

2022 Summary Report

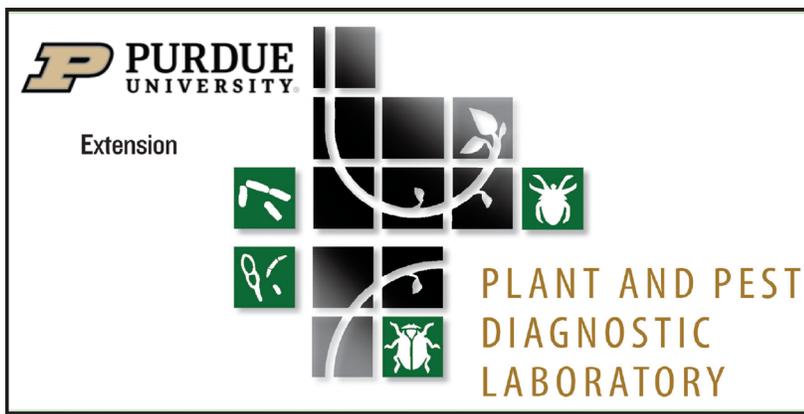
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Lab Director

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Plant Disease Diagnostician

Todd Abrahamson
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2022 Plant & Pest Diagnostic Lab Annual Summary Report





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Introduction

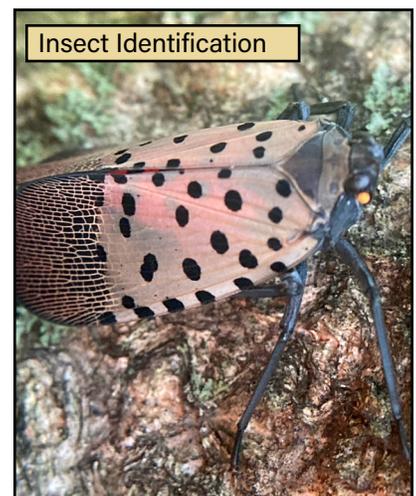
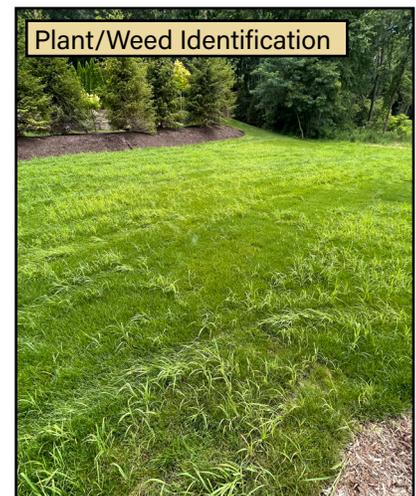
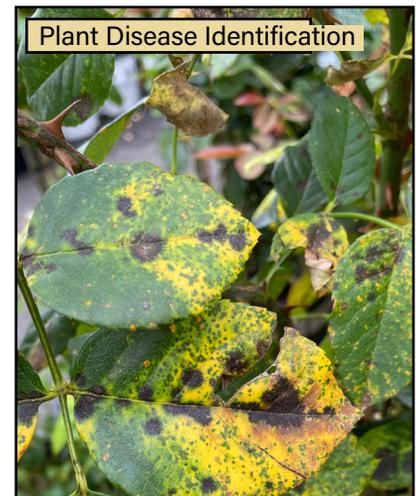
The Plant and Pest Diagnostic Laboratory (PPDL) remains dedicated to helping protect Indiana's agriculture, the green industry and individual landscapes, by providing rapid and reliable diagnostic services for plant disease and pest problems. We also provide appropriate pest management strategies and diagnostics training. We are a participating member lab in the National Plant Diagnostic Network (NPDN), a consortium of Land Grant University diagnostic laboratories established to help protect our nation's plant biosecurity infrastructure.

Regulatory/State Collaboration

In addition to general diagnostic samples the PPDL serves as the state laboratory charged with assuring accuracy in disease diagnosis for phytosanitary certification for exports, administered by the Indiana Dept. of Natural Resources (IDNR). We also support the work of the IDNR by providing insect identification and disease diagnosis for nursery inspection samples and official state survey samples such as for Ramorum blight (Sudden Oak Death). The PPDL serves as the lab of record for the Indiana Crop Improvement Association (ICIA) and provides hands-on disease identification phytosanitary training to field inspectors annually. We also partner with the Office of the Indiana State Chemist (OISC) to evaluate potential damage from herbicides, disease and insects on samples collected as part of official investigations of pesticide misapplication cases.

Extension Specialist Collaboration

The PPDL could not provide the range of services we offer without the diagnostic expertise provided by specialists in multiple departments (Table 1). As in past years, faculty and staff from the Departments of Botany & Plant Pathology, Agronomy, Entomology, Horticulture & Landscape Architecture, and Forestry & Natural Resources very generously assisted with problem diagnoses involving their specialties. The PPDL team provides an ongoing point of connection between county-based Extension educators, the public and Extension specialists on campus; facilitating knowledge exchange and information about trends in lab samples to promote more informed recommendations for disease and pest management.



Diagnostic Highlights and Surveys

Ramorum Blight/Sudden Oak Death survey:

Since 2004 the PPDL has partnered with the IDNR in annual Cooperative Agriculture Pest Survey (CAPS) efforts to assure Indiana nurseries are free from *Phytophthora ramorum*, the causal agent of Ramorum Blight (SOD). If this pathogen became established in the state it would threaten a wide range of ornamental woody plants and forest trees, including rhododendron, azalea, viburnum and oaks. This nursery survey assists in protecting Indiana landscapes, forests and the timber industry from a potentially destructive pathogen while preventing impacts to trade that might occur if *P. ramorum* became established in our nurseries and forests. Fortunately there were no *P. ramorum* detections in the 202 survey samples (Table 2).

ICIA Collaboration:

In Indiana, ICIA field inspectors assist the IDNR by providing field inspections of crops grown for international export so that IDNR may issue appropriate Phytosanitary export certificates. The PPDL provides phytosanitary corn and soybean disease diagnostics workshops to train Indiana Crop Improvement Association (ICIA) field inspectors annually to promote high standards of plant inspection work.

Table 1. Department faculty and staff that assisted with sample diagnoses - 2022

Faculty/Staff	Number of Diagnoses	Faculty/Staff	Number of Diagnoses
Agromony	9	Entomology	225
Keith Johnson	2	Cliff Sadof	91
Other	7	Alicia Kelley	47
Botany & Plant Pathology	3019	Tim Gibb	40
John Bonkowski	1534	Elizabeth Long	22
Tom Creswell	999	Laura Ingwell	11
Marcelo Zimmer	254	Other	18
Janna Beckerman	113	Horticulture & Landscape Architecture	74
Lee Miller	55	Kyle Daniel	29
Dan Egel	16	Aaron Patton	27
Other	48	Other	18
Forestry & Natural Resources	4	Non-Purdue Specialist	36
Lindsey Purcell	3	Jan Bryne, MSU	34
Other	1	Other	2

Table 2. Affiliation of persons submitting samples to the PPDL - 2022

Affiliation	Number of Samples	% of Total
Non-regulatory	1711	72.47%
Commercial	1243	52.65%
Garden Center/Greenhouse/Nursery	383	16.22%
Landscaper/Lawn & Tree Care	166	7.03%
Grower/Farmer	139	5.89%
Crop Consultant	120	5.08%
Agribusiness	93	3.94%
Other	93	3.94%
Arborist	89	3.77%
Researcher/Specialist	80	3.39%
Golf Course	34	1.44%
Extension Educator	24	1.02%
Pest Control	22	0.93%
Non-Commercial	468	19.82%
Homeowner	316	13.38%
Extension Educator	82	3.47%
Researcher/Specialist	70	2.96%
Regulatory Samples	650	27.53%
IDNR (SOD <i>P. ramorum</i> Nursery Survey)	202	8.56%
Office of the Indiana State Chemist	186	7.88%
IDNR (Nursery Inspection)	132	5.59%
IDNR/ICIA (Phytosanitary certification field inspection)	89	3.77%
APGA Invasive Insect Survey	31	1.31%
Corn/Soybean Foliar Disease Survey	10	0.42%
Total:	2361	100.00%

Corn Tar Spot Update:

Since our lab first detected this disease in the United States in 2015, Tar spot of corn, caused by *Phyllachora maydis* (Fig. 1), has become an important disease in Indiana, primarily in the northern counties of the state.

The 2022 Summer season was very dry and there was low disease severity reported throughout the state for tar spot, as well as most foliar diseases. Crop loss due to tar spot is lower than previous years due to environmental conditions.

Dr. Darcy Telenko's, <https://ag.purdue.edu/btny/telenkolab/>, applied research efforts have shown that tar spot alone has caused an estimated loss of 107 million bushels (\$489 million) in Indiana and 473 million bushels (\$2.1 billion) in the US, since 2018 (loss.cropprotectionnetwork.org). Her lab's research efforts focus on gaining a better understanding of how quickly the disease is spreading and its distribution in Indiana. The PPDL supported this research by diagnosing tar spot on 103 samples submitted from 41 Indiana counties. To date, *Phyllachora maydis* has been detected in 86 out of 92 counties in Indiana.



Fig. 1: Tar spot symptoms on corn.

Southern Rust of Corn:

Southern rust, caused by the fungal pathogen *Puccinia polysora* (Fig. 2), is an annual threat to corn production in the US. While the fungus cannot survive the winter in Indiana, it is blown northward each year, mainly from Mexico and South America. In severe outbreaks, growers can experience yield reductions as high as 25 bushels/acre if not managed.

Since 2019, Dr. Darcy Telenko has conducted a state-wide survey to determine the distribution of southern rust in Indiana in order to recommend appropriate management strategies. With funding provided by the Indiana Corn Marketing Council, her program paid for sample handling fees for all southern rust samples submitted to the PPDL for diagnosis. Similar to tar spot, the dry Summer lead to reduced disease severity and incidence in 2023. We diagnosed southern rust on 40 samples submitted from 28 Indiana counties.



Fig. 2: Orange pustules of Southern rust shown on corn leaf. Photo by K. Wise.

Vascular Streak Dieback

A new unexplained dieback and plant decline syndrome has been identified in redbud, maple, and other hardwood trees and shrubs in the last few years. Thin brown streaks found within vascular tissue in woody plants has been observed in frequent association with plants exhibiting dieback and decline symptoms (Fig. 3). Our lab has been working with specialists and multiple institutions in states where this issue has been found in order to learn more about the disease issue and potential causes. To date, two nursery stock interceptions have occurred in Indiana by the IDNR. See our article on this problem in the Purdue Landscape Report at: <https://www.purduelandscapereport.org/article/vascular-streak-dieback-of-redbud-what-plant-pathologists-know-so-far/>

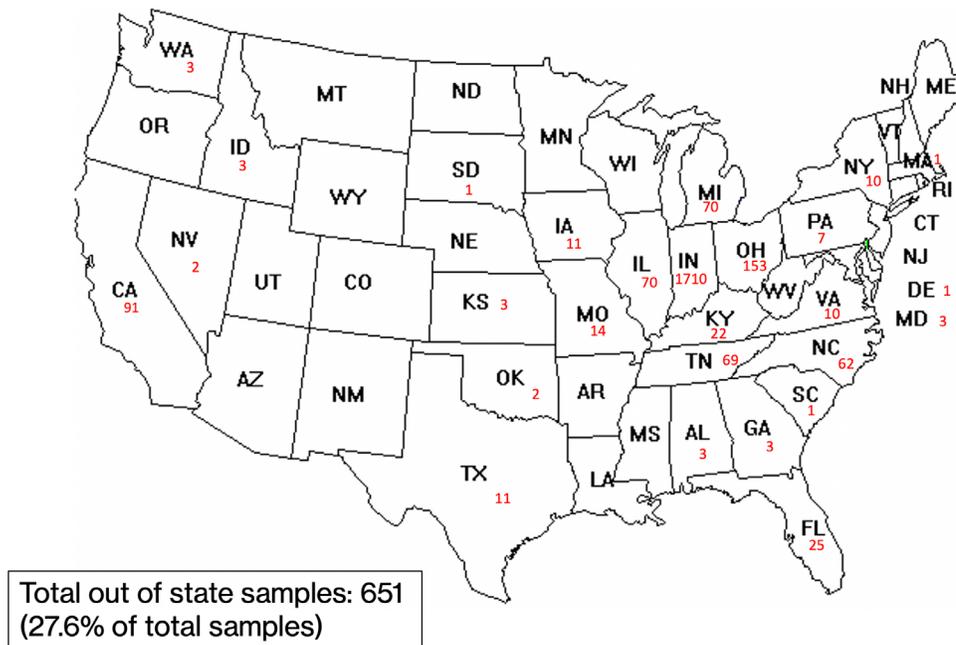


Fig. 3: Vascular streak dieback symptoms on redbud.

Sample Overview

In 2022, we diagnosed 3572 problems on a total of 2361 samples submitted (Tables 2 and 4), both of which represent an increase over 2020 and 2021 totals. Figure 5 shows sample numbers for the last five years categorized by non-regulatory and survey samples. Samples originating from outside Indiana increased from 18.6% of total samples (436 samples) to 27.6% (651 samples) in 2022 (Fig. 4).

Fig. 4 Origin of samples received by the Plant and Pest Diagnostic Laboratory – 2022

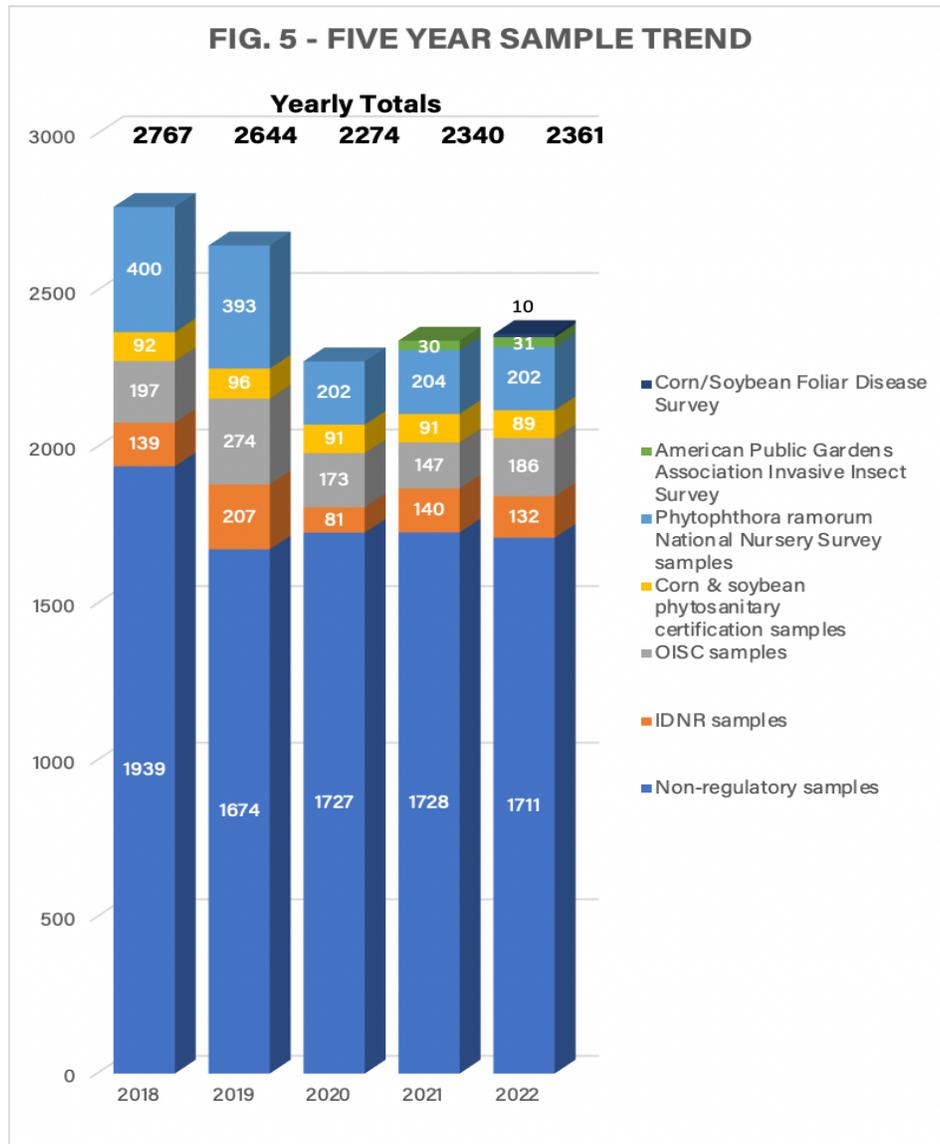


Ornamental plants are consistently the largest category of non-regulatory samples (53%), followed by agronomic crops (16%), highlighting the reliance of Indiana's green industry on the expertise provided by the PPDL (Fig. 6). A more detailed list of sample types is given in Table 3.

While diseases comprised 52.5% of our diagnoses last year, arthropod problems and damage due to non-living (abiotic) factors such as herbicide injury and weather extremes, especially drought stress, continue to be a significant segment of the problems diagnosed and have increased since 2021 (Fig. 7 and Table 4).

New Purdue University Extension Turfgrass Plant Pathology Specialist

Dr. Lee Miller began as an assistant professor of turfgrass pathology in January 2022 with responsibilities including turfgrass disease diagnosis and management for stakeholders in Indiana and the surrounding region. Since he began, the PPDL received 34 golf course samples in 2022, up from 2 in 2021.



Extension and Teaching Activities

The PPDL staff participates in multiple in-person training events throughout the state each year. Presentations, workshops, and speaking engagements were conducted in face-to-face, recorded presentations, and online webinars in accordance with Protect Purdue guidelines, with many of these restrictions being removed by the end of the year.

In 2022 our educational efforts included participation in Indiana Green Expo, Turf and Landscape Field Day, Indiana Arborists Association meeting, Indiana Professional Lawn and Landscape Association, Category 1A Pesticide Certification Training and Master Gardener events. We also provided classroom lectures and/or lab experiences related to diagnostic work for students in six courses: BTNY 605, BTNY 208, BTNY 301, HORT 318 and FNR 444.

FIG. 6 - NON-REGULATORY SAMPLE CATEGORIES

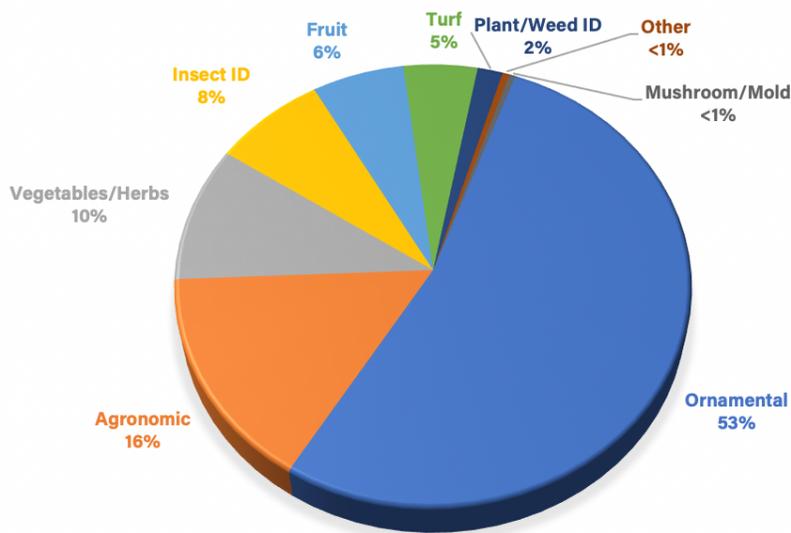


Table 3. Non-regulatory Samples by Category - 2022

Category	# of Samples	% of Samples
Agronomic	266	15.5%
Corn	138	8.1%
Soybean	94	5.5%
Small Grains - wheat,oats,barley	13	0.8%
Sorghum	7	0.4%
Nematode (Soil only)	6	0.4%
Forage	5	0.3%
Other Agronomic	3	0.2%
Fruit	106	6.2%
Fruit tree	60	3.5%
Small Fruit	46	2.7%
Ornamental	911	53.2%
Woody ornamental - Deciduous	419	24.5%
Woody ornamental - Evergreen	236	13.8%
Perennial	144	8.4%
Annual	58	3.4%
Other Ornamental	54	3.2%
Turf	85	5.0%
Vegetables/Herbs	170	9.9%
Lettuce	55	3.2%
Tomato	37	2.2%
Other Vegetables	35	2.0%
Herbs	15	0.9%
Pepper	11	0.6%
Spinach	10	0.6%
Pumpkin	7	0.4%
Miscellaneous	173	10.1%
Insect ID	129	7.5%
Plant/Weed ID	29	1.7%
Other (Multiple Host, Aquatics)	8	0.5%
Mushroom/Mold	7	0.4%
Total Samples:	1711	100.0%

Journal Publications:

Whole genome sequencing-based tracing of a 2022 introduction and outbreak of *Xanthomonas hortorum* pv. *pelargonii*. A.J. Weisberg, E.R. Ruita, K.B. Kilday, J.C. Bonkowski, T.C. Creswell, M. Daughtrey, K. Rane, N. Grunwald, J.H. Chang, M. Putnam. *Phytopathology*, 2022, <https://doi.org/10.1094/PHYTO-09-22-0321-R>

First report of smoketree rust, caused by *Pileolaria cotini-coggygriae*, in the Midwest USA. P. Kaishan, T. Creswell, J. Bonkowski, C. Aime. *Plant Health Progress*, 2022, <https://doi.org/10.1094/PHP-08-22-0080-BR>

First Report of *Belonolaimus longicaudatus* Infecting Soybean in Indiana. Bonkowski J, Crow WT, Habteweld A. 2022. *J Nematol.* Nov 12;54(1). <https://doi.org/10.2478/jofnem-2022-0034>

First report of *Exserohilum pedicellatum* causing root rot of corn in Indiana. J. Bonkowski, G. Ruhl, T. Creswell. *Plant Disease*. 2022, <https://doi.org/10.1094/PDIS-06-21-1245-PDN>

Strawberry Cultivar Susceptibility to *Neopestalotiopsis* leaf spot in Indiana. W. Guan, J. Bonkowski, T. Creswell, D. Egel, *Plant Health Progress*, 2023, <https://doi.org/10.1094/PHP-05-22-0049-RS>

FIG. 7 - DIAGNOSIS BY PROBLEM CATEGORY

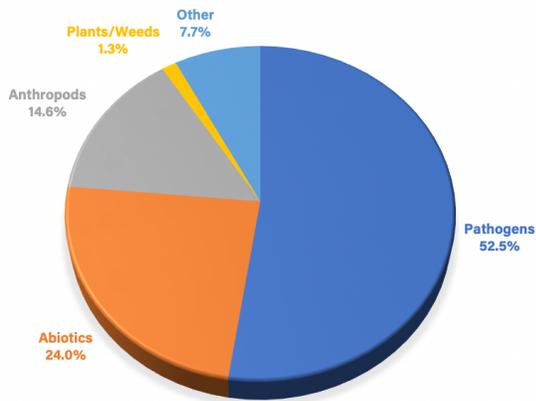


Table 4. Diagnosis Sorted by Category - 2022

Category	Number of Diagnoses	Percentage of Total
Pathogens	1874	52.5%
Fungi	1560	43.7%
Viruses	201	5.6%
Bacteria	113	3.2%
Abiotics	856	24.0%
Culteral/Environmental	403	11.3%
Chemical/Herbicide Injury	324	9.1%
Other	74	2.1%
Nutritional	55	1.5%
Anthrhopods	521	14.6%
Insects	374	10.5%
Mites	89	2.5%
Nematodes	50	1.4%
Other	8	0.2%
Plants/Weeds	47	1.3%
Other	274	7.7%
Totals:	3572	100.0%

Purdue Landscape Report articles 2022:

John Bonkowski All of the Galls in the Landscape
<https://www.purduelandscapereport.org/article/all-of-the-galls-in-the-landscape/>

John Bonkowski Stem Girdling Roots
<https://www.purduelandscapereport.org/article/stem-girdling-roots/>

Tom Creswell Volutella Blight and Dieback of Boxwood;
<https://www.purduelandscapereport.org/article/volutella-blight-and-dieback-of-boxwood/>

John Bonkowski, Tom Creswell Rows and Rows of Holes
<https://www.purduelandscapereport.org/article/rows-and-rows-of-holes/>

Tom Creswell Orange Goo - Dramatic but Harmless
<https://www.purduelandscapereport.org/article/orange-goo-dramatic-but-harmless/>

Kyle Daniel, Tom Creswell Stop Making These Arborvitae Mistakes! Common Transplant problems of arborvitae
<https://www.purduelandscapereport.org/article/stop-making-these-arborvitae-mistakes-common-transplant-problems-of-arborvitae/>



PURDUE PLANT DOCTOR

John Bonkowski What is happening to the Weeping Willows?
<https://www.purduelandscapereport.org/article/what-is-happening-to-the-weeping-willows/>

Tom Creswell Kretschmaria Basal Canker: Fast Path to Tree Failure
<https://www.purduelandscapereport.org/article/kretschmaria-basal-canker-fast-path-to-tree-failure/>

John Bonkowski Lamentable Lilac Leaf Diseases
<https://www.purduelandscapereport.org/article/lamentable-lilac-leaf-diseases/>

John Bonkowski Beech Leaf Disease: Another worm to worry about
<https://www.purduelandscapereport.org/article/beech-leaf-disease-another-worm-to-worry-about/>

Tom Creswell Zinnia Bacterial Spot
<https://www.purduelandscapereport.org/article/zinnia-bacterial-spot/>

Extension Publications 2022:

Janna Beckerman, Tom Creswell Symptoms and Signs for Plant Problem Diagnosis - An Illustrated Glossary; BP-164-W
<https://mdc.itap.purdue.edu/item.asp?itemID=24577>

John Bonkowski, Tom Creswell Verticillium Wilt of Woody Plants; BP-6-W
https://mdc.itap.purdue.edu/item.asp?Item_Number=BP-6-W

PURDUE UNIVERSITY Extension
 Botany and Plant Pathology
 ag.purdue.edu/btny
 BP-164-W

Symptoms and Signs for Plant Problem Diagnosis - An Illustrated Glossary

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DISEASES OF LANDSCAPE PLANTS

Verticillium Wilt of Woody Plants

Sudden wilting and browning of foliage on one side of the tree is typical of Verticillium wilt. (Photo by John Obermeyer)

Verticillium wilt, caused by fungi in the genus *Verticillium*, is one of the most common and destructive diseases of woody ornamental plants in the Midwest. Common and highly susceptible hosts include redbud, smoketree, tree-of-heaven, and maples. Rose, lilac, boxwood, and barberry are also frequent hosts. In addition, *Verticillium* also infects many food crops, including potato, tomato, pepper, eggplant, and raspberry. In all, more than 300 plant species have been reported susceptible to this disease (Table 1).

Table 1. Woody Plants Susceptible to Verticillium Wilt

Common Name	Scientific Name	Common Name	Scientific Name
Ash	<i>Fraxinus</i> spp.	Magnolia	<i>Magnolia</i> spp.
Barberry	<i>Berberis</i> spp.	Maple	<i>Acer</i> spp.
Boxwood	<i>Buxus</i> spp.	Osage Orange	<i>Maclura pomifera</i>
Brambles	<i>Rubus</i> spp.	Persimmon	<i>Diospyros</i> spp.
Buckeye	<i>Aesculus</i> spp.	Privet	<i>Ligustrum</i> spp.
Black gum	<i>Nyssa sylvatica</i>	Redbud	<i>Cercis canadensis</i>
Black locust	<i>Robinia pseudoacacia</i>	Rose	<i>Rosa</i> spp.
Box elder	<i>Acer negundo</i>	Russian Olive	<i>Elaeagnus angustifolia</i>
Catalpa	<i>Catalpa</i> spp.	Sassafras	<i>Sassafras albidum</i>
Cherry, Plum	<i>Prunus</i> spp.	Serviceberry	<i>Amelanchier</i> spp.
Cork tree	<i>Quercus suber</i>	Smoke Tree	<i>Cotinus coggygria</i>
Elm	<i>Ulmus</i> spp.	Sumac	<i>Rhus</i> spp.
Golden rain tree	<i>Koeleruteria paniculata</i>	Tree-of-heaven	<i>Ailanthus altissima</i>
Honeysuckle	<i>Lonicera</i> spp.	Tuliptree	<i>Liriodendron tulipifera</i>
Horse chestnut	<i>Aesculus</i> spp.	Tupelo	<i>Nyssa</i> spp.
Japanese pagoda tree	<i>Styphnolobium japonicum</i>	Viburnum	<i>Viburnum</i> spp.
Lilac	<i>Syringa</i> spp.	Weigela	<i>Weigela</i> spp.
Kentucky coffee tree	<i>Gymnocladus dioica</i>	Yellowwood	<i>Cladrasia kentuckea</i>



Extension
 Plant and Pest Diagnostic Lab