum Pox Virus (PPV) is a federally regulated virus of fruit trees.

Dr. Grimme coordinated the annual webinar series of the Great Plains Diagnostic Network (GPDN) on topics including dealing with clients, new diagnostic methods useful for the GPDN, identifying mycotoxin problems, musings on a Plant Pathologist's Meandering Career Path, downy mildew on sunflower, characterization of Fusarium species, and how to navigate the NPDN national repository. The series consisted of eight presentations during January to March 2015 and was attended by 209 individuals. The complete list and recordings of the seminars can be found at the GDPN website www.gdpn.org.

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.

Professional Training

Dr. Eva Grimme attended the STAR-D phase 2 training for the accreditation process of laboratories. Accreditation to STAR-D is currently a voluntary process whereby a laboratory's quality management system is periodically reviewed in detail to ensure continued technical competence and compliance with the NPDN STAR-D requirements and standard. The goal is for all NPDN laboratories to become STAR-D accredited STAR-D was created to provide an assessment of laboratories within the NPDN system. Accreditation through the STAR-D program signifies that a laboratory has met essential requirement and standards by demonstrating

technical competence to perform testing, using reliable methodologies and equipment, and having both qualified staff and appropriate facilities.

Outreach, Education & Media Efforts to increase Urban Plant Diseases and IPM Implementation

Presentations

- Master Gardener Level III; Plant Diseases, August 21, 2015
- Diseases of woody ornamentals, Master Gardener Level II, October 14, 2015
- Diseases of woody ornamentals and perennial plants, Master Gardener Level II, November 2, 2015
- Disease Findings 2015, Pesticide Applicator Training, November 10, 2015

Workshops

- Ag Agent Training, Schutter Laboratory MSU Extension; April 29, 2015
- Mastering Urban Plant Diagnostic Issues; October 21, 2015

Media

- MSU gumshoes solve mysteries about Montana's plants, insects; Bozeman Daily Chronicle, July 4, 2015
- MSU Researchers Solving Mysteries of Montana's Insects and Plants; Fox News/ABC, July 7, 2015

Urban Ag Alerts

The Urban Ag Alert system is a special mailing list server that is managed by the Schutter Lab at Montana State University Extension in Bozeman, MT and was started in spring 2015. The system is intended to inform extension agents, landscape professionals, arborists, city foresters/managers, and homeowners about current issues of plant diseases, insects and horticultural topics in general in the urban landscape.

- 6 articles were distributed to 101 subscribers addressing specific plant diseases in the urban environment.

Refereed Publications:

Miller, Z., E. Lehnhoff, F. Menalled, and M. Burrows. 2016. Effects of nitrogen and CO2 fertilization on the epidemiology of Wheat streak mosaic virus. Plant Disease (in press, First Look).

Harveson, R., M. Burrows, J. Pasche, S. Markell, F. Dugan, W. Chen. 2016. Bacterial blight of peas. Plant Health Progress. (in advanced prep)

McKenzie, S., H. Parkinson, J. Mangold, M. Burrows, S. Ahmed, F. Menalled. 2016. Agricultural professionals' needs, perceptions, and decision-making differs among stakeholders. PLoS ONE. (accepted)

Burrows, M., C. Thomas, N. McRoberts, R. Bostock, L. Coop, J. Stack. 2016. Coordination of Diagnostic Efforts in the Great Plains: Wheat Virus Survey and Modelling of Disease Onset. Plant Dis. (in press, Feature Article, First Look).

Lehnhoff, E., Miller, Z., D. Ito, F. Menalled, and M. Burrows. 2015. Wheat and barley susceptibility and tolerance to multiple isolates of Wheat streak mosaic virus. Plant Disease. 99: 1383-1389.

Lonergan, E., J. Pasche, L. Skoglund, M. Burrows. 2015. Sensitivity of Ascochyta species infecting pea, lentil, and chickpea to boscalid, fluxapyroxad, and prothioconazole. Plant Disease 99: 1254-1260.

Education and Extension publications:

Grimberg, F. Menalled, M. Burrows. Plant Viruses: Biology, Ecology, and Management. Educational module for K-12, APS Education Center (in prep). 'Francis the farmer' animation https://vimeo.com/124056111 Received the 2015 American Society of Agronomy Materials Award; Enzyme linked immunosorbant assay video https://vimeo.com/117442610 (password: plantvirus)

M. Burrows, S. Markell. 2016 Pulse Crop Pest Calendar 'Stack the Deck in Your Favor' (printed by Northern Pulse Growers Association)

M. Burrows, E. Lehnhoff, W. Grey, Z. Miller. 2015. Cereal viruses of importance in Montana. MSU Extension Publications MontGuide MT200911AG.