2017 Schutter Diagnostic Laboratory Annual Report- Summary

The Schutter Diagnostic Laboratory (SDL) at Montana State University (MSU) is provided as a service to the citizens of Montana for plant pest identification and integrated pest management education. In 2017, the SDL conducted 2,554 plant disease, insect, and plant identification diagnoses.

By the numbers- results of 2017 client survey (n=200):

• 97% of clients surveyed are likely to recommend the service to others

• 92% of clients surveyed reported the SDL influenced their pest management decision

Clients stated these outcomes of interactions with the SDL were most beneficial to them in 2017:

- being able to manage pests with increased knowledge
- being able to confirm diagnosis and/or identification of a pest
- being more informed/knowledgeable about the pests in their environments
- having the knowledge/confidence to follow the recommendations either presently and/or in the future to prevent the same problems from reoccurring
- being able to help a homeowner control a pest/disease problem on their property in a timely manner and at a low cost

Quotes from clients:

- "Having the peace of mind that a panel of experts has verified and/or identified complicated and/or unknown plant disease and/or insect issues is of tremendous value both to me and my clients"
- "I was better able to reduce spread of pests because of increased knowledge"
- "Biggest benefit to us is that we get an answer to the problem we are dealing with in the field and can make the right economic decisions"
- "Having a lab report legitimizes a diagnosis in the mind of the customer. It adds a stamp of professional legitimacy"
- "My non-profit organization was better able to implement best practices in pest management, protect cultural heritage artifacts, and maintain national accreditation"
- "I was able to understand what was poisonous to my young son in our yard and garden, so that I could remove it or not worry about it harming him"
- "Staff appear to appreciate the importance, economic and peace of mind, of their efforts for Montana producers and strive to provide the best professional service possible in a prompt manner"

Data and information from report, "Schutter Diagnostic Lab Evaluation – 2017" compiled by Yellowstone Evaluation Services, LLC.

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Introduction

Montana State University (MSU) and MSU Extension provide plant pest identification through the Schutter Diagnostic Laboratory (SDL). The mission of the SDL is to safeguard Montana agriculture, landscapes and public spaces from plant pests by offering identification services, management recommendations, and education. Our recommendations are based on integrated pest management (IPM) principles, which is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools to minimize economic and environmental risks. The mission of the SDL also includes the early detection of new and invasive pests that may pose a risk to agricultural production and international trade.

In 2017, the SDL conducted a total of 2,554 plant disease, insect, and plant identification diagnoses (Table 1). One notable sample was the first report for the nuisance species the elm seed bug, *Arocatus melanocephalus*, from Ravalli County which was later confirmed in five other counties in Montana. We are also an important resource to accurately identify new plant species in Montana and increase knowledge of our flora. In 2017 we confirmed a first report of tumble windmillgrass (*Chloris verticilliata*), a grass species native to North America but that had never been reported in Montana.

Table 1. Samples submitted to the SDL in 2017.

	Number of Diagnoses
Plant Disease	800
Insects & Other Arthropods	726
Plant & Mushroom ID	577
Herbicide Injury	105
Other Abiotic Disorders	346
Total	**2,554**

In addition to diagnostic services, SDL diagnosticians provided outreach, research, and educational materials about pests of concern to clients in Montana. This year we expanded our online presence. For example, we updated the MSU IPM webpage which offers easier access to MSU resources. A new resource page was also created on the Urban IPM webpage with links to relevant sites. The SDL also maintains a Facebook page that has over 300 users. In 2017 we had a post reach of over 55,000 from our total of 165 Facebook posts, and an average of 20 engaged users per post. We use this format to focus on timely information about plant diseases, insects, and plant identification for our wide range of clientele.

2017 Plant Disease Summary

Diagnostic Staff:
Dr. Mary Burrows, Extension Plant Pathologist & Montana IPM Coordinator
Dr. Eva Grimme, Plant Disease Diagnostician & Associate Extension Specialist

Extension Specialists:
Dr. Barry Jacobsen, Plant Pathologist
Toby Day, Extension Horticulture Specialist

Cooperators:
Dr. Mareike Johnston, Plant Pathologist
Priyanka Kudalkar, Research Assistant
Sarah Eilers, Research Assistant

Trends in 2017

The major field crops were winter wheat (85 samples, 144 diagnoses), spring wheat (32,51), barley (30,44) chickpea (30,37) and alfalfa (17,27). In alfalfa, spring black stem (*Phoma medicaginis*) was common throughout the season, as well as bacterial stem blight *(Pseudomonas syringae*). Bacterial diseases were also common in barley (11 samples in July). *Wheat streak mosaic virus* was common in spring (15 samples) and winter (32) wheat, although submissions were lower than last year due to drought conditions and successful education in 2017 according to a client survey by Changsoo Song, UNL. Durum wheat (9 samples, 13 diagnoses) were submitted primarily for Fusarium root rot and Fusarium head blight. Chickpeas were primarily submitted for submission of Ascochyta blight (10 samples confirmed), but herbicide injury, drought and root rot were another primary cause for submission. An AgAlert on 6 July significantly reduced submissions of chickpea. Peas and lentils were submitted for leaf spots and root rot, primarily. Chia, quinoa and hemp were interesting minor crop submissions this year. Chia and hemp grown near Big Sandy had Fusarium root rot. Quinoa grown near Shelby had Phoma stem blight. Staff are pursuing greenhouse trials for Koch's postulates and will publish a first report in Plant Disease, pending results.

Following the wet and cool spring in 2017, many trees and shrubs showed symptoms of bacterial diseases. The SDL received a high number of apple and crabapple tree samples with fire blight and bacterial blight as the dominant diseases. Lilac shrubs and trees predominantly showed symptoms of bacterial blight (*Pseudomonas syringae*). Throughout the year, evergreen samples were submitted with symptoms of Cytospora canker and Rhizosphaera needle cast disease. In late summer, Marssonina leaf spot was evident on aspen, poplar and cottonwood trees (Table A2, Appendix). Powdery mildew on vegetables, annual/perennial plants, vines, shrubs, and trees was a common occurrence this season.

Total Disease Identification and Sample Source

In 2017, the SDL made 800 plant disease and 346 abiotic disorder diagnoses, a decreasing number compared to 2,227 diagnoses in 2016. Samples were mainly submitted from 48 counties in Montana (Table 2). Seven samples were submitted from out of state, two from North Dakota and five samples from Wyoming. The highest submissions were from Gallatin, Yellowstone, Cascade, Fergus, and Hill County. Sample submissions were greatest in May, June, July, and August with 124, 313, 187, and 120 samples, respectively.

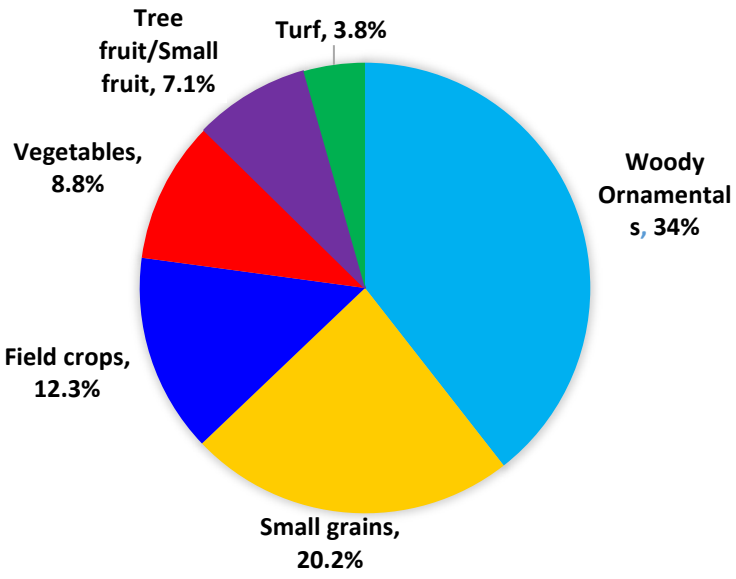
Table 2. Disease sample submission by county in 2017

Gallatin	113	Teton	22	Flathead	10
Yellowstone	46	Liberty	18	Richland	10
Cascade	39	Beaverhead	17	Valley	8
Fergus	32	Pondera	17	Roosevelt	7
Hill	32	Carter	16	Rosebud	7
Chouteau	31	Lake	15	Toole	7
Park	25	Glacier	12	McCone	6
Ravalli	23	Blaine	11	Powell	6

Samples were mainly submitted by commercial entities outside of MSU (39%), with a 22% increase compared to 2016. The number of extension noncommercial samples were similar to last years and accounted for 31%. A dramatic reduction of samples can be observed for extension commercial samples, which dropped from 41% in 2016 to 10% in 2017. Commercial samples, extension and non-extension combined, accounted for 49% of the samples. The highest number of samples came from homeowners/gardeners (26.6%), growers/farmers (11.4%), agribusiness (11.2%), and arborists (8.3%). Other submitters include crop consultants, companies, regulatory agents, and lawn care professionals.

Turf samples accounted for 3.8% of samples, deciduous and evergreen woody ornamentals accounted for 34% of the total disease samples submitted to the SDL (Figure 1). This is a 12% increase in sample numbers of woody ornamentals compared to 2016. Small grains samples, primarily wheat, accounted for 20.2% of disease samples, a 20.1% decrease in sample numbers compared to the previous year.

Figure 1. Distribution of disease samples by host category.



Additional Activities

Certifications

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

Education and Outreach Activities

Webinars

Dr. Grimme coordinated the annual webinar series of the Great Plains Diagnostic Network (GPDN) on topics including "Pathotype characterization of *Phytophthora sojae* affecting soybean in South Dakota", "The wonderful world of weeds: plant identification and herbicide injury diagnosis at the Schutter Diagnostic Lab", "Learning about Montana's Mushrooms", "Introduction to Bacterial Leaf Streak Disease of Corn", "IPM for Primary Insect Pests of Apple and Cherry", "*Fusarium* spp. interacting with soybean cyst nematode on soybean", "Solving turf puzzles - It's not as bad as you think!". The series consisted of eight presentations during January to March 2017. The complete list and recordings of the seminars can be found at the GDPN website www.gdpn.org.

Urban IPM Workshop

A "Turf to Trees – Urban IPM Workshop" was held in August with 30 participants from across the state. Dr. Grimme coordinated and hosted this event and Dr. Megan Kennelly, from Kansas

State University, was the guest speaker. She spoke about abiotic and biotic issues of ornamentals and turf. Toby Day guided the participants on a walking tour of the campus pointing out the diseased, damaged, and infested trees. A talk by Noelle Orloff had everyone on their feet using keys to identify common trees and shrubs. Dr. Laurie Kerzicnik spoke about the challenging insect issues facing the urban landscape.

Montana AgAlerts

Twenty-two AgAlerts were received by 1,026 subscribers by email and 98 subscribers by text message. The AgAlerts website is very popular with 9447 visitors in 2017.

Montana Urban Alerts

The Urban Alert system is a special mailing list server that is managed by the SDL that 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. Currently, the Urban Alert system has 308 email and 10 text subscribers. The website enjoys popularity and had 2,032 visitors.

- 9 articles were distributed addressing educational opportunities and specific plant diseases in the urban environment.

2017 Insect Identification Summary

Diagnostic Staff:
Laurie Kerzicnik, Urban Insect Diagnostician
Ruth O'Neill, Research Associate, Wanner Lab & Cropland Insect Diagnostician

Other Assistants/Specialists:
Toby Day, Horticulture Specialist, MSU
Ian Foley, Pest Management Specialist, 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 & Outcomes

- Confirmed swallow bugs, bat bugs, and carpet beetles in six cases, preventing unnecessary treatment costs from suspected bed bugs.
- Spider outreach and education has been effective, as spider sample submissions decreased by 87% from 2015-2017.
- Springtails were diagnosed for a suspected termite case, preventing unnecessary treatment costs for termites.
- Confirmed identification of *Blapstinus substriatus*, a drought-associated tenebrionid beetle, damaging lentils in Valley County, a first report of high numbers of this species since 1931 and a potential indicator for spring 2018.
- Confirmed identification of the maggots of an invasive fly species, the alfalfa blotch leafminer *Agromyza frontella*, in Lewis and Clark County, which prompted the release of an AgAlert that encourages reliance on beneficial insects and discourages ineffective chemical sprays.
- A diagnosis of non-harmful horsehair worms prevented treatment costs for potential sheep parasites in a pasture.
- First report of damage on a crop (cabbage) by the invasive root weevil, *Cathormiocerus spinosus*.
- First report for the elm seed bug, *Arocatus melanocephalu*s, from Ravalli County (confirmed in 2017 but found in 2016) and later confirmed in five other counties in Montana.
- Two Rocky Mountain wood ticks were identified, and clients were assured that they did not have ticks that vectored Lyme disease.
- Insect identifications helped to protect several important artifacts in museums across the state, including books, textiles, Native American artifacts, repositories for Western artists, and contemporary art.

Trends from 2017

There was an outbreak of fruit flies (*Drosophila* sp.) in Richland County in May 2017. The source was not officially determined. Seven samples were submitted over concern of the potential wood-boring invasive, the Emerald ash borer, *Agrilus planipennis* (no Emerald ash borers were detected). Six bed bug cases were diagnosed, confirming the need for further outreach and prevention for this insect across the state. Leaf-cutting bees (Family Megachilidae) were common around windows and homes (particular those with cedar siding). Eriophyid mites (several species) were diagnosed and causing injury to several woody ornamentals throughout the summer. Outbreaks of spider mites on tree trunks (several species) occurred in several counties, although the spider mite species was not determined. Wheat stem maggots were a common problem in wheat and occurred in one field of triticale.

Sample Summary

In 2017, 726 arthropod diagnoses were completed. Of these identifications, 93% were insects/other arthropods and 7% were spiders. Fifty-six percent of these samples were submitted by extension agents. Of these samples, 93% were homeowner samples and 7% were commercial. For the other 44% of the non-extension samples, 53% were submitted by homeowners while the other 47% were submitted from commercial clientele. Samples were submitted from 48 counties.

Of the samples submitted, field crops (primarily small grains and alfalfa) and seed crops accounted for 4% of the samples submitted (Table A1, Appendix). Samples from field crops included: Field peas (grasshoppers), fava beans (western flower thrips), lentils (*Blapstinus substriatus* beetle), alfalfa (alfalfa blotch leafminer, clover root curculio, false chinch bug, black blister beetle, alfalfa caterpillar, white grubs, unidentified leafhoppers) wheat (wheat stem sawfly, wheat stem maggot, Bank's grass mite, wheat head armyworm), triticale (wheat stem maggot), and barley (Haanchen mealybug). Samples from seed crops included: Seed alfalfa (alfalfa weevil) and arugula grown for seed (cabbage seedpod weevil). Cabbage seedpod weevil also infested broccoli being grown commercially on adjacent acreage.

The other 96% of the samples were submitted from trees, shrubs, vegetables, turfgrass, greenhouses, and households. The greatest number of **tree samples** came from ash, apple, aspen, birch, cherry, cottonwood, elm, hackberry, linden, maple, mountain ash, oak, pine, plum, poplar, spruce, and willow (Table A2, appendix). The **bush/shrub** hosts were cotoneaster, currant, hackberry, juniper, arborvitae, lilac, and rose. The **vegetable/fruit hosts** consisted of beans, broccoli, cabbage, cucumber, fava beans, garlic, kale, peppers, potato, spinach, and tomatoes. Some of the common insect pests associated with these vegetables/fruits included two-spotted spider mites, thrips, green peach aphids, and the spotted snake millipede, *Blaniulus guttulatus* (potatoes and strawberries). Flea beetle and flea beetle damage were common on tomatoes and potatoes. The spotted snake millipede was also found within **turfgrass**. As its biology is poorly understood, it could be causing root damage to several turfgrass species as densities are

increasing across the state. In the **greenhouse**, aphids, dark-winged fungus gnats, thrips, and leafhoppers were common. Most of the greenhouse samples consisted of tomatoes.

For **households**, a series of home-invading insects were identified (18% of the total samples). The elm seed bug, *Arocatus melanocephalu*s, was very prevalent in several counties this year, primarily as a home-invading insect; damage to elm or elm seeds was not evident. Also, several samples and calls were received about the black lygaeid seed bug, *Raglius alboacuminatus*, also known as the tuxedo bug. The Western conifer seed bug, though not as numerous as in 2016, was common in the fall on several buildings and in homes. An invasive root weevil, *Cathormiocerus spinosus*, was common in addition to three other weevils, the strawberry root weevil, the black vine root weevil, and *Romauldis bifoveolatus*. The Western boxelder bug was frequently identified. 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. Assassin bugs were common in homes.

Spider awareness and outreach have effectively reached many individuals, as spider submissions to the SDL have decreased by 87% since 2015. Spider samples constituted 29% of the home samples submitted. Of these samples, 24% were submitted for concerns about the hobo spider and whether it is harmful to humans. These diagnoses were followed with reports, which allowed for many clarifications of misinformation about spiders, particularly about the hobo spider and the brown recluse.

Other Activities

- Spoke to over 1562 people directly and over 54,000 people indirectly through 16 presentations, 3 booths, 7 “Ask an Expert” questions, 3 AMTOPP newsletters, walk-in samples, 5 media appearances, internet blogs on Facebook, 12 online alerts, emails, and phone calls
- Three articles for AMTOPP’s quarterly newsletters
- An article on carpenter ants for MSU Extension’s *“Lives and Landscapes”*
- Interview with the Glendive Ranger Review Newspaper about boxelder bugs invading homes
- Panelist on Montana Ag Live 5 times, discussing urban insect issues(average of 10,000 viewers per episode)
- 12 Urban Alerts (online PDFs) for insect and spider trends (reaching 330 subscribers with each alert)

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.

2017 Weeds Lab Summary – Plant ID, Mushroom ID, and Herbicide Injury

Diagnostic Staff

Noelle Orloff- Associate Extension Specialist

Extension Specialists

Dr. Jane Mangold, Extension Rangeland Invasive Plant Specialist
Dr. Fabian Menalled, Extension Cropland Weed Specialist

Other Cooperators

Dr. Cathy Cripps, Mushroom identification
Dr, Matt Lavin, Plant identification
Dr. Bill Hoch, Plant identification

Impacts for 2017

Accurate plant identification is critical in assessing plant toxicity, and we assisted clients with poisonous plant issues in 2017. For example, several elk died after eating an ornamental shrub, and we confirmed the plant was ornamental yew (*Taxus* x *media*), a shrub that can cause sudden death and has also been implicated in wildlife losses in Idaho in residential areas.

We are an important resource to accurately identify new plant species in Montana and increase knowledge of our flora. In 2017 we confirmed tumble windmillgrass (*Chloris verticilliata*) for the first time in our state.

Our services provide an essential resource for first detectors of high priority pests. For example, in 2017 we identified a suspected sample of common reed (*Phragmites australis* spp. *australis*), a priority 1A plant on Montana's noxious weed list. The sample is currently undergoing genetic testing to confirm our identification.

Trends in samples submitted offer opportunities to respond with increased education about emerging agriculture issues. In 2017, we noted a sharp increase in the number of pulse crop samples with symptoms consistent with herbicide carryover. We responded with phone calls, Ag Alerts through email and text, and social media posts to help raise awareness of this issue with growers, consultants, and Extension agents new to pulse crop production.

Plant Identification Activities

In 2017, the SDL processed 393 physical specimens for plant identification, and 158 electronic samples (i.e. photos in emails and texts). These numbers are similar to those observed in 2016. Samples came from 50 of 56 Montana counties (89%) and one county each in Arizona, Idaho, Nebraska, and North Dakota. The highest submission numbers were from Gallatin, Ravalli, and Flathead Counties with 97, 40, and 31 sample submissions, respectively.

Noncommercial sources (homeowners, small acreage landowners) accounted for 85% of sample submissions. Extension noncommercial was the most common submission type, accounting for 45% of all samples. These samples are typically from residential or small acreage

landowners who need information on how to control a plant in their gardens or pastures. Non-Extension noncommercial samples accounted for 40% of submissions. Samples from commercial sources (whether Extension or non-Extension) accounted for 15% of all submissions. These include farmers, ranchers, consultants, nurseries and representatives from agribusinesses.

The 551 samples submitted through physical samples and email represented 320 unique species. Forty-eight percent or 266 samples were exotic plants representing 136 unique species. The most commonly submitted exotic species were roving bellflower (*Campanula rapunculoides*, 11), dwarf alyssum (*Alyssum desertorum*, 10), Kentucky bluegrass (*Poa pratensis*, 10), yellow alyssum (*Alyssum alyssoides*, 7), and bittersweet nightshade (*Solanum dulcamera*, 7). Thirty-two percent or 179 specimens were native plants, representing 132 unique species. The most common native species was golden currant (*Ribes aureum*, 5). Ten-petal blazing star (*Mentzelia decapetala*), catchweed bedstraw (*Galium aparine*), horseweed (*Conyza canadensis*), Rocky Mountain beeplant (*Cleome serrulata*), and slender wheatgrass (*Agropyron trachycaulus*) each had four submissions.

Ten confirmed specimens of state-listed noxious weeds and regulated plants were submitted representing eight unique species (Table 3). In addition, one specimen we suspect is common reed (*Phragmites australis* ssp. *australis*) is being confirmed using molecular techniques in an outside lab. We also received specimens suspected of being high priority noxious weeds that were not. For example, two specimens suspected to be common reed were submitted to the lab and were identified as the native subspecies (*P. australis* spp. *americanus*). The SDL provides a valuable resource where land managers can get accurate information about suspected problematic plants such as these high priority noxious weeds.

Table 3. State listed noxious weeds and regulated plants submitted to the SDL in 2017. Record in italics is currently being molecularly confirmed by an outside lab.

Species	**County**	**Priority**
Canada thistle	Gallatin	2B
Cheatgrass	Anaconda-Deerlodge, Park	3
Common buckthorn	Sheridan, Yellowstone	2A
Common reed	*Lewis and Clark*	*1A*
Field bindweed	Toole	2B
Houndstongue	Gallatin	2B
Perennial pepperweed	Judith Basin	2A
Russian knapweed	Sweet Grass	2B
Yellow toadflax	Fergus	2B

Mushroom Identification Activities

In addition to plants we also identify mushroom specimens. In 2017 Dr. Cathy Cripps assisted the SDL by identifying 26 mushroom samples. These specimens were of 20 different species. Ninety-two percent of these samples were from noncommercial sources, and were found in mainly 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.

Herbicide Injury Diagnosis

We assessed 105 samples for potential herbicide injury in 2017, a 60% increase compared to 2016 (65). Of these, 40% were submitted from an agricultural setting, while 60% were submitted from urban or residential settings. We suspected herbicide injury to be affecting samples in 85% of these cases.

Of the 43 commercial agricultural samples we assessed for herbicide injury, the largest percentage was the 15 pulse crop samples we suspected were affected by herbicide carryover. This number increased dramatically since last year, when we received one pulse crop sample with symptoms consistent with this issue. We also recorded 12 cases where symptoms were consistent with herbicide injury were from in-crop applications of herbicide that resulted from situations such as mistakes in tank mixes and interactions between weather events and herbicide applications. Most of these cases were consistent with warnings on herbicide product labels, such as warnings about frost soon after application or labelled intervals between persistent herbicide application and planting legumes.

The other main group of herbicide injury cases was from turf and ornamental settings, where we assessed 62 samples for herbicide injury symptoms. Of these, 47 showed symptoms consistent with synthetic auxin herbicide injury. These symptoms could have arisen due to situations like herbicide drift from lawn applications or from herbicide carryover in garden amendments or topsoil. Several of these cases were consistent with off-label use of an herbicide not labelled for residential application (i.e. aminopyralid or metsulfuron). In seven cases we were able to pinpoint the likely cause as carryover in garden amendments. In two cases turf grasses died due to suspected misapplication of unknown herbicides.

Education and Outreach Activities

The diagnostician provided 19 workshops or interactive trainings in 2017 that reached 925 participants. These trainings covered topics including herbicide injury diagnosis, plant anatomy, noxious weed and invasive annual grass identification and management, first detector training for phragmites, grass identification, use of a dichotomous key, and identification of common or important urban trees. Audiences included school groups, private and commercial/governmental pesticide applicators, landscape professionals, agricultural producers, and Extension faculty.

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 timely pest management and pesticide education articles for Montana homeowners, pesticide applicators, farmers, and ranchers.

Goals for 2018 are to continue to offer accurate, timely reports on plant identification and herbicide injury issues; provide education on weed and native plant identification and promote IPM practices to manage weeds; develop identification workshops for species commonly used in landscaping in Montana; and assist with developing curriculum and resources focused on the issue of herbicide injury diagnosis and prevention.

Appendices: Pests associated with specific hosts in 2017

Table A1. Diseases associated with agricultural hosts submitted to the SDL in 2017.

Host	Disease	Insect/mite
Alfalfa	Alfalfa bacterial stem blight Fusarium wilt Rhizoctonia root rot Spring black stem Stemphylium laf spot	Alfalfa blotch leafminer Alfalfa caterpillar Alfalfa weevil Black blister beetle Clover root curculio False chinch bug Leafhoppers White grubs
Arugula	NA	Cabbage seedpod weevil
Barley	Bacterial blight Barley leaf streak Barley loose smut Barley net blotch Fusarium crown and/or root rot Helminthosporium diseases Rhizoctonia root rot	Haanchen mealybug
Cabbage	NA	Cabbage seedpod weevil
Chia	Fusarium root rot	NA
Chickpea	Ascochyta blight Ascochyta leaf spot Bacterial blight Fusarium root rot Verticillium wilt	
Corn	Alternaria leaf spot	NA
Dry field pea	Ascochyta leaf spot Fusarium root rot Bacterial blight	Grasshoppers
Fava bean	Nutrient imbalance	Western flower thrips
Lentil	Ascochyta leaf spot Fusarium root rot Phoma leaf spot Pythium root and/or crown rot	*Blapstinus substriatus* beetle
Triticale	NA	Wheat stem maggot

Host	Disease	Insect/mite
Wheat	Cephalosporium stripe	Bank's grass mite
	Fusarium root and/or crown rot	Wheat head armyworm
	Helminthosporium diseases	Wheat stem maggot
	Pythium root and/or crown rot	Wheat stem sawfly
	Rhizoctonia root rot	
	Take-all	
	Tan spot	
	Wheat powdery mildew	
	Wheat streak mosaic virus + wheat curl mites	

Table A2. Diseases and insects associated with urban/ornamental plant hosts submitted to the SDL in 2017.

Host	Disease	Insect
Apple	Fire blight Bacterial blight	Appleleaf blister mites Codling moth Flat-headed apple tree borer
Apricot	Bacterial canker	NA
Ash	Anthracnose	Ash plant bug Ash flower gall mite, *Eriophyes fraxiniflora* Cambium miner, *Phytobia* sp. Carpenterworm Cottony ash psyllid (black ash only) Lilac/ash borer Western ash bark beetle
Aspen/Cottonwood/ Poplar	Cytospora canker Marssonina leaf spot	Aspen leaf miner Oystershell scale Poplar borer Poplar blackmine beetle Poplar bud gall mite Poplar vagabond aphid Two-spotted spider mite
Birch	NA	Aphids Birch leafminer
Cherry	Bacterial canker	Erineum galls Leafcurl plum aphid Pear sawfly
Choke Cherry	Black knot	NA
Cotoneaster	Bacterial leaf spot	Oystershell scale
Crabapple	Bacterial blight Bacterial leaf spot Fire blight	NA
Elm	NA	Elm leafminer Eriophyid mites European elm scale Wooly elm aphid
Fir	Cytospora canker	Spruce spider mite Western spruce budworm

Host	Disease	Insect
Hackberry	NA	Hackberry nipplegall maker
Honeylocust	Powdery mildew	Honeylocust leafhopper Honeylocust podgall midge Honeylocust spider mite
Honeysuckle	Bacterial blight	Spider mites Thrips
Lilac	Bacterial blight	Eriophyid mites Rust mites
Linden	NA	Eriophyid mites Linden aphid
Maple	Abiotic disorder	Cottony maple scale Eriophyid mites (finger & erineum galls) European fruit lecanium Norway maple aphid
Mountain ash	NA	Eriophyid mites
Oak	Oak leaf blister	Gall wasp (*Callirhytis* sp.) Oak rough bulletgall wasp Scarlet oak sawfly
Pine	Dothistroma needle blight Western gall rust	Conifer sawflies Pine engraver, *Ips* sp. Pine needle scale Pine sawyer beetle Spittlebug Spruce spider mite
Pear	Fire blight	NA
Plum	Bacterial blight	European fruit lecanium Leafcurl plum aphid Plum gouger Plum curculio
Rose	Abiotic disorder	Black vine weevil Pear sawfly Rose midge Thrips Tortricid leafrollers Two-spotted spider mite

Host	Disease	Insect
Spruce	Cytospora canker Rhizosphaera needle cast Sudden needle drop Spruce broom rust	Pine needle scale Cooley spruce gall adelgid Giant conifer aphids Spruce spider mite Western spruce budworm White sitka spruce weevil
Turfgrass	Snow mold Pythium root rot Rhizoctonia root rot Take-all	NA
Viburnum	Sooty mold	Snowball aphid Viburnum erineum mite Western flower thrips
Vines/Virginia creeper	Abiotic disorder	Western grape leafhopper Virginia creeper leafhopper
Willow	Bacterial leaf spot	Eriophyid mites Two-spotted spider mite Willow redgall sawfly