2021 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 2021, the SDL conducted 2643 plant, plant disease, insect, mushroom, and abiotic diagnoses in 53 of 56 Montana counties and reservation offices and 8 additional states.

- **$1.8 million USD were saved based on SDL diagnoses and associated management recommendations affecting approximately 810,672 acres.**
- 84% of clients utilized recommendations and/or resources that were provided by the diagnosticians in the diagnostic reports.
- 96% of the survey respondents found it easy to submit samples.
- 94% of the survey respondents thought the timeliness of a response/diagnosis was good or excellent.

*Results of 2021 client surveys, n=186 *Data from "Schutter Diagnostic Lab Surveys" compiled by MSU HELPS Lab, 2021.

Impacts and Outcomes

- The timely and accurate identification of a plant disease in a nursery stock resulted in immediate removal of the affected plants, therefore preventing the spread to other valuable plants.
- Disease diagnoses provided by the SDL support ongoing research activities at Montana State University and expand the scope of these studies to also consider the role of pathogen populations and disease pressure.
- The diagnoses of environmental or cultural causes of reduced plant health, where disease problems were initially suspected, saved growers and homeowners money from unnecessary treatments and reduced the potential environmental impact associated with pesticide applications.
- The brown marmorated stink bug, an invasive insect, was found in Montana for the first time in Billings, MT in January of 2021. The pest has been found in 48 states and 4 Canadian provinces with an estimated economic impact of approximately $23 billion.
- Accurate plant identification is critical when assisting clients who suspect poisonous plants are impacting livestock, and we assisted many clients with these types of questions in 2021.

Quotes from Clients in 2021

- "The Schutter Lab's diagnosis allowed us to help the community and to personally have safe, non-toxic options for my own garden needs."
- "The diagnostic lab gave us reassurance that our no-treatment decision was scientifically justifiable and probably a best management practice for that situation."
- "The diagnosis helped to stop the occurrence of animal deaths due to toxic plants."
- "It's just a great resource to contact and it's free! The ladies at the SDL are very friendly, a joy to interact with, and very focused on solving problems. We are lucky to have such a great service available to us free of charge."
- "We will make changes to what we plant in the future or add seed treatment to the crop before planting."
- "The diagnostic report gave me peace of mind in knowing that the insects I found are not a major concern for my health and the integrity of my furniture and books. I learned that a chemical treatment is not necessary and that I can likely bring these insects under control with some simple steps like sealing cracks and not storing things directly on the ground."

MONTANA STATE UNIVERSITY EXTENSION Integrated Pest Management

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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 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. 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 2021, the SDL conducted a total of 2643 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 2021.

Diagnosis Type	Number of Diagnoses
Plant Disease	1026
Arthropods	792
Plant ID	385
Mushroom ID	49
Herbicide Injury	81
Other Abiotic Disorders	310
Total	**2643**

Samples were received from 53 of 56 counties and reservation offices in Montana and 8 additional states- Arizona, Colorado, Idaho, Minnesota, New Jersey, North Dakota, Oregon, and Wyoming. The greatest number of diagnoses were in Gallatin, Park, Hill, Jefferson, and Lewis and Clark Counties in 2021.

In addition to diagnostic services, SDL diagnosticians provided outreach, research, and educational materials about pests of concern to clients in Montana. The Schutter Lab maintains a Facebook page that has over 800 followers. In 2021, we published a total of 58 Facebook posts reaching over 38,000 people, engaging 65 followers per post on average. 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 (528 subscribers) is intended for Extension agents, landscape professionals, arborists, city foresters/managers, and any other client concerned with ornamental plants and vegetables. In 2021, 14 urban alerts were posted. The MSU AgAlert system (1154 subscribers) provides current and research-based information for Montana agricultural clients. There were 23 AgAlerts posted in 2021.

MONTANA STATE UNIVERSITY EXTENSION Integrated Pest Management

2021 Plant Disease Summary

Diagnostic Staff:

Dr. Eva Grimme, Plant Disease Diagnostician & Associate Extension Specialist II
Dr. Uta McKelvy, Associate Research Professor

Other Assistants/Specialists:

Dr. Cathy Cripps, Mycologist
Dr. Mareike Johnston, Plant Pathologist
Abiya Saeed, Extension Horticulture Specialist
Sarah Eilers, IPM Manager

Impacts & Outcomes

The team of the Schutter Diagnostic Lab (SDL) strives to provide accurate and timely plant disease diagnoses and is often involved in the detection of new pathogens. Noteworthy or unusual pathogens arriving in the SDL in 2021 included: flax rust on flax, Verticillium wilt on fava bean, Cercospora leaf blight on soybean, crown gall on raspberry plants, and white mold on zinnia plants. As the agricultural crop and horticulture portfolio in Montana becomes more diverse, the diagnostic staff at the SDL is preparing to diagnose new and emerging diseases in the state and provide its clients with high-quality disease and management information.

The accurate and timely diagnosis of plant diseases is the key to applying successful management strategies. The SDL team is focusing on integrated pest management strategies to address plant problems. Numerous samples were submitted to the SDL that were suspected to be affected by disease. In many cases, environmental or cultural factors were causing the plant stress, resulting in reduced plant health. Through collaboration of the SDL team with MSU Extension specialists, best management strategies are developed to effectively address the problem in an environmental-friendly way.

In 2021, 345 plant disease diagnoses for agricultural crops impacted a total of 810,672 acres and $1.8 millions USD were saved based on SDL recommendations (based on SDL Survey).

The SDL is testing mint mother stock and in-vitro plants for *Verticillium dahlia* for the second year. The absence of *Verticillium* is essential for mint growers to ensure that only healthy plant materials are distributed to customers. In 2021, we tested 275 samples. We will continue to support Montana's mint producers by providing this testing service.

The SDL diagnosed 60 field samples of spring wheat, barley, and lentils from a crop rotation study conducted at the Montana Agricultural Experiment Station in Moccasin for soilborne diseases. The primary objective of this crop matrix study is to evaluate the effects of diversifying wheat-based cropping systems with broadleaf crops, such as pea, lentil, and canola, on small grain crop performance. By providing plant disease diagnoses, the SDL is expanding the scope of this particular study to also consider the impact of diversified crop rotation on disease pressure and pathogen populations.

The SDL is screening samples submitted by the Montana Department of Agriculture as part of the Cooperative Agricultural Pest Surveys (CAPS). These surveys are part of a nationwide effort to detect introduced plant pests and/or monitor their spread. In 2021, the SDL processed 32 CAPS samples consisting of wheat, alfalfa, and barley. No regulated plant pathogens were detected on samples in 2021. The SDL will continue to support Montana CAPS to protect the state's agricultural and ecosystems from potentially damaging new and invasive plant diseases and pests.

Trends from 2021: Agriculture

Agricultural crops accounted for 341 plant disease diagnoses in 2021. Samples were received from 32 of 56 Montana counties and 3 additional states (Colorado, Wyoming, North Dakota). Four plant disease diagnoses were made for electronically submitted samples (sample submission app). Overall, it was a low disease year due to severe drought conditions across most of the state that persisted since the fall of 2020. Sample submission was likely also reduced as a result of the ongoing COVID-19 pandemic.

Of the 345 diagnoses for agricultural crops, 244 diagnoses identified diseases problems (72%) and 37 diagnoses identified abiotic disorders (11%).

Seventy-four percent of disease diagnoses in 2021 were associated with fungal and fungal-like pathogens. Root and crown rots were prevalent disease issues on agronomic crops in 2021, accounting for 45% of all disease diagnoses. Root rots associated with *Fusarium* sp. were very common (24%) affecting alfalfa, barley, chickpea, dry field pea, garlic, lentil, millet, oats, soybean, western wheatgrass, spring, and winter wheat. *Rhizoctonia* sp. (10%) caused root diseases in alfalfa, barley, dry field pea, lentil, oats, spring, and winter wheat. *Cochliobolus sativus* caused common root rot (7%) on barley and spring wheat. More than one root rot-causing organism was frequently detected on crop samples (root rot complex).

Foliar diseases caused by fungal pathogens accounted for 8% of all crop disease diagnoses in 2021. Alfalfa samples were frequently affected by fungal foliar diseases, such as spring black stem (*Phoma medicaginis*), Stemphylium leaf spot (*Stemphylium* sp.), and alfalfa common leaf spot (*Pseudopeziza medicaginis*). Net blotch (*Dechlsera teres*), spot blotch (*Bipolaris sorokiniana*), and scald (*Rhynochosporium secalis*) were common foliar diseases on barley caused by fungal organisms. Fungal foliar and stem diseases affecting chickpea and lentil were most frequently identified as Ascochyta blight (*Ascochyta rabiei/lentis*), white mold (*Sclerotinia sclerotiorum*), and Stemphylium leaf spot (*Stemphylium* sp.).

Fifteen percent of disease diagnoses were associated with bacterial pathogens. *Xanthomonas* sp. caused bacterial leaf spot and bacterial blight on alfalfa, bacterial leaf streak on barley, millet, triticale, spring and winter wheat; *Pseudomonas* sp. caused bacterial leaf blight on field pea; *Erwinia carotovora* caused bacterial soft rot on cabbage.

Noteworthy samples received in the SDL in 2021 included flax rust (*Melampsora mili*) on flax (out-of-state sample) and verticillium wilt (*Verticillium* sp.) on fava bean. We further diagnosed Cercospora leaf blight on soybean (*Cercospora kikuchii*). Only one sample was diagnosed with wheat streak mosaic disease in 2021 (winter wheat), which originated from central Montana.

The impact of severe drought conditions and extreme temperatures on Montana crops during the 2021 crop year are reflected in the abiotic disorders diagnosed. Environmental stress, drought stress, and freeze/frost/cold damage accounted for 30, 16, and 11% of the abiotic disorder diagnoses, respectively, while herbicide injury accounted for 14%. Hail damage (8%) and nutrient deficiencies and imbalances (11%) were also diagnosed.

Trends from 2021: Horticulture

Horticultural samples accounted for 581 diagnoses (samples submitted through the Plant Diagnostic Information System [PDIS]) and 100 plant disease diagnoses for electronically submitted samples (i.e., photos in emails and through the sample submission app).

The drought conditions during fall 2020 and the unusually high temperatures in May and June 2021 caused heat and drought stress on most plants in the urban landscape. Plants showed symptoms of dieback, discoloration, nutrient deficiency, and stunted growth.

Fungal diseases were predominant during 2021. Evergreen samples, especially Colorado blue spruce and blue spruce, were submitted with signs of Rhizosphaera needle cast disease (42) and/or sudden needle drop (29). Pine trees were mainly affected by Dothistroma needle blight (25). Two Douglas-fir samples were confirmed for Rhabdocline needle cast disease.

Cytospora canker was diagnosed on spruce and Colorado blue spruce trees (31), apple trees (2), poplar trees (4), mountain maple (1), and Russian olive (1).

This season, the SDL received five elm tree samples which were tested for Dutch elm disease (causal agent: *Ophiostoma* spp.). Only one American elm sample tested positive for the disease. Two of the submitted elm samples showed symptoms of bacterial wetwood.

Seventeen plant samples, including apple, crabapple, pear, mountain-ash, and cotoneaster, 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, three pear tree samples, one cotoneaster, and one Mountain-ash sample.

Root rots caused by *Rhizoctonia* sp., *Fusarium* sp, and *Phythium* sp. were confirmed on 44 samples (8%). A variety of samples, including bell pepper, dahlia, elderberry, garden bean, sweet basil, and turfgrass, were diagnosed with Pythium root rot. Rhizoctonia root rot and brown patch was confirmed on 16 turfgrass samples. Fusarium root rot was diagnosed on turfgrass, one pumpkin plant, one watermelon plant, on white lupine, and one sweet corn sample.

White mold infection (causal agent: *Sclerotinia* sp.) was confirmed on broccoli, garlic, and zinnia plants. Foliar diseases like powdery mildew and anthracnose were found on only a few samples this season (pea shrub, sunflower, highbush cranberry, choke cherry, maple).

Due to the very dry conditions during the 2021 season, only one lilac and one tomato sample were diagnosed with bacterial leaf spot/bacterial blight.

Sample Summary

In 2021, the SDL completed 1,026 plant disease diagnoses (agricultural and horticultural samples). Samples were mainly submitted by extension personnel (45.2%) with 39.8% from non-commercial and 5.4% from commercial entities. Commercial entities outside of MSU accounted for 34% of the samples. The number of non-extension, non-commercial samples accounted for 18.8%. Based on 186 survey responses (2021 Schutter Diagnostic lab survey), samples were submitted by homeowners/gardeners (26.3%), growers/farmers (6.3%), researcher/specialists (6.3%), agribusiness (5.9%), arborists (5.3%), crop consultants (2.9%), and regulatory agents (1.8%).

Deciduous and evergreen woody ornamentals accounted for 54% of the horticulture diagnoses made by the SDL. Sample hosts of this category included Colorado blue spruce, blue spruce, pine trees, juniper, poplar, apple, crabapple, pear, green ash, mountain-ash, cotoneaster and maple trees.

Fruit and vegetable samples (apple, pear, cherry, raspberry, tomato, garlic, herbs) accounted for 22%, perennial & annual plants for 5%, and turf samples accounted for 8% of the horticulture diagnoses.

Small grain crops accounted for 53% of all agricultural crop samples in 2021 (180 diagnoses total; 68 barley, 43 spring wheat, 32 winter wheat, further durum wheat, millet, Triticale, oats, western wheatgrass, and non-specified wheat). Pulse crops constituted the second-largest group of crop samples (68 total; 52 lentil, 9 chickpea, 7 dry field pea), followed by alfalfa (51 diagnoses). Other crops submitted for disease diagnosis in 2021 included pota-to, soybean, flax, garlic, camelina, clover, fava bean, white mustard, spring canola, and pasture grasses.

2021 Weeds Lab Summary – Plant ID, Mushroom ID, and Herbicide Injury

Diagnostic Staff

Noelle Orloff- Associate Extension Specialist

Extension Specialists

Dr. Jane Mangold
Dr. Tim Seipel

Other Cooperators

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

Impacts and Outcomes

During the drought conditions of 2021, producers encountered different plants than usual in pastures and rangeland, leading to issues with toxicity to livestock. Accurate plant identification is an important step in addressing these types of issues. For example, this year we processed several samples of pasture and rangeland plants after livestock losses had occurred. Poisonous plants such as western waterhemlock (*Cicuta douglasii*) and nitrate accumulating plants like those in the goosefoot genus (*Chenopodium* spp.) were identified and recommendations for next steps were given. In many cases, we confirmed submitted plants were not known to be toxic or problematic to livestock.

We are an important resource for early detection of new pests. For example, the agricultural industry is concerned about the potential for the weeds waterhemp (*Amaranthus tuberculatus*) and Palmer amaranth (*A. palmeri*) to impact agriculture in Montana. In 2021, we worked with the Agricultural Genotyping Center in Fargo, ND to confirm a new population of waterhemp in a sugarbeet field in Montana, and we were able to confirm a suspected Palmer amaranth population was instead the more benign Powell amaranth (*A. powellii*).

Plant Identification Activities and Trends

In 2021, the SDL processed 212 physical specimens for plant identification and 164 electronic samples (i.e. photos in emails, texts, and through our sample submission app). Most samples came from noncommercial sources such as government personnel, homeowners, and small-acreage landowners. These samples accounted for 53% 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 47% of all submissions.

Plant identification samples submitted represented 241 unique diagnoses. Thirty-five percent of samples were of exotic plants. The most commonly submitted exotic species were dwarf alyssum (*Alyssum desertorum*, 5), catchweed (*Asperugo procumbens*, 5), and roving bellflower (*Campanula rapunculoides*, 5). Forty-three percent of samples were Montana native plants. The most common native species submitted were biennial wormwood (*Artemisia biennis*, 6) and rush skeletonplant (*Lygodesmia juncea*, 6).

Five confirmed specimens of state-listed noxious weeds or regulated plants were submitted representing four 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 1. State listed noxious weeds and regulated plants submitted to the SDL in 2021.

Species	County	Priority
Yellow toadflax	Sanders	2B
Oxeye daisy	Valley	2B
Common tansy	Granite	2B
Cheatgrass	Gallatin, Madison	3

Mushroom Identification Activities

In addition to plants, we also identify mushroom specimens. In 2021, Dr. Cathy Cripps assisted the SDL by identifying 49 mushroom samples. These specimens were of 36 different species. All but three 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 Diagnosis

We assessed 68 physical samples for potential herbicide injury along with 13 electronically submitted samples. We suspected herbicide injury to be affecting samples in 78% of these cases. Several cases involving damage to property were referred to the Montana Department of Agriculture field offices for further investigation.

Most herbicide injury cases were from ornamental or vegetable garden settings, where we assessed 60 samples for herbicide injury symptoms. Of these, eleven woody ornamental samples showed symptoms consistent with synthetic auxin herbicide injury. These symptoms may have arisen due to herbicide drift or root uptake resulting from lawn applications. Twelve 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 (seven cases), drift of contact herbicides from nearby crop fields (four cases). In eleven potential herbicide injury cases, plant symptoms were suspected to be due to other environmental factors.

Of the 21 commercial agricultural samples we assessed for herbicide injury, there were several different suspected causes of injury with no clear pattern. We recorded several 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. For example, we observed symptoms of photosynthesis inhibitor herbicide injury in pulse crops following pre-plant applications of sulfentrazone and carfentrazone. There were a range of other issues suspected including herbicide drift, herbicide residual issues, and tank contamination. Finally, we assessed five crop samples where symptoms were explained by other environmental factors or plant disease rather than herbicides.

2021 Insect Diagnostics Summary

Diagnostic Staff:

Laurie Kerzicnik, Associate Extension Specialist II, Urban and Horticultural Arthropod Diagnostician
Ruth O'Neill, Research Associate, Wanner Lab & Cropland Insect Diagnostician
Marni Rolston, Research Associate, Schutter Diagnostic Lab

Other Assistants/Specialists:

Dr. Michael Ivie, Systematic Entomologist, Montana State University
Dr. Justin Runyon, Entomologist, USDA Forest Service
Dr. Casey Delphia, Research Associate/Entomologist, Montana State University

Impacts & Outcomes

- The brown marmorated stink bug, an invasive insect, was found in Montana for the first time in Billings, MT in January of 2021. The pest has been found in 48 states and 4 Canadian provinces with an estimated economic impact of approximately $23 billion.
- A swallow bug was identified in a Montana hospital, which prevented the need for the unnecessary spraying of insecticides for bed bugs.

Trends from 2021

- Grasshoppers, particularly the two-striped grasshopper, *Melanoplus bivitattus*, were a serious issue throughout the state in both croplands and yards and gardens.
- In late-June to mid-July, a fair number of blister beetles (Family Meloidae) were sent to the Schutter Lab from agricultural land in the northern and eastern regions of Montana.
- The beneficial banded argiope spider, *Argiope trifasciata*, was very common throughout the state (known to feed heavily on grasshoppers).
- Several emails and photos were received about the Carolina wolf spider, *Hogna carolinensis*, a beneficial spider.

Sample Summary

In 2021, 792 arthropod diagnoses were completed. Of these identifications, 94% were urban/horticulture samples while 6% where field crop samples. Of the samples submitted, 55% were submitted from extension agents and 45% were submitted directly from homeowners, growers, consultants, arborists, and others. Eighty-five percent of the samples submitted were from non-commercial sources (primarily homeowners). Samples were submitted from 50 counties and reservation offices in Montana, and one sample was submitted from Johnson County in Wyoming.

Urban/Household Samples

The greatest number of woody ornamental samples came from apple, ash, aspen, cherry, cotoneaster, cottonwood, Douglas-fir, elm, juniper, pine, poplar, rose, and spruce. The most common pests associated with these woody ornamentals are shown in Table A1.

For the yard and garden samples, grasshoppers, blister beetles, elm sawflies, garden millipedes, banded Argiope spiders, Carolina wolf spiders, and cicada killers were commonly diagnosed.

For households (17% of all diagnoses), spiders, bed bugs, seed bugs (western conifer seed bugs, Rhyparocromid seed bugs, false chinch bugs, and *Arhyssus* sp.) , carpet beetles, ants, and root weevils were commonly found in the home. Spider samples constituted 8% of all samples submitted and 46% of the home samples 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.

The main vegetable hosts consisted of carrots, garlic, kale, potatoes, raspberries, strawberries, tomatoes, and turnips. Some of the common pests on these hosts included aphids, cabbage loopers, flea beetles, grasshoppers, raspberry sawflies, slugs, spider mites, spotted snake millipedes, and thrips. In the greenhouse, thrips, spider mites, springtails, and broad mites were common.

Field Crop Samples

Forty-seven samples that were categorized as potential arthropods of agricultural importance were submitted to the Schutter Diagnostic Lab in 2021. Most of the agricultural samples received were from alfalfa (14 samples) and wheat (10 samples). However, samples were also received from apple (5), canola (4), peach (2), camelina (1), chickpea (1), dry field pea (1), oats (1), hay (2), mixed grass species (2), and crested wheatgrass (1). In alfalfa, the most common insect pests submitted were various species of blister beetles (ash-grey, spotted, black, and punctate blister beetles). Other alfalfa pests received by the Schutter Lab were cowpea aphid (1), alfalfa weevil (1), clover root curculio (2), and the western yellowstriped armyworm (1). Insect pests of wheat that were submitted included the wheat stem sawfly (2), the Hessian Fly (2), and two species of flour beetles in stored grain. Canola pests included a western flower thrips (1) and a diamondback moth (1). Additionally, samples from commercial orchards (5) were submitted as part of on-going monitoring efforts for the spotted wing drosophila and oriental fruit moth.

Several samples of non-damaging/beneficial arthropods were also submitted from agricultural lands, including a few species of solitary wasps, a Collops beetle, and a tiger beetle.

Table A1. Common insects and diseases associated with urban/ornamental plant hosts submitted to the Schutter Diagnostic Lab in 2021.

Host Tree	Common Insects/Arthropods	Common Diseases
Apple	Oystershell scale, blister mites, codling moth, apple-and-thorn skeletonizer	Fire blight, Cytospora canker
American Elm	N/A	Dutch elm disease
Arborvitae	False spider mites, spruce spider mites	Pestalotiopsis tip blight
Ash	Ash flower gall mites, ash plant bugs, western ash bark beetles	Ash anthracnose, Cytospora canker
Aspen/ Cottonwood/ Poplar/*Populus* spp.	Aspen blotch leafminers (tentiform leafminer), *Chaitophorus* aphids, poplar vagabond aphids, large aspen tortrix, poplar blackmine beetles, poplar borers, poplar leaf gall mites, poplar leaf-folding sawflies, spider mites	Cytospora canker, Crown gall, Marssonina leaf spot
Birch	Psyllids	N/A
Boxelder	Fall cankerworm	N/A
Cherry	Pearslugs/sawflies, chokecherry gall midge	Fungal canker
Cotoneaster	Oystershell scale, pearslugs/sawflies	Cytospora canker, fire blight
Douglas-Fir	Cooley spruce gall adelgid, pine needle scale, spruce spider mites, western spruce budworm	Rhabdocline needle cast
Elm	Elm leafminer, European elm flea weevil, European elm scale, smaller European bark beetle, woolly elm aphids	Bacterial wetwood
Fir	Pine needle scale, spruce spider mite, western spruce budworm	Needle cast disease, Cytospora canker
Honeylocust	Honeylocust podgall midge	Fungal canker
Juniper	False spider mites, juniper scale, spruce spider mites	Cedar-apple rust, Kabatina tip blight, Botryosphaeria canker
Lilac	Root weevils	Bacterial blight, anthracnose
Maple	N/A	Maple anthracnose
Mountain-ash	Pearslugs/sawflies	Cytospora canker, fire blight
Oak	N/A	Oak leaf blister
Pine	Bark beetles, black pineleaf scale, Cinara aphids (giant conifer aphids), *Dioryctria* moths, *Essigella* aphids, spruce spider mites, pine needle scale, pine sawyer beetles	Dothistroma needle blight, blue stain fungus, Rhizosphaera needle cast
Plum/Pear/Prunus	Black cherry aphids, blister mites, leafcurl plum aphids, pearslugs/sawflies	Cytospora canker, fire blight
Rose	Mossyrose gall wasps, two-spotted spider mites, western tent caterpillars	N/A
Spruce	Cooley spruce gall adelgid, giant conifer aphids, pine needle scale, spruce bud scale, spruce spider mites, western spruce budworm, white pine/sitka spruce weevil	Rhizosphaera needle cast, Cytospora canker, sudden needle drop
Viburnum	Viburnum erineum mite	Powdery mildew
Willow	*Pterocomma* aphids, tortricid leafrollers	Willow black canker