2019 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 2019, the SDL conducted 2,588 plant, plant disease, insect, mushroom, and abiotic diagnoses in 55 of 56 Montana counties and seven additional states.

- Over $4.9 million was saved affecting approximately 190,000 acres as a result of SDL recommendations.
- 86% of the survey respondents thought the SDL services were extremely or very useful in solving plant or arthropod-related problems.
- 93% of the survey respondents thought the timeliness of response was good or excellent.
- 70% of survey respondents said the diagnoses and recommendations from the SDL influenced their management decisions.

**Results of 2019 client surveys, n=225* *Data from "Schutter Diagnostic Lab Surveys" compiled by MSU HELPS Lab, 2019.

Impacts and Outcomes

- The timely response and correct diagnosis of the diagnostic team ensures that unnecessary treatments are avoided, and integrated pest management strategies are applied to address pest problems. For example, examples rapid identification of diseases on plants grown in a hydroponic setting prevented financial losses of up to $150,000.
- Montana residents trust the unbiased diagnostic reports and continue to reach out to the SDL for solving plant disease problems. One respondent to a survey claimed that $1.7 million was saved as a result of a sample submitted to the SDL.
- Insect identifications helped to protect several important artifacts in museums across the state, including books, textiles, repositories for Western artists, and contemporary art.
- For four cases of "suspected bed bugs", swallow bugs and bat bugs were confirmed, eliminating an unnecessary need for costly bed bug treatments.
- We are an important resource to accurately identify new plant species in Montana and increase knowledge of our flora. In 2019 we confirmed globe thistle (*Echinops sphaerocephalus*) and partridge pea (*Chamaecrista fasciculata*) for the first time in our state.
- Accurate plant identification is critical in assessing plant toxicity, and we assisted clients with poisonous plant issues in 2019. For example, this year we processed several samples of pasture plants that clients were concerned may be toxic to their livestock.

Quotes from clients in 2019

- "I was able to supply my clients with accurate diagnosis of their specific problem, from a non-biased source."
- "Identifying and reducing pests were significant for helping our customers succeed."
- "Your quick diagnoses and plainly stared mitigation steps are truly appreciated by clients and the guys and me."
- "Sample submission is very easy and response time is amazingly fast."
- "The SDL is a tremendous resource for agriculture in Montana. We regularly take advantage of the plant identification, plant disease (herbicide injury), and insect identification services it provides from its great staff."

Contents

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 advice, 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 in a way that minimizes 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 Montana and to the U.S. to prevent significant limitations to agricultural production and international trade.

In 2019, the SDL conducted a total of 2,588 plant disease, insect/other arthropod, plant, mushroom, herbicide injury, and other abiotic disorders diagnoses through physical, email, and APP (Plant Sample Submission App) samples (Table 1).

Table 1. Number of diagnoses by the Schutter Diagnostic Lab in 2019.

	Number of Diagnoses
Plant Disease	950
Insects & Other Arthropods	724
Plant & Mushroom ID	491
Herbicide Injury	95
Other Abiotic Disorders	328
Total	**2588**

Samples were received from 55 of 56 counties in Montana and seven additional states- Colorado, Michigan, Nebraska, North Dakota, Oregon, Washington, and Wyoming. The greatest number of diagnoses were in Gallatin, Hill, Park, Lewis and Clark, and Flathead Counties in 2019.

In addition to diagnostic services, SDL diagnosticians provided outreach, research, and educational materials about pests of concern to clients in Montana. The SDL maintains a Facebook page that has over 550 users. In 2019, we had a post reach of over 36,000 from our total of 60 Facebook posts, and an average of 80 engaged users per post. Our posts usually focus on timely information about plant diseases, insects, and plant identification for our wide range of clientele. We also send out Urban Alerts (https://mturbanalert.org) and AgAlerts (https://mtagalert.org) that inform our clientele on trends and pertinent diagnostic issues statewide. The MSU Urban Alert system (483 subscribers) is intended for Extension agents, landscape professionals, arborists, city foresters/managers, and any other client concerned with ornamental plants and vegetables. In 2019, 20 urban alerts were posted. The MSU AgAlert system (1213 subscribers) provides current and research-based information for Montana agricultural clients. There were 25 AgAlerts posted in 2019.

2019 Plant Disease Summary

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

Other Assistants/Specialists:
Dr. Cathy Cripps, Mycologist
Toby Day, Extension Horticulture Specialist (January-April 2019)
Dr. Mareike Johnston, Plant Pathologist
Cheryl Moore-Gough, Extension Horticulture Specialist (June-December 2019)
Sarah Eilers, IPM Manager
Chance Noffsinger, Research Assistant

Impacts & Outcomes

- The timely response and correct diagnosis of the diagnostic team ensures that unnecessary treatments are avoided, and integrated pest management strategies are applied to address pest problems. Examples are the timely diagnosis of a) "winter injury" of numerous spruce trees in spring of 2019 which prevented unnecessary treatment applications and b) rapid identification of diseases on plants grown in a hydroponic setup prevented financial losses from $5,000 to $150,000.
- Montana residents trust the unbiased diagnostic reports and continue to reach out to the SDL for solving plant disease problems. One respondent to a survey claimed that $1,7 million was saved as a result of a sample submitted to the diagnostic lab.
- We detected white rust (*Albugo candida*) for the first time in Montana. It was detected on mustard, and it can be an important pathogen of canola.

Trends from 2019: Agriculture

Agricultural crops accounted for 302 plant disease diagnoses. Overall it was a low disease year due to an extended cold spring. Late or lack of harvest of cereals and pulses in the northeastern corner of the state may provide disease inoculum for 2020 if environmental conditions are favorable.

The most frequently submitted crops were cereals (31 winter wheat, 27 barley, 21 spring wheat, 5 durum wheat) and pulse crops (26 chickpea, 21 lentil, 24 dry pea). A new disease in the state noted on mustard was white rust, *Albugo candida*, which can be an important pathogen of canola. Fusarium diagnoses dominated including Fusarium root rot (39) and Fusarium crown rot (9). Fusarium affected barley, spring/winter/durum wheat, chickpea, dry field peas, lentils, and corn. Pythium (8) and Rhizoctonia (17) root rot were also common affecting barley, winter and spring wheat, and chickpea. Foliar diseases of chickpea were dominated by Ascochyta blight (14). Safflower (2) was affected by Alternaria leaf blight. Four samples of Wheat streak mosaic virus were confirmed (1 barley, 2 spring wheat, 1 winter wheat). White mold was confirmed in chickpea, dry pea, and lentil. Aphanomyces euteiches was confirmed in several counties with a history of pulse production.

Reduced efficacy of prothioconazole (trade name: Proline) on Ascochyta blight of chickpea in research plots at the Eastern Agricultural Research Center was noted by Dr. Frankie Crutcher. She is currently testing isolates for fungicide resistance.

Trends from 2019: Horticulture

Horticultural samples accounted for 648 disease diagnoses. The extreme low temperatures in February and March caused winter injury on 64 submitted conifer samples. Fruit trees also showed symptoms of frost damage. Apple and crabapple tree samples were diagnosed with mainly fire blight this year.

Vegetables like tomatoes, eggplants and garlic were affected by white mold (*Sclerotinia* sp.). Lettuce, tomatoes, and other vegetables grown under controlled and/or hydroponic production were affected by powdery mildew, grey mold and root rot pathogens.

An unusual number of raspberry samples with deformed and discolored leaves were submitted. Following investigation, the plants were not affected by disease but suspected to be affected by environmental and/or cultural factors.

Throughout the year, evergreen samples, especially Colorado blue spruce and blue spruce, were submitted with symptoms of Rhizosphaera needle cast disease or sudden needle drop. Pine trees were affected by Dothistroma needle blight.

In late summer, Marssonina leaf spot was evident on aspen, poplar and cottonwood trees. Turfgrass was mainly affected by root rots caused by *Rhizoctonia* sp. or *Pythium* sp.

Sample Summary

In 2019, the SDL made 950 plant disease and 328 abiotic disorder diagnoses. Samples were mainly submitted by extension personnel (52%) with 44% from non-commercial and 8% from commercial entities. Commercial entities outside of MSU accounted for 28 % of the samples. The number of non-Extension, non-commercial samples accounted for 20%. The highest number of samples came from homeowners/gardeners (30%), growers/farmers (10%), agribusiness (8%), and arborists (5%). Other submitters include crop consultants, companies, regulatory agents, and lawn care professionals.

Deciduous and evergreen woody ornamentals accounted for 42% of the total disease samples submitted to the SDL. Sample hosts of this category included apple, crabapple, Colorado blue spruce, blue spruce, green ash, maple, aspen and pine trees. Field crops like chickpea, lentils, dry peas and small grains like wheat and barley accounted for 25% of disease samples. Fruit and vegetable samples (apple, raspberry, tomato, lettuce, herbs) accounted for 15%, and turf samples accounted for 4% of the samples.

2019 Insect Diagnostics Summary

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

Other Assistance/Specialists:
Dr. Michael Ivie, *Systematic Entomologist,* MSU
Dr. Justin Runyon, *Entomologist,* US Forest Service
Dr. Casey Delphia, *Research Associate/Entomologist,* MSU
Dr. Thomas Schwan, *Rocky Mountain Laboratories*

Impacts & Outcomes

- Quarantined pest discovered in Ravalli Co., *Rhyparochromus vulgaris* (Hemiptera: Rhyparochromidae)
- New county records for the following:
  - *Prionus fissicornis* (Coleoptera: Cerambycidae)-Daniels Co.
  - *Hyperplatys aspersa* (Coleoptera: Cerambycidae)-Sheridan Co.
- For several samples submitted from agricultural land, identifications of non-damaging/beneficial organisms were made, including potworms, lady beetle larvae, *Collops* beetles, and dung beetles.
- For four cases of "suspected bed bugs", swallow bugs and bat bugs were confirmed, eliminating an unnecessary need for costly bed bug treatments.
- Insect identifications helped to protect several important artifacts in museums across the state, including books, textiles, repositories for Western artists, and contemporary art.
- A beneficial ground beetle was confirmed, *Pterostichus* sp., for a suspected blister beetle, eliminating the need for treatment or economic concerns in alfalfa hay.
- The American dog tick, *Dermacentor variabilis*, was identified, and the clients were assured that they did not have a tick that vectored Lyme disease.
- A diagnosis of wasps rather than honeybees in Gallatin County saved a homeowner from an unnecessary interior wall demolition within his home.

Trends from 2019

- An outbreak of thistle caterpillars, the larval stage of the painted lady butterfly, occurred throughout the month of June. Thistle caterpillars feed on over 100 host plants, mainly in the Asteraceae family. They are capable of completely defoliating the host, and their favorite targets are weedy thistles. Painted lady butterflies migrate from the deserts of northern Mexico as far north as Canada, breeding at intervals along the way. Outbreak years occur when population explosions in Mexico cause massive northward migrations.
- As quinoa acreage grows, we see an increasing number of quinoa insect samples submitted for identification and management recommendations. These include goosefoot groundling caterpillar, *Scrobipalpa atriplicella*, and the plant bugs *Melanotrichus coagulatus* and *Lygus lineolaris*.
- Several reports of the poplar borer, *Saperda calcarata*, were recorded statewide, particularly on aspens.

- Horntails (both *Urocerus* sp. and the pigeon tremex, *Tremex columba*) were commonly found throughout the state on trails and yards.
- The aspen blotch leafminer, *Phyllonorycter* sp., is a moth that infests cottonwoods, poplars, and aspen leaves, causing leaf blotches and necrotic spots. Damage is usually considered cosmetic.
- Garden spiders, both the banded garden spider, *Argiope aurantia*, and the silver Argiope, *Argiope trifasciata*, were commonly reported.
- Caterpillars of the bedstraw hawkmoth, *Hyles gallii*, were common, particularly in Gallatin County.
- Several species of carpet beetles and ants were submitted for diagnosis from inside the home. For ants, the odorous house ant, *Tapinoma* sp., and pavement ants, *Tetramorium* sp. were common.
- Stink bugs were submitted as suspected invasive insects from a shipment of explosives from Peru for avalanche control at Big Sky Resort and were confirmed as non-invasives.

Sample Summary

In 2019, 724 arthropod diagnoses were completed. Of these identifications, 71 (10%) were spiders and 653 (90%) were insects or other arthropods.

Of the samples submitted, 93% were submitted from trees, shrubs, vegetables, turfgrass, greenhouses, and households. The greatest number of tree/bush samples came from apple, arborvitae, ash, aspen, birch, cherry, cotoneaster, Douglas-fir, elm, grape, hackberry, honeylocust, juniper, lupine, maple, mountain ash, oak, pine, poplar, raspberry, rose, spruce, and willow. The most common pests associated with these woody ornamentals are shown in Table A1. The main vegetable hosts consisted of bell pepper, cabbage, cucumber, eggplant, garlic, tomato, potato, and spearmint. Some of the common pests on these hosts included aphids, beet leafminers, flea beetles, spider mites, and thrips. In the greenhouse, thrips, spider mites, springtails, and broad mites were common. Field crops accounted for the other 7% of the samples submitted. Samples from field crops and forages included alfalfa, quinoa, pea, canola, hemp, lentil, barley, rye, safflower, wheat, and wheatgrass.

For households (20% of all insect diagnoses), ants, spiders, flour beetles, flies (fungus gnats, milichiid flies), ground beetles, leaf-cutting bees, and root weevils were commonly found in the home. Bed bug samples were submitted from several counties, suggesting a further need for awareness and prevention throughout the state.

Spider samples constituted 10% of all diagnoses and 26% of the household samples submitted. Several suspected brown recluse spiders were submitted. All diagnoses were followed with reports, which allowed for many clarifications of misinformation about spiders, particularly about the hobo spider and the brown recluse.

2019 Weeds Lab Diagnostic Summary

Diagnostic Staff:
Noelle Orloff, Associate Extension Specialist II

Other Assistance/Specialists:
Dr. Cathy Cripps, Mushroom Identification
Dr. Matt Lavin, Plant Identification
Dr. Jane Mangold, Rangeland Invasive Plant Specialist
Chance Noffsinger, Mushroom Identification
Dr. Tim Seipel, Cropland Weed Specialist

Impacts & Outcomes

- Accurate plant identification is critical in assessing plant toxicity, and we assisted clients with poisonous plant issues in 2019. For example, this year we processed several samples of pasture plants that clients were concerned may be toxic to their livestock.
- We are an important resource to accurately identify new plant species in Montana and increase knowledge of our flora. In 2019 we confirmed globe thistle (*Echinops sphaerocephalus*) and partridge pea (*Chamaecrista fasciculata*) for the first time in our state.
- Our services provide an essential resource for first detectors of high priority pests. For example, in 2019 we assisted in identification of a suspected sample of common reed (*Phragmites australis* spp. *australis*), a priority 1A plant on Montana's noxious weed list. The sample's identity was confirmed using molecular methods and is a first report for Missoula County.
- Our identifications help protect native plant communities by preventing unnecessary pest control. For example, a client was concerned they had Montana noxious weed ventenata (*Ventenata dubia*), but we were able to identify their grass of concern as Montana native bunchgrass Richardson's needlegrass (*Achnatherum richardsonii*).

Plant Identification Activities and Trends

In 2019, the SDL processed 279 physical specimens for plant identification, and 163 electronic samples (i.e. photos in emails, texts, and through our sample submission app). These sample numbers are 30% lower than those observed in 2018.

Most samples came from noncommercial sources such as government personnel, homeowners, and small acreage landowners. These samples accounted for 80% of sample submissions. Noncommercial samples are typically from residential or small acreage landowners who need information on how to control a plant in their management area or in gardens or small pastures. Samples from commercial clients such as farmers, ranchers, consultants, nurseries, and representatives from agribusinesses accounted for 20% of all submissions.

The samples submitted represented 295 unique species. Forty-five percent of these samples were exotic plants. The most commonly submitted exotic species were cheatgrass (*Bromus tectorum,* 8), roving bellflower (*Campanula rapunculoides*, 7), smooth brome (*Bromus inermis*, 6), and witchgrass (*Panicum capillare*, 6). Thirty six percent of physical samples were native plants. The most common native species were hairy evening primrose (*Oenothera villosa*, 6) and fireweed (*Epilobium angustifolium*, 5).

Sixteen confirmed specimens of state-listed noxious weeds were submitted representing 12 unique species (Table 2). This number includes one samples that is a new report of a given noxious weed in that county. 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 2. State listed noxious weeds and regulated plants submitted to the SDL in 2019. Records in italics represent first county reports.

Species	County	Priority
Common buckthorn	Lake	2A
Common reed	*Missoula*	1A
Common tansy	Gallatin	2B
Dalmatian toadflax	Beaverhead	2B
Hoary alyssum	Flathead, Gallatin, Judith Basin	2B
Houndstongue	Flathead	2B
Knotweed complex	Lewis & Clark	1B
Perennial pepperweed	Judith Basin	2A
Rush skeletonweed	Mineral	1B
St. Johnswort	Big Horn, Sanders	2B
Ventenata	Wheatland	2A
Whitetop	Fergus	2B

Mushroom Identification Activities

In addition to plants we also identify mushroom specimens. In 2019 Dr. Cathy Cripps and Chance Noffsinger assisted the SDL by identifying 47 mushroom samples. These specimens were of 30 different species. All but one of these samples were from noncommercial sources, and were found in mainly lawns, gardens, or natural areas. Mushroom identification clients are most often interested in edibility or toxicity of mushrooms, and proper identification is vital for these types of questions.

Herbicide Injury Activities and Trends

We assessed 88 physical samples for potential herbicide injury along with seven electronically submitted samples. This number is a 35% decrease compared to 2018. Of these, 27% were submitted from an agricultural setting, while the remaining 73% were submitted from non-crop or residential settings. We suspected herbicide injury to be affecting samples in 87% of these cases.

Most herbicide injury cases were from ornamental or vegetable garden settings, where we assessed 62 samples for herbicide injury symptoms. Of these, 27 woody ornamentals showed symptoms consistent with synthetic auxin herbicide injury. These symptoms could have arisen due to situations like herbicide drift from lawn applications. Fourteen vegetable samples from home gardens also showed symptoms consistent with synthetic auxin herbicide injury. These cases may have also been due to herbicide drift, or they may have arisen because of herbicide carryover in garden amendments or soil. Other issues we encountered in residential landscapes included soil sterilant herbicide injury symptoms (3 cases) and plants showing glyphosate injury symptoms (2 cases).

Of the 24 commercial agricultural samples we assessed for herbicide injury, the largest percentage was the eight samples where symptoms were explained by other environmental factors or plant disease. We also recorded six cases where symptoms were consistent with herbicide injury from in-crop or pre-plant applications of herbicide that resulted from situations such as interactions between weather events and herbicide applications. Examples of these were symptoms of photosynthesis inhibitor herbicide injury in pulse crops following pre-plant applications of sulfentrazone and carfentrazone and necrotic spotting of small grains following applications that contained bromoxynil. There were a range of other issues suspected including herbicide carryover in pulse crops for both ALS inhibitor herbicides (1) and synthetic auxin herbicides (1).

Appendix: Pests associated with specific hosts in 2019.

Table A1. Common insects and diseases associated with ornamental plant hosts submitted to the Schutter Diagnostic Lab, 2019.

Host Tree	Common Insects	Common Diseases
Apple	Blister mites, oystershell scale	Fire blight
Arborvitae	False spider mites, spruce spider mites	Pestalotiopisis tip blight
Ash	Ash flower gall mites, ash plant bugs, eriophyid mites	Ash anthracnose
Aspen, Cottonwood, Poplar/Populus spp.	Aspen blotch leafminers, Chaitophorus aphids, cottonwood leaf beetles, eriophyid mites, poplar borers, poplar leaf gall mites, spider mites	Marssonina leaf spot, cytospora canker
Birch	Birch leafminers, bronze birch borer, tortricid leafrollers	NA
Boxelder	Boxelder erineum mite	NA
Cherry	Tortricid leafrollers, black cherry aphids, pear slugs/sawflies	Fungal canker
Cotoneaster	Oystershell scale, aphids	NA
Douglas fir	Spruce spider mites, Western spruce budworm	Rhabdocline needle cast
Elm	Woolly elm aphids, lacebugs, elm leafminer, European elm flea weevil, European elm scale	Dutch Elm disease, anthracnose
Fir	Western spruce budworm	Needle cast disease
Hackberry	Hackberry nipple gall maker	NA
Honeylocust	Honeylocust podgall midge	NA
Maple	Eriophyid mites, plant bugs	Maple anthracnose
Mountain ash	Eriophyid mites	Fire blight, cytospora canker
Oak	Callirhytis oak gall wasp, rough oak bulletgall wasp	Oak leaf blister
Pine	Cinara aphids (giant conifer aphids), spruce spider mites, pine needle scale, European pine sawfly	Dothistroma needle blight
Plum/Pear/Prunus spp.	Aphids, tent caterpillar, pear slugs/sawflies	Shothole disease, cytospora canker, powdery mildew
Rose	Gall wasps, rose slug, European fruit lecanium	Rose rust
Spruce	Aphids, Cooley spruce gall adelgid, leafhoppers, pine needle scale, spruce bud scale, spruce spider mites, Western spruce budworm, white pine/sitka spruce weevil	Rhizosphaera needle cast, cytospora canker
Viburnum	Snowball aphid, viburnum erineum mites	Bacterial leaf spot
Willow	Cottonwood leaf beetles, Pterocomma aphids, willow redgall sawfly	Willow black canker