2020 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 2020, the SDL conducted 2,695 plant, plant disease, arthropod, mushroom, and abiotic diagnoses in 52 of 56 Montana counties and five additional states.

- Over $2.5 million was saved affecting approximately 1.1 million acres as a result of SDL recommendations.
- 82% 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.
- 68% of survey respondents said the diagnoses and recommendations from the SDL influenced their management decisions.

*Results of 2020 client surveys, n=152 *Data from "Schutter Diagnostic Lab Surveys" compiled by MSU HELPS Lab, 2020.

Impacts and Outcomes

- In many plant identification cases, we confirmed plants were not known to be toxic or problematic to livestock, which avoided unnecessary control measures, saved producers time and money, and helped preserve native plant communities.
- Several new pathogens were detected, including Thielaviopsis spp. on lupine and field pea, Verticillium wilt on chickpea, and Erwinia bacterial blight on a South Dakota field pea sample.
- Numerous suspected disease samples were submitted to the SDL where environmental or cultural factors were diagnosed, saving homeowners and producers money from unnecessary treatments.
- The old house borer, Hylotrupes bajulus (Coleoptera: Cerambycidae), was detected for the first time in Montana (Gallatin County) where imported eastern white pine timbers were installed throughout the home.
- We helped confirm three new county reports of plants that are problematic for agriculture in Montana [waterhemp (Amaranthus tuburculatus), Roosevelt County; Italian ryegrass (Lolium persicum), Judith Basin County; and common barberry (Berberis vulgaris), Fergus County].
- Collaboration with North Dakota State University led to the detection of Phytophthora spp. on chickpea samples from North Dakota; detection of the pathogen in our neighboring state will inform future disease monitoring in Montana.

Quotes from Clients in 2020

- "Weed identification gave one ranch piece of mind when a new plant was found on the ranch and there were dead cattle. After identification, the Schutter Lab went above and beyond and hand delivered the weed to the state lab for toxicity testing."
- "With the lab helping with the samples, it gives us the answers to help the growers."
- "My potatoes in my garden had a disease. Because of the diagnosis I received I know I need to wait a period of time before planting potatoes in the same location again."
- "The Schutter Lab helped identify the exact issue so that an appropriate management recommendation could be given."
- "The biggest benefit to me is the increased confidence for both myself and my clients that the problems we are seeing are confirmed by an independent panel of experts."
- "The SDL is an excellent service to have in MT. We call upon the knowledgeable staff at least 2-3 times a year and they have been very helpful."
- "SDL has a great impact on best management practices for both rural and urban pest control in Montana."

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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, which are 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 2020, the SDL conducted a total of 2,695 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 (2,695 total) by the Schutter Diagnostic Lab in 2020.

Diagnosis Type	Number of Diagnoses
Plant Disease	944
Arthropods	792
Plant ID	437
Mushroom ID	32
Herbicide Injury	111
Other Abiotic Disorders	379

Samples were received from 52 of 56 counties in Montana and five additional states- Arizona, Colorado, Idaho, North Dakota, and South Dakota. The greatest number of diagnoses were in Gallatin, Park, Hill, Jefferson, and Lewis and Clark Counties in 2020.

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 700 users. In 2020 we had a post reach of over 82,000 from our total of 85 Facebook posts, and an average of over 90 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 (480 subscribers) is intended for Extension agents, landscape professionals, arborists, city foresters/managers, and any other client concerned with ornamental plants and vegetables. In 2020, 25 urban alerts were posted. The MSU AgAlert system (1047 subscribers) provides current and research-based information for Montana agricultural clients. There were 39 AgAlerts posted in 2020.

* Please note: italics were not used for species names/Latin names to follow ADA accessibility standards.

2020 Plant Disease Summary

Diagnostic Staff:

Dr. Mary Burrows, Extension Plant Pathologist & Montana IPM Coordinator
Dr. Eva Grimme, Plant Disease Diagnostician & Associate Extension Specialist II
Dr. Uta McKelvy, Associate Research Professor

Other Assistants/Specialists:

Dr. Cathy Cripps, Mycologist
Cheryl Moore-Gough, Extension Horticulture Specialist (January-June 2020)
Dr. Mareike Johnston, Plant Pathologist
Abiya Saeed, Extension Horticulture Specialist (July 2020 - present)
Sarah Eilers, IPM Manager
Chance Noffsinger, Research Assistant

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 included: Thielaviopsis spp. on lupine and field pea, Verticillium wilt on chickpea, and Erwinia bacterial blight on a South Dakota field pea sample.

Collaboration with North Dakota State University led to the detection of Phytophthora spp. on chickpea samples from North Dakota; detection of the pathogen in our neighboring state will inform future disease monitoring in Montana.

The accurate diagnosis of plant diseases ensures that unnecessary treatments are avoided and that integrated pest management strategies are implemented 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 are causing the plant stress, resulting in reduced 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.

The SDL is now testing mint mother stock and in-vitro plants for Verticillium dahliae. The absence of Verticillium is essential for mint growers to ensure that only healthy plant materials are distributed to customers. This year, we tested more than 300 samples. We will continue to support Montana's mint producers by providing this testing service.

Trends from 2020: Agriculture

Agricultural crops accounted for 253 plant disease diagnoses (physical samples) and 18 plant disease diagnoses for electronically (sample submission app) submitted samples. Overall, it was a low disease year due to an extended cold spring. Sample submission was likely reduced as a result of the COVID-19 pandemic.

The most frequently submitted crops were cereals (164 diagnoses total; 42 spring wheat, 30 winter wheat, 23 barley, 20 corn, 16 durum wheat, further rye, triticale, malted wheat, corn seed), pulse crops (35 diagnoses total; 15 lentil, 13 chickpea, 7 field pea), and forage alfalfa (28).

Fusarium diagnoses dominated including Fusarium crown rot (15) and Fusarium root rot (9). Fusarium affected spring/winter/durum wheat, corn, lentil, chickpea, dry field peas and cowpea. Only one durum wheat sample was diagnosed for Fusarium head blight. Rhizoctonia (14) and Pythium (7) root rot were also common affecting spring/winter/durum wheat, barley, oat, chickpea, lentil, and alfalfa. Common root rot (3) was diagnosed on spring wheat. Aphanomyces root rot (1) was diagnosed on cow pea. Fifteen samples of Wheat streak mosaic virus were confirmed (11 spring wheat, 1 winter wheat, 2 barley, 2 durum wheat), which originated predominantly from northeast and central Montana counties.

Foliar diseases of cereal crops were dominated by Septoria leaf spot (8) and Tan spot (8) affecting barley and winter/spring wheat. Stemphylium leaf spot (6) was dominant on alfalfa and lentil. Ascochyta (5), Botrytis (2), and Alternaria leaf blight (2) were diagnosed on chickpea, lentil, dry field pea, and alfalfa. Sclerotinia white mold was confirmed in lentil and alfalfa. Alfalfa was also diagnosed for spring black stem (3).

Bacterial disorders were dominated by Xanthomonas spp., causing bacterial leaf streak (5) on spring/winter wheat and oats, black chaff on oats, and bacterial pustules on soybean. Pseudomonas leaf blight was detected on soybean and Triticale.

Trends from 2020: Horticulture

Horticultural samples accounted for 613 plant disease diagnoses (samples submitted through the Plant Diagnostic Information System [PDIS]) and 60 plant disease diagnoses for electronically submitted samples (i.e. photos in emails and through the sample submission app). An early cold snap in September 2019, followed by tough winter conditions, damaged a wide range of deciduous and evergreen trees and shrubs. The damage resulted in delayed leafing out (mainly green ash trees), chlorosis, early fall coloration (especially 'Autumn Blaze Maple': Acer × freemanii), and dieback. Numerous juniper shrubs did not recover and showed only browning and dieback.

Throughout 2020, evergreen samples, especially Colorado blue spruce and blue spruce, were submitted with symptoms of Rhizosphaera needle cast disease (58) and/or sudden needle drop (20). Pine trees were mainly affected by Dothistroma needle blight (26). One Douglas-fir sample was confirmed for Rhabdocline needle cast disease.

Following a wet and cool spring, anthracnose disease caused leaf spots and lesions on various plants including green ash, aspen, black currant, clematis, grape, lilac, raspberry, and maple.

The SDL received numerous grape and grape vine sample from vineyards. Early in the season, anthracnose on leaves and fruits was detected. Later in the season, grape vines were affected by powdery mildew and fruits by black rot (causal agent: Guignardia bidwellii).

This season, the SDL received several elm tree samples which were tested for Dutch elm disease (causal agent: Ophiostoma spp.). Fortunately, only one sample tested positive for the disease.

Over 30 plant samples, including apple, crabapple, pear, mountain ash, and cotoneaster, were submitted to the SDL with suspected fire blight infection. We were able to test the samples with rapid disease diagnostic kits and confirmed 10 positive cases.

Cytospora canker disease and other fungal cankers were diagnosed on a variety of trees, including aspen, spruce, apple, and mountain ash. Stressed trees are mainly affected by these fungal diseases. Deep planting, drought conditions, and over-watering were some of the stressors that were observed in submitted cases.

Mid-to-late season foliar diseases included Marssonina leaf spot, shot hole disease, and powdery mildew. Marssonina spp. mainly affected aspen and cottonwood trees while shot hole disease was evident on choke cherry and plum trees. Powdery mildew affected numerous plants including choke cherry, caragana, lilac, maple, currant, grape, cucumber, and tomato.

Turfgrass was mainly affected by root rots caused by Rhizoctonia spp. or Pythium sp. During late summer, brown patch disease was observed, which is also caused by Rhizoctonia spp.

Sample Summary

In 2020, the SDL made 944 plant disease diagnoses. Samples were mainly submitted by extension personnel (57%) with 48% from non-commercial and 9% from commercial entities. Commercial entities outside of MSU accounted for 24% of the samples. The number of non-extension, non-commercial samples accounted for 18%. The highest number of samples was submitted by homeowners/gardeners (40%), agribusiness (10%), growers/farmers (9%), and arborists (5%). Other submitters include crop consultants (3%), companies (2%), regulatory agents (5%), researcher/specialists (4%), and lawn care professionals (1%).

Deciduous and evergreen woody ornamentals accounted for 46% of the total disease samples submitted to the SDL. Sample hosts of this category included Colorado blue spruce, blue spruce, pine trees, aspen, apple, crabapple, green ash, and maple trees. Field crops like chickpea, lentils, dry peas and small grains like wheat and barley accounted for 23% of disease samples. Fruit and vegetable samples (apple, raspberry, tomato, lettuce, herbs) accounted for 16%, perennial & annual plants for 7%, and turf samples accounted for 2% of the samples.

2020 Weeds Lab Summary – Plant ID, Mushroom ID, and Herbicide Injury

Diagnostic Staff:

Noelle Orloff- Associate Extension Specialist II

Extension Specialists:

Dr. Jane Mangold
Dr. Tim Seipel

Other Cooperators:

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

Impacts and Outcomes

Accurate plant identification is critical in assessing plant toxicity, and we assisted clients with poisonous plant issues in 2020. For example, this year we processed several samples of pasture and rangeland plants that clients were concerned may be toxic to their livestock. In many cases poisonous plants such as death camas (Zigadanus spp.) and locoweed (Astragalus spp.) were detected and management recommendations were given. In many other cases we confirmed plants were not known to be toxic or problematic to livestock, and we were able to recommend taking no action. Knowing a plant is likely safe for livestock helps avoid unnecessary control measures, which in turn saves producers time and money and helps preserve native plant communities.

Our services provide an essential resource to connect Extension field faculty with state resources and to increase knowledge of our Montana flora. For example, in 2020 we helped confirm three new county reports of plants that are problematic for agriculture in Montana [waterhemp (Amaranthus tuburculatus), Roosevelt County; Italian ryegrass (Lolium persicum), Judith Basin County; and common barberry (Berberis vulgaris), Fergus County]. In all three cases the plants were accurately identified by Extension field faculty, and we confirmed their identifications and obtained samples of the plants and collection information to include in the herbarium. These records are now part of our knowledge of Montana plant distributions.

Our services increase our clients' knowledge of pesticides and help connect them to regulatory resources. For example, in 2020 we assessed 29 garden vegetable samples that showed symptoms consistent with synthetic auxin herbicide injury. In many of these cases, newly purchased topsoil or newly applied manure was suspected to be the source of the symptoms. We distributed information about this ongoing issue to gardeners, vegetable farmers, and pesticide applicators, and referred clients to regulatory resources at the Montana Department of Agriculture when appropriate.

The SDL provides a valuable resource where land managers can get accurate information about suspected problematic plants such as high priority noxious weeds. Many samples are submitted to the SDL that are suspected of being noxious weeds but are not. For example, we received several samples suspected to be invasive annual grass ventenata (Ventenata dubia), but only one of these was confirmed as the regulated plant, while most were native Montana grasses. Preventing managers from mistakenly controlling beneficial plants saves time and money and preserves native plant communities in Montana.

Plant Identification Activities and Trends

In 2020, the SDL processed 212 physical specimens for plant identification, and 225 electronic samples (i.e. photos in emails, texts, and through our sample submission app). Overall, these sample numbers are about the same as those observed in 2019. However, this is the first year that more samples were completed electronically (i.e. email and our smartphone app) than by our traditional model of physical samples.

Most samples came from noncommercial sources such as government personnel, homeowners, and small acreage landowners. These samples accounted for 83% 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 17% of all submissions.

Plant identification samples submitted represented 298 unique species. Forty-seven percent of confirmed identifications were of exotic plants. The most commonly submitted exotic species were roving bellflower (Campanula rapunculoides, 9), black henbane (Hyoscamum niger, 5), and houndstongue (Cynoglossum officinale, 4). Fifty-three percent of confirmed samples were native plants. The most common native species submitted were rush skeletonplant (Lygodesmia juncea, 6) and stinging nettle (Urtica diocia, 5).

Fourteen confirmed specimens of state-listed noxious weeds were submitted representing 12 unique species (Table 2). The SDL provides a valuable resource where land managers can get accurate information about suspected problematic plants such as these high priority noxious weeds. Many samples are also submitted to the SDL that are suspected of being noxious weeds but are not. For example, we received several samples suspected to be the new invader ventenata (Ventenata dubia), but only one of these was confirmed as the regulated plant, while most were native Montana grasses.

Table 2. State listed noxious weeds and regulated plants submitted to the SDL in 2020.

Species	County	Priority
Canada thistle	Jefferson	2B
Cheatgrass	Teton	3
Common buckthorn	Stillwater	2A
Common St. Johnswort	Lake	2B
Houndstongue	Liberty, Park	2B
Knotweed complex	Rosebud, Sweet Grass	1B
Meadow hawkweed	Judith Basin	2A
Russian knapweed	Gallatin	2B
Spotted knapweed	Gallatin	2B
Ventenata	Wheatland	2A
Whitetop	Chouteau	2B

Mushroom Identification Activities

In addition to plants we also identify mushroom specimens. In 2020 Dr. Cathy Cripps and Chance Noffsinger assisted the SDL by identifying 32 mushroom samples. These specimens were of 25 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 Diagnosis

We assessed 77 physical samples for potential herbicide injury along with 34 electronically submitted samples. Overall, we assessed 17% more samples for herbicide symptoms compared to 2019. 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 77% 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 67 samples for herbicide injury symptoms. Of these, 25 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. Twenty-nine 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. This number of cases is a sharp increase compared to previous years. Other issues we encountered in residential landscapes included woody plants showing glyphosate injury symptoms (three cases), drift of photosynthesis inhibitor herbicides from nearby crop fields (two cases), and soil sterilant herbicide injury symptoms on mature trees (one case).

Of the 30 commercial agricultural samples we assessed for herbicide injury, most were due to soil residual herbicide issues from the synthetic auxin and ALS inhibitor herbicide mode of action groups. We also recorded five 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 drift and operator error. Finally, we assessed seven samples where symptoms were explained by other environmental factors or plant disease rather than herbicides.

2020 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 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

- New state record (1st time found in the state):
  The old house borer, Hylotrupes bajulus (Coleoptera: Cerambycidae), was detected in Belgrade, MT (Gallatin Co.); infestation detected in a home where imported eastern white pine timbers were installed throughout the home.
- An early detection of a clothes moth infestation, Tineola bisselliella, in a museum in Cascade County saved the destruction of several valuable items.
- The identification of a seed weevil on snapdragons and subsequent management recommendations prevented a commercial flower farm from losing the entire crop.
- For four cases of "suspected bed bugs", swallow bugs and bat bugs were confirmed, eliminating an unnecessary need for costly bed bug treatments.

Trends from 2020

- Several suspected "murder hornets" or Asian giant hornets were submitted as pictures and physical samples, which were actually cicada killers, horntails (both Urocerus sp. and the pigeon tremex, Tremex columba), and elm sawflies. The Asian giant hornet is yet to be detected in Montana. A nest was located in Blaine, WA in the fall of 2020 and has been destroyed (although two queens were found and killed that had escaped the nest).
- Root maggots were prevalent early in the season in onions, garlic, and other root vegetables.
- Several slug samples were submitted from the garden.
- Elm sawfly adults were prevalent in the summer from several counties in MT.
- There was a heavy infestation and damage from ash bark beetles on urban green ash trees. They have been established for years but dieback and woodpecker feeding on the larvae (immatures) under the bark were unprecedented.
- Heavy populations of two-spotted grasshoppers, Melanoplus bivittatus, occurred in yards and gardens.
- Blister beetle infestations were also common throughout the state.
- The aspen blotch leafminer (also known as a tentiform leafminer), Phyllonorycter sp., is a moth that infests cottonwoods, poplars, and aspen leaves, causing leaf blotches and necrotic spots. Damage is usually considered cosmetic but populations of the moth are increasing.
- Pearslug damage was widespread on cotoneaster and cherry in mid- to late summer.
- Thrips migrations were occurring in late summer in eastern Montana. Several reports of bites on humans were reported from the high number of thrips present and landing on human skin.
- Several species of carpet beetles, ants, and spiders were submitted for diagnosis from inside the home.

Sample Summary

In 2020, 792 arthropod diagnoses were completed. Of these identifications, 6% were spiders and 94% were insects or other arthropods. Ninety-two percent of the samples were urban/structural samples while eight percent were submitted from crops. Of the samples submitted, 56% were submitted from extension agents and 44% were submitted directly from homeowners, growers, consultants, arborists, and others. Seventy-five percent of the samples submitted were from non-commercial sources (primarily homeowners). Samples were submitted from 51 counties and one reservation in Montana, and one sample was submitted from Montezuma County in Colorado.

Urban/Household Samples

The greatest number of woody ornamental samples came from apple, arborvitae, ash, aspen, cherry, cotoneaster, Douglas-fir, elm, grape, hackberry, honeylocust, juniper, 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. For the yard and garden samples, grasshoppers, false chinch bugs, blister beetles, elm sawflies, garden millipedes, Nevada bumble bees, and cicada killers were commonly diagnosed.

For households (13% of all diagnoses), spiders, carpet beetles, ants, and root weevils were commonly found in the home. Spider samples constituted 6% of all samples submitted and 45% 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 beans, corn, cucumber, garlic, potato, spinach, and tomato. Some of the common pests on these hosts included aphids, beet leafminers, flea beetles, spider mites, bumble flower beetles, bulb mites, spotted snake millipedes, slugs, root maggots, and thrips. In the greenhouse, thrips, spider mites, springtails, and broad mites were common.

Field Crop Samples

Samples from field crops and forages included alfalfa, quinoa, pea, canola, hemp, lentil, barley, rye, safflower, wheat, and wheatgrass.

Table A1. Common insects and diseases associated with urban/ornamental plant hosts submitted to the Schutter Diagnostic Lab in 2020.

Host Tree	Common Insects/Arthropods	Common Diseases
Apple	Oystershell scale, blister mites, tortricid leafrollers, codling moth, apple-and-thorn skeletonizer	Fire blight
Arborvitae	Fletcher scale, false spider mites, spruce spider mites	Pestalotiopsis tip blight
Ash	Ash flower gall mites, ash plant bugs, eriophyid mites, leafcurl ash aphids, oystershell scale, tortricid leafrollers, lacebugs	Ash anthracnose
Aspen/ Cottonwood/ Poplar/*Populus* spp.	Aspen blotch leafminers (tentiform leafminer), tortricid leafrollers, carpenterworms, poplar borers, poplar blackmine beetles, Chaitophorus aphids, poplar vagabond aphids, eriophyid mites, poplar leaf gall mites, spider mites, oystershell scale	Cytospora canker, Marssonina leaf spot
Birch	Birch leafminers, bronze birch borer, tortricid leafrollers	
Boxelder	Boxelder erineum mite	
Cherry	Tortricid leafrollers, black cherry aphids, pearslugs/ sawflies, oblique-banded leafrollers, cankerworms, chokecherry gall midge	Fungal canker, shot hole disease
Cotoneaster	Oystershell scale, aphids, pearslugs/sawflies	
Douglas-Fir	Spruce spider mites, Western spruce budworm, Cooley spruce gall adelgid	Rhabdocline needle cast
Elm	Woolly elm aphids, elm leafminer, European elm flea weevil, European elm scale	Anthracnose, Dutch Elm disease
Fir	Western spruce budworm	Needle cast disease, cytospora canker
Hackberry	Hackberry nipple gall maker	
Honeylocust	Honeylocust podgall midge	
Juniper	Spruce spider mites	Cedar-apple rust, Kabatina tip blight, Phomopsis tip blight
Lilac	Root weevils	
Maple	Eriophyid mites	Maple anthracnose
Mountain-ash	Eriophyid mites, spider mites	Cytospora canker, fire blight
Oak	Callirhytis oak gall wasp, rough bulletgall wasp	Oak leaf blister
Pine	Cinara aphids (giant conifer aphids), spruce spider mites, pine needle scale, black pineleaf scale, pine sawyer beetles, Dioryctria moths	Dothistroma needle blight, blue stain fungus
Plum/Pear/Prunus	Aphids, tent caterpillars, pearslugs/sawflies, leafcurl plum aphids, plum gouger	Cytospora canker, powdery mildew, shot hole disease
Rose	Gall wasps, rose slug, aphids	
Spruce	Aphids, Cooley spruce gall adelgid, 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	Snowball aphid, viburnum erineum mites, viburnum clearwing borer	Bacterial leaf spot
Willow	Cottonwood leaf beetles, *Pterocomma* aphids, willow redgall sawfly, eriophyid mites	Willow black canker