2024 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 2024, the SDL conducted 2,309 plant, plant disease, insect, mushroom, and abiotic diagnoses in 49 Montana counties and 5 additional states – Arizona, Colorado, Michigan, North Dakota, and Wyoming.

- 90% of SDL clients thought the timeliness of a response/diagnosis was good or excellent*.
- 91% of SDL clients found the clarity of the information provided with the diagnosis/identification was good to excellent*.
- 84% of SDL clients found SDL services very to extremely useful in solving their plant- or arthropod-related problems*.
- 57% of SDL clients adapted their pest management decisions based on recommendations provided in the SDL report*.

Selected Impacts and Outcomes

- We are an important resource for documenting new organisms that occur in our state.
    - A tick removed from a hunting dog in eastern Montana's Dawson County was confirmed to be the blacklegged tick (*Ixodes scapularis*, also called the deer tick), which is the primary tick that carries and transmits Lyme disease in the eastern United States. This is the first time this important tick species has been documented in Montana, and the discovery has important health implications for those working and recreating outdoors.
- Early detection of agriculturally important pests is an important role of our lab. Two *Amaranthus* species, Palmer amaranth (*A. palmeri*) and waterhemp (*A. tuberculatus*), are of increasing concern in Montana due to their projected economic impact on agriculture. Due to this concern, in 2024 we received eight *Amaranthus* samples for identification along with numerous questions.
    - Working with local Extension field faculty we confirmed Palmer amaranth in one new county in Montana and sent the samples for PCR testing for confirmation. This is the third known detection of Palmer amaranth in Montana, with the first being confirmed by the SDL in 2023.
    - In the remaining cases where field faculty, clients, and partners were concerned about Palmer amaranth and waterhemp, we identified other species instead. These identifications saved producers and land managers significant time and money by avoiding unnecessary and costly treatments.
- The diagnoses of environmental or cultural causes of reduced plant health, where disease problems were initially suspected, saved SDL clients money from unnecessary treatments and reduced the potential environmental impact associated with pesticide applications. For example, over two hundred submitted woody ornamental samples were suspected of disease but were diagnosed as winter injury or other abiotic disorders, making a pesticide application unnecessary.
- “The Schutter Diagnostic Lab provides a plethora of services that benefit Montanan’s. From diagnosing diseases that can cause thousands of dollars in crop damage to helping the local gardener identify an insect eating their potatoes, the lab is a phenomenal asset. Many people with low incomes are also served as the lab is free and easy to use.”**

* Results of the 2024 SDL client survey, n=92, compiled by MSU Social Data Lab.

** Direct quote copied verbatim from the 2024 Extension agent feedback survey, n=92, compiled by MSU Social Data Lab.

How MSU Extension field faculty benefited from SDL services in 2024[†]:

- "Help constituents with lawn, garden, insect, and plant diagnosis and identification. The lab is easy to work with and an asset to Montanans."
- "We can speculate all we want about which disease is affecting the plants. To have affirmation is key. Then we can solve the problem."
- "Peace of mind that I don't need to be able to id/diagnose everything! I've got a team at SDL for confirmation, advise, tips, and management a phone call away!"
- "Providing producers with accurate information so they can move forward with research based management decisions."
- "Being able to assure customers that diagnosis of plant and tree is correct."

What other SDL clients appreciated about SDL services in 2024[‡]:

- "[We benefited by] Receiving an accurate diagnosis so we could treat or not treat the trees appropriately. In both cases no pesticides were determined to be necessary, so no unnecessary chemical treatments were used."
- "I work at a school, and we needed to know what type of bug we had in our building and yes it did help us identify and realize what we needed to do to protect the other children in our care."
- "Identification of the source of the problem and recommendations not only how to deal with it at the moment, but how to prevent recurrence in the future."
- "Discovering that such detailed and expert advice is readily available to the home gardener was a pleasant surprise. It's a great help to those of us without the expertise to analyze and combat similar problems on our own. I'm delighted to see my tax dollars go to the provision of such a great service. Thank you!"
- "The diagnosis and subsequent email exchange helped me to understand more about the native cottonwoods on our property and contributed to better preservation of a riparian area alongside Bear Creek."
- "This is a great service that helps not only the person submitting a sample but for all of Montana when serious situations show up. There is no other service like this available in the state."

MONTANA STATE UNIVERSITY
EXTENSION
Schutter Diagnostic Laboratory

† Selected quotes copied verbatim from the 2024 Extension agent feedback survey, n=29, compiled by MSU Social Data Lab.

‡ Selected quotes copied verbatim from the 2024 SDL client survey, n=92, compiled by MSU Social Data Lab.

Contents

Introduction

The mission of the Schutter Diagnostic Laboratory (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, where IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic and environmental risks. Our mission also includes early detection of new and invasive pests that may pose a risk to Montana and the U.S. to prevent significant limitations to agricultural production and international trade.

Local MSU Extension offices represent the largest SDL customer group. Other SDL clients submitting samples in 2024 were homeowners/gardeners (47.2%), growers/farmers (13.5%), researchers/specialists (5.6%), agribusiness (5.6%), landscapers (4.5%), arborists (4.5%), regulatory agents (4.5%), crop consultants (3.4%), agent/educator (2.3%), tree farmer (3.2%), and pest control operators (1.1%), based on 92 survey responses to the 2024 SDL client survey.

In 2024, the SDL conducted a total of 2,309 plant disease, insect/other arthropod, plant, mushroom, herbicide injury, and other abiotic disorders diagnoses through physical, email, and Plant Sample Submission app samples (Table 1).

Table 1. Number of diagnoses by the Schutter Diagnostic Lab in 2024.

Diagnosis Type	**Number of Diagnoses**
Plant Disease	846
Arthropods	679
Plant ID	288
Mushroom ID	29
Herbicide Injury	69
Other Abiotic Disorders	398
Total	**2,309**

We received samples from all 49 counties in Montana and 5 additional states – Arizona, Colorado, Michigan, North Dakota, and Wyoming. Most samples, 62%, were submitted through MSU Extension services, and 38% were submitted from non-Extension clientele. Most samples from Extension were received from Gallatin, Hill, Sanders, and Ravalli Counties. Ninety percent of Extension samples were from non-commercial clientele while 10% were from commercial sources. For the non-Extension samples, 60% were from non-commercial clientele and 40% from commercial sources. Eighty percent of the sample diagnoses were associated with a weed, disease, or pest while 20% of the diagnoses were from abiotic causes (i.e., winter injury, nutrient imbalance, suspected herbicide injury, drought, or cultural problems).

In addition to diagnostic services, SDL diagnosticians provide outreach materials about pests of concern to clients in Montana. For example, the SDL maintains a Facebook page that has over 1,000 followers. In 2024, we published a total of 20 Facebook posts reaching over 63,000 people, with an average of 83 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 and AgAlerts that inform our clientele about pertinent issues statewide via text or email. The MSU Urban Alert system (865 subscribers) is intended for Extension field faculty, landscape professionals, arborists, and anyone concerned with ornamental plants and vegetables. In 2024

we posted 6 Urban Alerts. The MSU AgAlert system (2,179 subscribers) provides current and research-based information for Montana agricultural clients. There were 16 AgAlerts posted in 2024.

2024 Plant Disease Summary

Diagnostic Staff

Dr. Uta McKelvy, Assistant Professor Extension Plant Pathology
Dr. Eva Grimme, Plant Disease Diagnostician & Associate Extension Specialist III

Other Assistants/Specialists

Erin Gunnink-Troth, Research Associate
Abiya Saeed, Extension Horticulture Specialist
Sarah Eilers, Montana Master Gardener Coordinator

Impacts and Outcomes

- Accurate and timely diagnosis of plant diseases is key to applying successful management strategies. The SDL team is focusing on integrated pest management strategies to address plant problems. Through collaboration of the SDL team with MSU Extension specialists, best management strategies are developed to effectively address plant health issues.
- Over two hundred submitted woody ornamental samples were suspected of disease but were diagnosed as winter injury or other abiotic disorders, making a pesticide application unnecessary.
- Suspected fire blight samples were diagnosed utilizing disease diagnostic kits, rapidly confirming the disease on 33% of the submitted samples. Clients were able to implement IPM strategies promptly.
- The SDL is testing in-vitro mint plants for *Verticillium dahliae* for the fifth year. The absence of Verticillium is essential for mint growers to ensure that only healthy plant materials are distributed to customers. In 2024, we tested in-vitro samples of nine lines. We will continue to support Montana's mint producers by providing this testing service.

Sample Summary

In 2024, the SDL completed 846 plant disease diagnoses (agricultural and horticultural samples). Samples submitted through the Plant Diagnostics Information System (PDIS) by MSU Extension personnel (54.6%) consisted of 49.2% non-commercial and 5.4% commercial entities. Samples submitted by entities outside of MSU Extension accounted for 44.9 % with 22.4% coming from commercial sources and 20.5% from non-commercial sources.

A total of 188 agricultural samples were submitted for disease diagnosis in 2024. Small grain crops accounted for 60% of all crop samples 4 (113 samples processed; 42 winter wheat, 23 unspecified wheat, 11 barley, 8 spring wheat, further durum wheat, oats, corn, triticale, and kernza). Pulse crops (17%) constituted the second-largest group of crop samples (32 samples processed; 8 chickpea, 6 dry field pea, and 3 lentil samples), followed by potato (17 samples). Other crops submitted for disease diagnosis in 2024 included garlic (8%), potato (7%), alfalfa (4%) dry beans (3%) and forage grasses (2%).

Deciduous woody ornamentals accounted for 26% and evergreen woody ornamentals accounted for 21% of the horticulture diagnoses made by the SDL in 2024. Sample hosts of these categories included Colorado blue spruce, blue spruce, pine trees, fir, lilac, juniper, poplar, crabapple, oak, arborvitae, and maple trees.

Fruit and vegetable samples (apple, pear, cherry, raspberry, tomato, garlic, herbs) accounted for 19%, perennial & annual plants for 6%, and turf samples accounted for 2% of the horticulture diagnoses.

Trends from 2024: Agriculture

Agricultural crops accounted for 308 plant disease diagnoses in 2024. This is a decrease compared to 458 diagnoses processed in 2023. Of these, 236 diagnoses identified disease problems (77%) and 72 diagnoses identified abiotic disorders (33%). Samples were received from 37 of 56 Montana counties, with Gallatin, Hill, Choteau, Cascade, Pondera, and Teton counties contributing over 50% of agricultural crop samples.

Fifty-five percent of diagnoses that identified a disease problem in 2024 were associated with fungal and fungal-like pathogens. Root, crown, and seedling rots accounted for 28% of all crop disease diagnoses in 2024. Root rots associated with *Fusarium* sp. were very common (17%) affecting spring and winter wheat, chickpea, field peas, garlic, lentil, blue flax, bluebunch wheatgrass, and triticale; *Rhizoctonia* sp. (5%) caused root diseases in chickpea, garlic, spring and winter wheat; *Cochliobolus sativus* caused common root rot (2%) on spring and winter wheat and oats, while oomycete pathogens (*Aphanomyces* sp., *Pythium* sp.) caused root rot (3%) on dry peas, flax, garlic, soybean, and sugar beet. Phytophthora root rot was diagnosed on a blue flax sample.

Fungal foliar diseases accounted for 13% of all crop disease diagnoses in 2024 (29 diagnoses). This represents a decrease compared to 2023 when a total of 82 diagnoses described fungal foliar disease. Although the 2024 growing season started cool and wet, conditions quickly changed to hot and dry weather in mid-June which was not conducive for foliar disease development. Leaf spot diseases accounted for 8.1% of all crop diseases in 2024 and included net blotch (*Drechlsera teres*) in barley; tan spot (*Pyrenophora tritici-repentis*) in winter wheat; Ascochyta blight (*Didymella rabiei*) in chickpea, Septoria leaf spot (*Septoria pisi*) in field peas, and Stemphylium blight in lentil (*Stemphylium botryosum*); and spring black stem (*Phoma medicaginis*), Stemphylium leaf spot (*Stemphylium* sp.), and common leaf spot (*Pseudopezizia medicaginis*) in alfalfa. White mold, caused by *Scleoritnia sclerotiorum*, was diagnosed on six agricultural samples in 2024, including garlic, dry bean, and hemp. Other fungal foliar diseases observed in agricultural crop samples included stripe rust and powdery mildew on wheat and Fusarium foliar blight on garlic.

Several fungal wilt diseases were diagnosed in 2024, including Fusarium yellows on dry bean, Verticillium wilt on dry peas, and fusarium wilt on potatoes and sugar beet (one diagnoses each).

Post-harvest and storage disorders associated with fungal pathogens accounted for 9% of all crop disease diagnoses in 2024. This included mold issues in hay and silage associated with *Alternaria* sp., *Aspergillus* sp., *Penicillium* sp., *Fusarium* sp., and *Rhizopus* sp.; black point (*Alternaria* sp.) and sooty molds in oats, northern wheatgrass, and winter wheat; and skin blotch (*Embellisia allii*) and blue mold (*Penicillium hirsutum*) in garlic.

Seven percent of disease diagnoses were associated with bacterial pathogens in 2024. *Pseudomonas* sp. caused bacterial stem blight in alfalfa, bacterial brown spot on beans, bacterial leaf blight on dry peas and oats. Other bacterial diseases observed in 2024 included post-harvest and storage such as bacterial soft rot in potato (*Erwinia* sp./spp.) and garlic (unidentified bacteria) and common scab in potato (*Streptomyces scabies*).

Three percent of disease diagnoses identified pathogenic nematodes: the stem and bulb nematode (*Ditylenchus dipsaci*) was identified in one chickpea and field pea sample and 4 garlic bulb samples in 2024. The increasing number of stem and bulb nematode detections in seed garlic samples is a noteworthy trend.

Few diagnoses were attributed to viral disease in 2024; 1% of all disease diagnoses. Only two diagnoses identified symptoms of Wheat streak mosaic virus infection and confirmed the presence of the wheat curl mite vector (*Aceria tosischella*) in kernza and winter wheat.

The relatively cold start to the 2024 growing season is reflected in abiotic disorder diagnoses, where 20% of all abiotic diagnoses were attributed to frost, freeze or cold damage predominantly on spring and winter wheat, dry peas, and sugar beet. Low soil pH and nutrient imbalances were the second most common abiotic disorder (16%), followed by cultural/environmental problems (14%). The sudden switch to very hot and dry growing conditions at the end of June 2024 is reflected in several diagnoses of heat and drought stress (11%) mostly on oats, winter and spring wheat. Physiological leaf spot was diagnosed on 9 winter wheat samples in 2024, reflecting a markable decrease compared to 2023.

Trends from 2024: Horticulture

Horticultural samples accounted for 554 diagnoses (samples submitted through the Plant Diagnostic Information System [PDIS]) and 56 plant disease diagnoses for electronically submitted samples (i.e., photos in emails).

Foliar fungal diseases were again predominant during 2024 due to the cool and moist conditions in spring. Evergreen samples, especially Colorado blue spruce and blue spruce, were submitted with signs of Rhizosphaera needle cast disease (11) and/or sudden needle drop (23). Pine trees were mainly affected by Dothistroma needle blight (15) and junipers by tip blight (16). In deciduous samples, apple scab was confirmed on apple (1) and crabapple (4) samples. Anthracnose disease was confirmed this season on green ash (1), lilac (1), maple (1), oak (1), and viburnum (1). Oak leaf blister disease was confirmed on one oak tree sample. Cytospora canker was diagnosed on spruce trees (5), chokecherry (3), fruit trees (12), poplar trees (2), weeping willow (1) and mountain ash (1). Powdery mildew infection was confirmed on currant (1), lilac (1), mockorange (1), penstemon (1), peony (1), and wild comfrey. Dutch elm disease was confirmed on one American elm tree sample. Marssonina leaf spot was confirmed on four poplar samples.

Eighteen plant samples, including apple, crabapple, pear, raspberry, and serviceberry were submitted to the SDL with suspected fire blight infection. Samples were tested with rapid disease diagnostic kits, confirming positive results on three apple tree samples, two crabapple samples, and one raspberry sample.

Root rots caused by *Rhizoctonia* sp. and *Pythium* sp. were only minor diseases this season. Rhizoctonia root rot was confirmed on one turfgrass and one garden pea sample. Pythium root rot was confirmed on one sample each of ranunculus, garden pea, pepper, petunia, poinsettia, and turfgrass. Phytophthora crown rot was confirmed on one rhubarb sample.

Due to extreme changes in temperature, thin barked fruit trees (8), including cherry, plum, apricot, and crabapple, were stressed and expressed signs of gummosis (abiotic disorder).

Statewide, juniper shrubs and trees showed severe dieback. While tip blight (a fungal disease) was found on some samples, the majority of plants did not show any disease or insect-related issues. We suspect that the drought and harsh winter conditions and potential wildlife damage of the last years contributed to the plants' decline.

2024 Insect Diagnostics Summary

Diagnostic Staff:

Chloe Rice, Extension Associate Specialist, Urban Arthropod Diagnostician
Marni Rolston, Research Associate, Agricultural Arthropod Diagnostician

Other Assistants/Specialists:

Dr. Michael Ivie, Systematic Entomologist, Montana State University
Dr. Casey Delphia, Research Associate/Entomologist, Montana State University
Dr. Frank Etzler, State Survey Coordinator, Montana Department of Agriculture
Abi Saeed, Horticulture Extension Specialist, Montana State University
Dr. Justin Runyon, Entomologist, USDA Forest Service

Impacts and Outcomes

- An aphid from a conifer tree was determined to be a new aphid record in Montana. We are currently working with a specialist to confirm the species identification.
- The common crypt ant (*Hypoponera opacior*) was identified from a commercial building in Broadwater County. This is the first report of this species in Montana. These ants are often predators of termites, so the building owner was told to inspect for these pests.
- Some arthropods were diagnosed as species which were less damaging/harmful than the species the clients had originally suspected. Examples included:
    - a suspected kissing bug (a vector of Chagas disease) identified instead as a masked hunter (not a vector of Chagas disease)
    - a suspected brown recluse spider (has necrotic venom) identified instead as a hobo spider (there is no conclusive evidence that hobo spider venom causes necrosis in humans)
    - damage to an aspen tree which the client was concerned was caused by emerald ash borer (a highly invasive beetle not yet detected in Montana) which we suspected was instead caused by poplar borer (a common beetle pest in Montana)
- Twenty-five percent of diagnoses were made via photos, saving clients the financial cost of sending physical samples by mail
- A tick found inside a home in northeastern Montana was identified as a bat tick (*Carios* sp.). These ticks usually spend their lives close to bats but occasionally enter living spaces when bats roost in lofts. Bat ticks are rarely recorded in Montana and comparatively little is known about their biology compared to other ticks.
- Spotted blister beetles (*Epicauta maculata*) were submitted from home gardens and alfalfa fields from multiple counties. Clients were informed that the blister beetle numbers were probably higher than normal because their larvae feed on grasshopper eggs, which have been abundant in recent years.
- Annual white grubs (*Cyclocephala* spp.) were identified from organic corn and potato fields in different parts of the state. Producers said it was helpful to learn that soils with high organic matter are attractive to these root-destroying grubs.

Arthropod Identification Activities and Trends

In 2024, 679 arthropod diagnoses were completed. Fifty-four percent of diagnoses were from samples submitted from Extension agents and the rest were from samples submitted directly from non-Extension sources such as home gardeners, growers, crop consultants, arborists, businesses, and others. Eleven

percent of the diagnoses were for commercial clientele while 89% were for non-commercial clients. Samples were submitted from 44 counties in Montana. Samples were also submitted from North Dakota, Wyoming, and Iowa. 627 (92%) diagnoses were from urban (horticulture, structural, indoor) settings and 52 (8%) were from agriculture-related settings. In addition to 515 diagnoses made for samples submitted through the Plant Diagnostics Information System (PDIS), 164 diagnoses were made via emails or phone calls.

Agriculture-Related Arthropod Samples

Fifty-two arthropod samples collected from agricultural settings were submitted to the SDL in 2024. Common host crops included spring wheat/winter wheat (20%), garlic (12%), pasture/rangeland (12%), and alfalfa (10%). The remaining samples were from a wide range of agricultural crops, including camelina, field peas, potato, yellow mustard, safflower, triticale and corn. Samples were also received from commercial greenhouses, livestock, and stored grain bins.

The most common small grain pest in 2024 was the wheat curl mite (Table A2). Other insects diagnosed from wheat include the cereal leaf beetle, false chinch bugs and the Hessian fly. Insects submitted from alfalfa fields include the spotted blister beetle and alfalfa weevils. Most of the alfalfa blister beetle samples were sent in by producers concerned about toxicity to livestock that may ingest these beetles. Other crop arthropods submitted to the SDL include pea leaf weevil in field peas, bulb mites and onion maggots in garlic, army cutworm and wireworms in safflower, flea beetles in yellow mustard, seedcorn maggot in soybean, and root-damaging white grubs in potato and organic corn fields.

Arthropods collected from agricultural-related stored grains were also submitted to the SDL in 2024, although none of them were economically important. Clients shared samples/pictures of broad-nosed weevils in hog feed, oribatid mites in barley bins, and long-horned beetles in lentil containers shipped from out-of-state.

A few samples of non-damaging/beneficial arthropods were also submitted from agricultural lands, including parasitic wasp cocoons in camelina, and a carabid beetle in safflower. Clients are often concerned about these non-damaging insects and are relieved to hear they are beneficial and don't need to be managed. Reports associated with the diagnoses of arthropod pests in agricultural landscapes usually include information about how to preserve these important beneficial arthropods.

Urban Arthropod Samples

In 2024, 627 arthropod diagnoses were from non-agricultural settings, which included gardens, yards, greenhouses, homes, and commercial properties or other non-residential buildings. At least 230 different types of arthropods were identified.

Woody ornamentals**:** Arthropods from woody ornamentals made up 42% of the urban arthropod diagnoses. The greatest number of samples came from spruce, apple, pine, ash, cherry, fir, aspen, cottonwood, and poplar. See Table A1 for common pests associated with these woody ornamentals.

Household: 15% of urban arthropod diagnoses were arthropods found inside homes. Approximately 50 different types of arthropods were identified. Some of the pantry pests diagnosed included the drugstore beetle, cigarette beetle, blue bone beetles, white marked spider beetles and Indianmeal moth. The most commonly identified group of arthropods were carpet beetles (family Dermestidae). A western black widow spider, *Latrodectus hesperus*, was identified and recommendations on keeping this spider out of the home were provided. Pests from houseplants included mealybugs, whiteflies, and fungus gnats. Examples of non-

damaging insects which entered homes included rove beetles, water scavenger beetles, ground beetles, and parasitic wasps. Clients were reassured that these insects were not typically considered structural or stored product pests.

Kitchen garden: Arthropods associated with vegetables made up 6% of urban arthropod diagnoses. The main vegetable hosts were tomato, potato, garlic, cucumber, and beans. Some of the common pests included thrips, aphids, plant bugs (Miridae), whiteflies, bulb mites, and onion maggots. Bean weevils were also found in stored common beans. Fruit trees, berries, and currants made up 14% of urban arthropod diagnoses and common pests included aphids, eriophyid mites, pear sawfly, and thrips.

Other noteworthy urban samples included a bot fly pupa found in a garden shed and a stilt-legged fly (Micropezidae) larva found alongside small animal fecal droppings on a piece of ash tree bark. Relatively little is known about the biology of stilt-legged fly larvae.

2024 Weeds Lab Summary – Plant ID, Mushroom ID, and Herbicide Injury

Diagnostic Staff

Noelle Orloff- Associate Extension Specialist III

Other Assistants/ Specialists

Dr. Cathy Cripps, Professor Emerita, Mycology
Dr. Jane Mangold, Extension Rangeland Invasive Plant Specialist, Montana State University
Dr. Tim Seipel, Extension Cropland Weed Specialist, Montana State University

Impacts and Outcomes

- Our plant ID services help clients such as Extension agents, county weed coordinators, and other professionals serve their clientele better. For example, one respondent of our annual SDL survey stated, “Noelle Orloff provides such a great benefit to myself and the landowners I represent. While I’m fairly familiar with noxious and common weedy/non-native plants, she helps me tremendously by identifying plants that are less common. It’s great to be able to designate between native and non-native plants with her expertise.”
- Early detection of agriculturally important pests is an important role of our lab. Two *Amaranthus* species, Palmer amaranth (*A. palmeri*) and waterhemp (*A. tuberculatus*), are of increasing concern in Montana due to their projected economic impact on agriculture. Due to this concern, in 2024 we received eight *Amaranthus* samples for identification along with numerous questions.
    - Working with local Extension field faculty we confirmed Palmer amaranth in one new county in Montana and sent the samples for PCR testing for confirmation. This is the third known detection of Palmer amaranth in Montana, with the first being confirmed by the SDL in 2023.
    - In the remaining cases where field faculty, clients, and partners were concerned about Palmer amaranth and waterhemp, we identified other common weedy species instead. These identifications saved producers and land managers significant time and money by avoiding unnecessary and costly treatments.

Plant Identification Activities and Trends

In 2024, the SDL processed 179 physical specimens for plant identification, and 109 electronic samples (i.e. photos in emails and our sample submission app). Most samples came from noncommercial sources

accounting for 80% of sample submissions. Noncommercial samples may be from agency or regulatory personnel, or 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. About 57% of plant identification samples were from local Extension offices submitting samples on behalf of their clients. We identified plants from 47 Montana counties and reservations, and one additional state (Colorado).

Plant identification samples submitted represented 185 unique species. Thirty percent of samples were of exotic plants. The most commonly submitted exotic species were kochia (*Kochia scoparia*, 10), catchweed (*Asperugo procumbens*, 5), and bur buttercup (*Ranunculus testiculatus*, 5). We also identified one specimen of Palmer amaranth (*Amaranthus palmeri*); a species native to North America but not to Montana. Fifty-one percent of samples were Montana native plants. The most common native species submitted were horseweed (*Conyza canadensis*, 3), common yarrow (*Achillea millefolium*, 2), redroot pigweed (*Amaranthus retroflexus*, 2), California oatgrass (*Danthonia californica*, 2), Lewis flax (*Linum lewisii*, 2), and witchgrass (*Panicum capillare*, 2). Notably, we received eight samples in the *Amaranthus* genus in 2024, due largely to concern about Palmer amaranth and waterhemp (*A. tuberculatus*).

Seven confirmed specimens of state-listed noxious weeds and other state-regulated plants were submitted representing nine unique species (Table 1). The SDL provides a valuable resource where land managers can get accurate information about suspected problematic plants such as noxious weeds.

Table 2. State listed noxious weeds and regulated plants submitted to the SDL in 2024.

Species	County	Montana Regulation
Palmer amaranth	Carter	Restricted seed species
Common buckthorn	Daniels	Priority 1B noxious weed
Ventenata	Park, Yellowstone	Priority 2A noxious weed
Leafy spurge	Yellowstone	Priority 2B noxious weed
Russian knapweed	Teton	Priority 2B noxious weed
Cheatgrass	Carbon	Priority 3 regulated plant

Mushroom Identification Activities

In addition to plants, we also identify mushroom specimens. In 2024, Dr. Cathy Cripps assisted the SDL by identifying 29 mushroom samples. These specimens were of 25 different species. All mushroom samples were from noncommercial sources (e.g. home gardeners, medical personnel, general public), and were found in mainly lawns, gardens, or natural areas. Clients interested in mushroom identification are most often concerned with edibility or toxicity of mushrooms, and proper identification and guidance is vital for these types of questions.

Herbicide Injury Diagnosis

We assessed 58 physical samples for potential herbicide injury along with 11 electronically submitted samples. This number was a 37% decrease compared with 2023. We suspected herbicide injury to be

affecting samples in 62% of these cases. Clients in several cases involving damage to property were referred to the Montana Department of Agriculture field offices for assistance with further investigation.

Most herbicide injury cases were from ornamental or vegetable garden settings, where we assessed 52 samples for herbicide injury symptoms. Of these, fifteen woody ornamental samples showed symptoms consistent with synthetic auxin herbicide injury. These symptoms may have arisen due to factors such as herbicide drift or root uptake after lawn herbicide applications. Fifteen vegetable samples from home gardens also showed symptoms consistent with synthetic auxin herbicide injury. Based on site histories it is likely most of these occurred because of herbicide carryover in garden amendments or newly purchased topsoil. Other issues we encountered in residential landscapes included woody plants showing glyphosate injury symptoms (two cases), and a suspected case of accidental application of glyphosate to a lawn. In 17 potential herbicide injury cases plant symptoms were suspected to instead be due to other environmental, insect, or disease related factors.

Of the 17 commercial agricultural samples we assessed for herbicide injury, there were several different suspected causes of injury. In three cases, we observed symptoms consistent with group 14 herbicide injury to pulse crops. We also suspected herbicide carryover in three cases (group 4, 15, and 27) affecting tomato, bean, and lentil crops. Herbicide drift from neighboring fields was suspected in two cases affecting wheat (group 22) and field peas (group 27). Finally, we assessed 9 crop samples where symptoms were explained best by other environmental factors or plant disease rather than herbicides.

Table A1. Common arthropods and diseases associated with urban/ornamental plant hosts submitted to the Schutter Diagnostic Lab in 2024.

Host Tree	Common Insects/Arthropods	Common Diseases
Apple/ Crabapple	Eriophyid gall mites, blister mites, thrips, oystershell scale, aphids, leafroller moths, codling moth	Fire blight, Cytospora canker, Apple scab
Ash/ Green Ash	Ash bark beetles, aphids, ash plant bug, lilac/ash borer moth, eriophyid mites	Anthracnose
Aspen/ Cottonwood/ Poplar	Poplar vagabond aphid, poplar bud gall mite, poplar borer, leafminer flies, eriophyid mites, leafhoppers, oystershell scale	Cytospora canker, Marssonina leaf spot
Cherry/ Chokecherry	Black cherry aphid, bark beetles, leafhoppers, stink bugs, pear sawfly, cherry fruit flies	Black knot, Cytospora canker
Cotoneaster	Leafroller moths	Nectria canker
Elm	Woolly aphids, elm leaf beetles, elm seed bugs	Dutch Elm disease
Fir	Giant conifer aphids, white pine weevil	Needle cast disease
Juniper	Juniper scale	Cedar-apple rust, Kabatina tip blight
Lilac	Root weevils	Powdery mildew
Maple	Cottony maple scale	Maple anthracnose, Powdery mildew
Oak	Gall wasps	Oak leaf blister
Pine	Pine needle scale, flat-headed wood borers, woolly pine adelgids, red turpentine beetle, whitespotted sawyer, thrips	Dothistroma needle blight, Rhizosphaera needle cast
Plum/Pear/*Prunus* (Other than Cherry)	Shothole borer, pear sawfly	Cytospora canker, Peach leaf curl
Rose	Gall wasps	N/A
Spruce	Pine needle scale, spruce bud scale, Cooley spruce gall adelgid, spruce spider mite, giant conifer aphids, western spruce budworm, white pine weevil	Rhizosphaera needle cast, Cytospora canker, Sudden needle drop
Willow	Willow gall sawfly, aphids, flea beetles	N/A

Table A2. Common arthropods and diseases associated with agricultural crop plant hosts submitted to the Schutter Diagnostic Lab in 2024.

Crop host	Common Insects/Arthropods	Common Disease
Alfalfa	Spotted blister beetle, alfalfa weevil	Spring black stem, Stemphylium leaf blight, Common leaf spot
Barley	NA	Net blotch
Camelina	Parasitic braconid wasps	NA
Chickpea	NA	Fusarium root rot, Ascochyta blight
Dry field peas	Pea leaf weevil	Fusarium root rot
Garlic	Bulb mites, onion maggots, Pyralid moths, millipedes	Embellisia skin blotch, White mold, Blue mold, stem and bulb nematode, Fusarium bulb and crown rot
Lentil	NA	Fusarium root rot
Oats	NA	Bacterial leaf blight
Potato	White grubs	Bacterial soft rot, Potato canker and black scurf, Common scab, Fusarium dry rot, Silver scurf
Wheat	*Spring wheat:* cereal leaf beetle, wheat curl mite, false chinch bug *Winter wheat*: Wheat curl mite, Hessian fly *Durum wheat*: Wheat curl mite	*Spring wheat*: Rhizoctonia root and crown rot *Winter wheat*: Fusarium root and crown rot, Tan spot, Rhizoctonia crown and root rot, Common root rot, Physiological leaf spot* (not a disease but GxE response)