

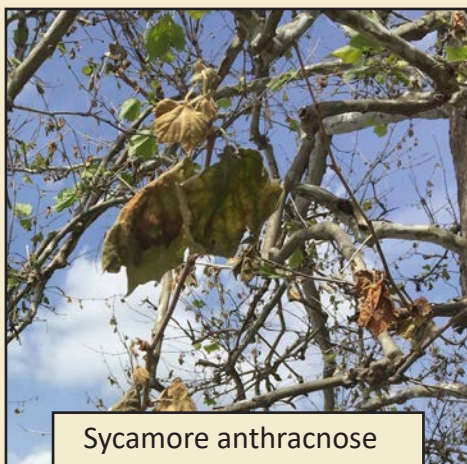
2023 Summary Report

Tom Creswell, PhD
Lab Director

John Bonkowski, DPM
Plant Disease Diagnostician

Tina Garwood
Lab Technician

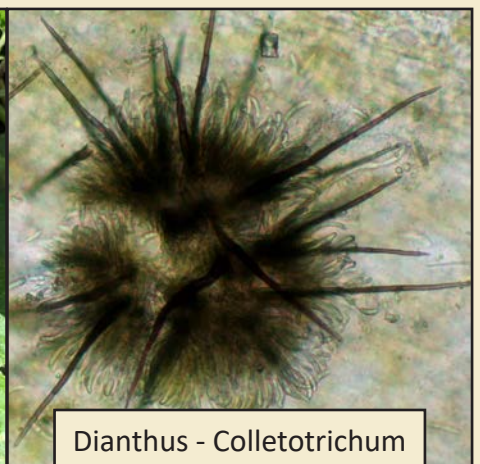
2023 Plant & Pest Diagnostic Lab Annual Summary Report



Sycamore anthracnose



Anemone - Foliar-nematode



Dianthus - Colletotrichum



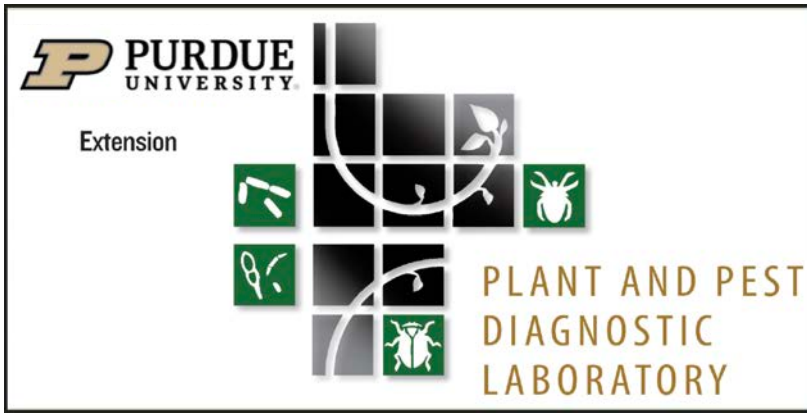
Hawthorn leaf miner



Cherry - Black-knot



Viburnum - Downy mildew



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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.

Sample Overview

In 2023, we diagnosed 4092 problems on a total of 2749 samples submitted (Table 1 & Fig. 1), both of which represent an increase over the last several years.

Ornamental plants are consistently the largest category of non-regulatory samples (62%), followed by agronomic crops (16%), highlighting the reliance of Indiana’s green industry on the expertise provided by the PPDL (Fig. 2).

While diseases comprised 54.5% of our diagnoses last year, arthropod problems and damage due to non-living (abiotic) factors such as herbicide injury and weather extremes continue to be a significant segment of the problems diagnosed and have increased since 2021 (Table 1).

FIG. 1 - TEN-YEAR SAMPLE TREND

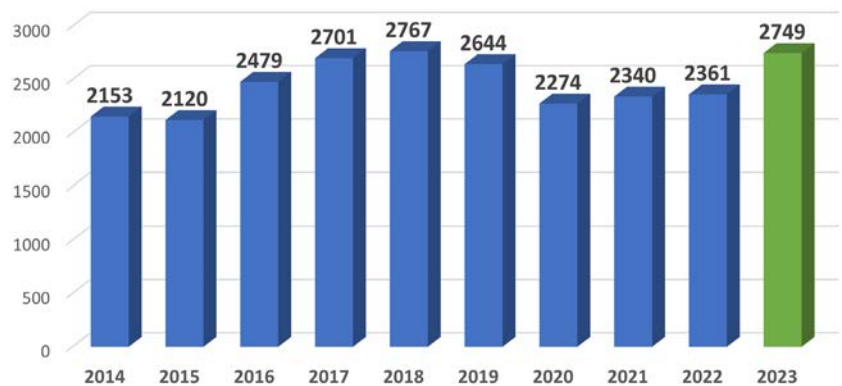
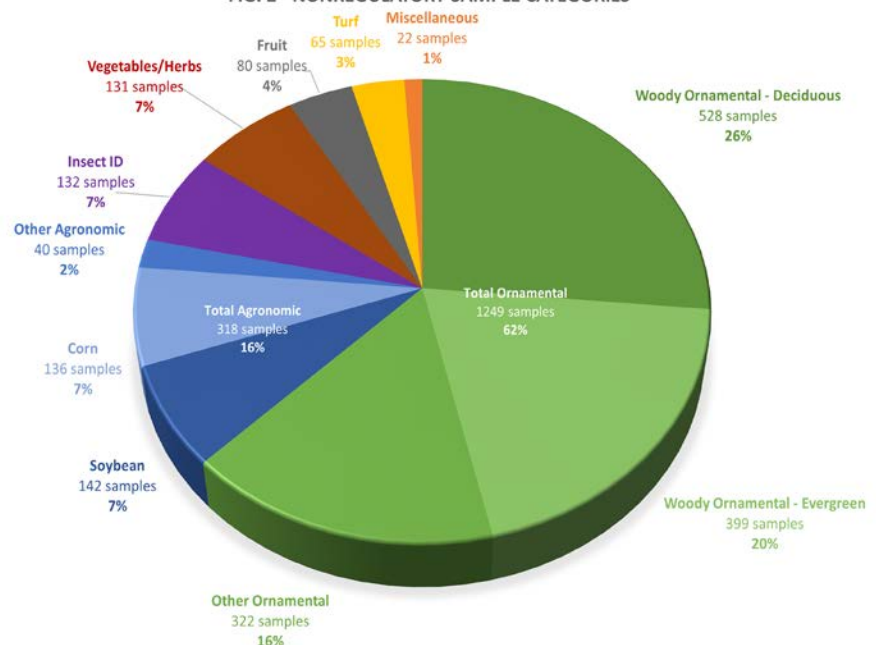


FIG. 2 - NONREGULATORY SAMPLE CATEGORIES



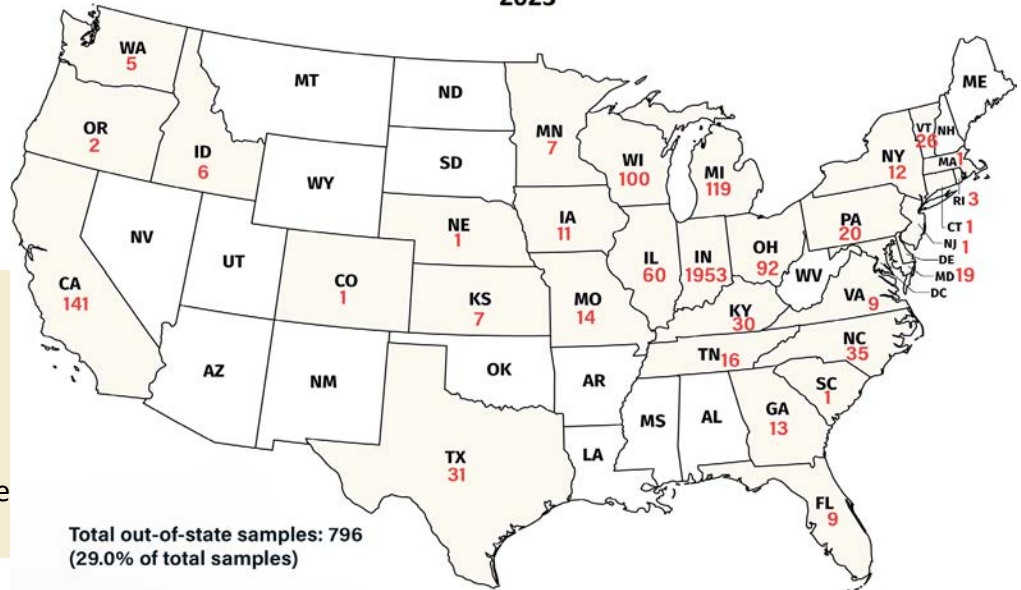
Category	Number of Diagnoses	Percentage of Total
Pathogens	2231	54.5%
Fungi/Oomycete	1825	44.6%
Viruses	302	7.4%
Bacteria	98	2.4%
Phytoplasma	6	0.1%
Abiotics	972	23.8%
Cultural/Environmental	558	13.6%
Chemical/Herbicide Injury	220	5.4%
Other	115	2.8%
Nutritional	79	1.9%
Arthropods	540	13.2%
Insects	387	9.5%
Mites	102	2.5%
Nematodes	51	1.2%
Plants/Weeds	54	1.3%
Other	295	7.2%
Totals:	4092	100.0%

Faculty/Staff	Number of Diagnoses	Faculty/Staff	Number of Diagnoses
Agronomy	10	Entomology	225
Keith Johnson	5	Doug Richmond	79
Other	5	Brock Harpur	57
Botany & Plant Pathology	3262	Cliff Sadof	31
John Bonkowski	1748	Tim Gibb	13
Tom Creswell	1196	Bob Bruner	12
Janna Beckerman	167	Elizabeth Long	10
Marcello Zimmer	58	Alicia Kelley	8
Lee Miller	52	John Obermeyer	6
Darcy Telenko	34	Laura Ingwell	5
Dan Egel	3	Other	4
Other	4	Horticulture & Landscape Architecture	76
Forestry & Natural Resources	10	Kyle Daniel	48
Non-Purdue Specialist	43	Aaron Patton	10
MSU	37	Stephen Meyers	10
Other	6	Liz Maynard	4
		Karen Mitchell	3
		Other	1

Extension Specialist Collaboration

The PPDL could not provide the range of services we offer without the diagnostic expertise provided by specialists in other departments (Table 2). 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 providing problem diagnoses involving their specialties. We extend a special thank you and congratulations to Dan Egel and Cliff Sadof as they retire. Both Dan and Cliff have been extremely supportive of the PPDL over the years, and they will be greatly missed. The PPDL 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.

FIG. 3 - ORIGIN OF SAMPLES SUBMITTED TO THE PPDL 2023



Samples originating from outside Indiana increased from 27.3% (651 samples) in 2022 to 29.0% (796 samples). Additionally, this year, we received 3 digital-only international samples, from the UK, Canada, and Sweden.

Indiana Department of Natural (IDNR) Resources Collaboration:

The PPDL serves as the state laboratory charged with assuring accuracy in disease diagnosis for phytosanitary certification for exports, administered by the 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. 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 and Sudden Oak Death. The CAPS 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 228 survey samples received this year (Table 3).

Indiana Crop Improvement Association (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 ICIA field inspectors annually to promote high standards of plant inspection work. This year, we processed 116 in-season samples from ICIA inspectors throughout Indiana (Table 3).

Office of the Indiana State Chemist (OISC) Collaboration:

We also partner with the OISC to evaluate potential damage from herbicides, disease and insects on samples collected as part of official investigations of pesticide misapplication cases. Reports were provided on 105 OISC samples last year (Table 3).



Fig. 4 Herbicide injury on grape

Table 3. Affiliation of persons submitting samples to the PPDL - 2023		
Affiliation	Number of Samples	% of Total
Non-regulatory	1997	72.6%
Commercial	1438	52.3%
Garden Center/Greenhouse/Nursery	447	16.3%
Landscaper/Lawn & Tree Care	375	13.7%
Crop Consultant	266	9.7%
Grower/Farmer	81	3.0%
Other	49	1.8%
Pest Control	30	1.1%
Golf Course	27	1.0%
Extension Educator	24	0.9%
Extension - Purdue on the Farm	34	1.2%
Researcher/Specialist	105	3.8%
Non-Commercial	559	20.3%
Homeowner	408	14.8%
Extension Educator	76	2.8%
Researcher/Specialist	75	2.7%
Regulatory	752	27.4%
IDNR (SOD <i>P. ramorum</i> Nursery Survey)	228	8.3%
Office of the Indiana State Chemist	105	3.8%
IDNR (Nursery Inspection)	143	5.2%
ICIA (Phytosanitary certification field inspection)	116	4.2%
Out-of-State Regulatory	160	5.8%
Total:	2749	100.0%

Corn Tar Spot and Southern Rust Update:

Tar spot of corn, caused by *Phyllachora maydis* (Fig. 5), continues to be a concern due to previous epidemics. In 2023, moderate levels of tar spot occurred in Indiana with pockets of severe disease. The environmental conditions are key in determining field risk year to year as temperature (64-73°F) for 30 days and leaf wetness play an important role in tar spot disease development (<http://doi.org/10.31274/cpn-20231220-1>).



Fig. 5: Tar spot symptoms on corn.

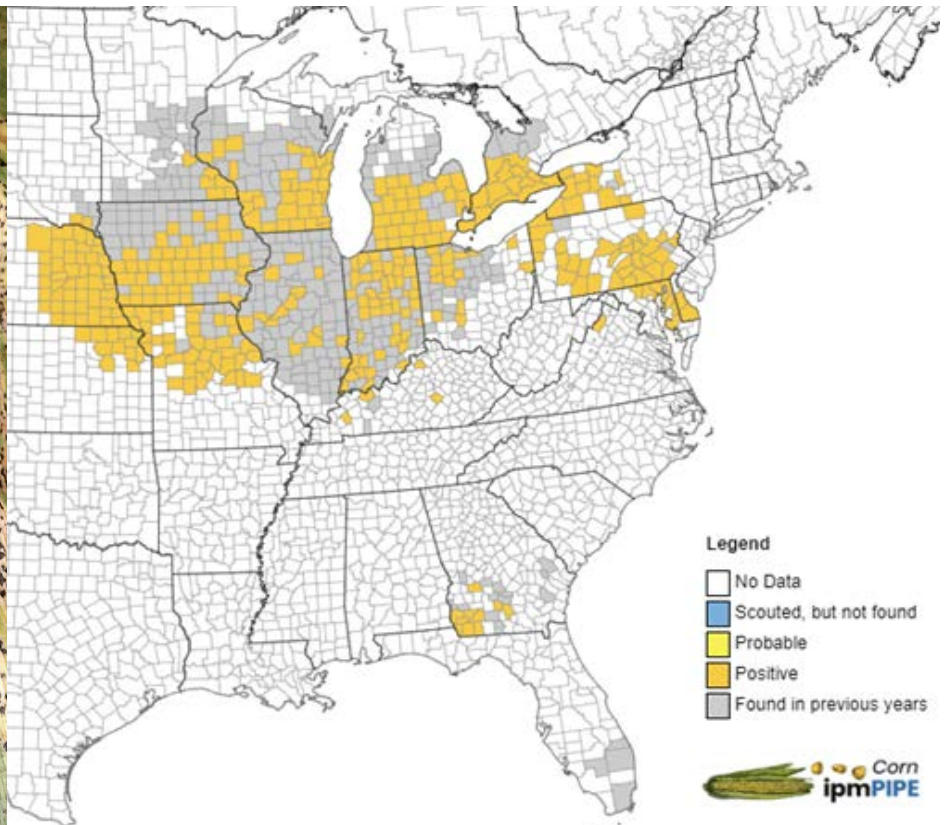


Fig. 6: Tar spot distribution across the Eastern United States

Darcy Telenko's field crop pathology team continued to scout for tar spot across the state with samples sent to the PDDL for diagnosis. One new county was confirmed with tar spot in 2023, making 87 counties total in Indiana to date. Over 263 samples were submitted to the PDDL for corn diseases with 47 being positive for tar spot. The distribution of tar spot in 2023 is shown in Fig. 6. (<https://corn.ipmPIPE.org/tarspot/historical-end-of-season-maps/>)

Southern rust, caused by the fungal pathogen *Puccinia polysora* (Fig. 7), had reduced incidence in 2023 due to dry summer weather, with only 8 samples diagnosed. With funding provided by the Indiana Corn Marketing Council, Dr. Telenko's program paid sample handling fees for all suspected southern rust samples submitted to the PDDL for diagnosis as part of an ongoing survey.



Fig. 7: Orange pustules of Southern rust shown on corn leaf. Photo by K. Wise.

Boxwood Dieback Issues

In 2022 temperatures were mild in late Fall and early Winter up until December 23 – 26 when nighttime temperatures dropped between 30 to 50 degrees F throughout most of the state. Boxwood plants, in particular, were heavily damaged by this sudden, rapid temperature drop leading to widespread dieback and increased *Volutella* disease (Fig. 8). The number of boxwood problems jumped from 71 in 2022 to 328 in 2023, almost all involving cold damage and *volutella* dieback. Boxwood blight, caused by *Calonectria pseudonaviculata*, was not detected in any samples in 2023.



Fig. 8 Boxwood with cold damage and *volutella* dieback

Vascular Streak Dieback

An unexplained dieback and plant decline syndrome, known as vascular streak dieback (VSD) has emerged as a new problem threatening nursery production of redbud, maple, and other hardwood trees since 2019 (Fig. 9). Thin brown streaks found within vascular tissue in woody plants have been observed in frequent association with plants exhibiting dieback and decline symptoms. To date, the IDNR has located three occurrences of VSD in nursery stock in Indiana, all of which were eradicated. There have been no occurrences in landscapes or native stands to our knowledge. Our lab continues to work with specialists and multiple institutions in states where this issue has been found to learn more about the disease issue and potential causes.

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/>

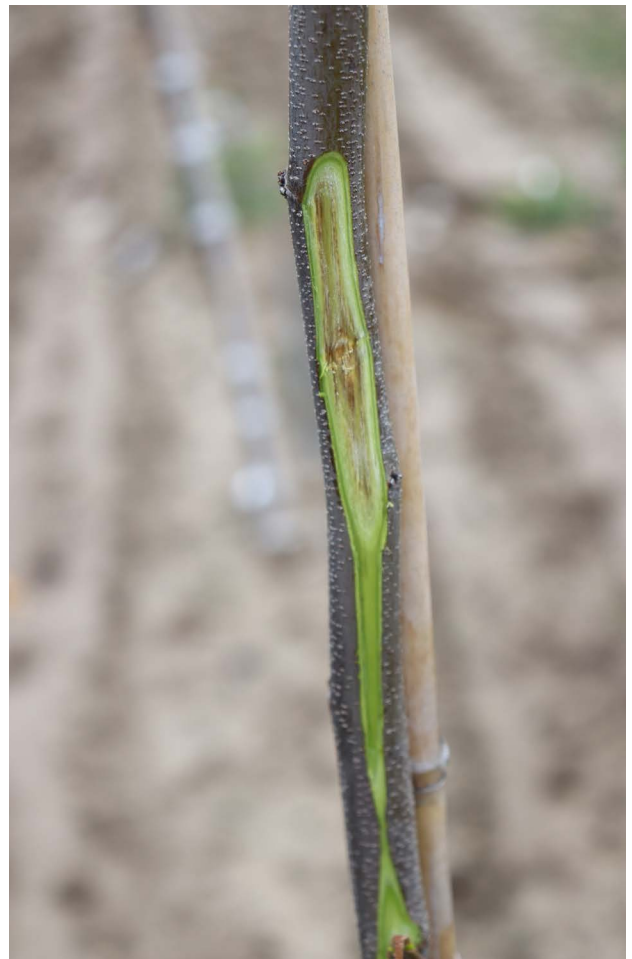


Fig. 9: Vascular streak dieback symptoms on redbud.



Fig. 10 Beech leaf disease symptoms

Beech Leaf Disease

First observed in Ohio in 2012, beech leaf disease (BLD) and the foliar nematode associated with symptomatic trees, *Litylenchus crenatae* subsp. *mccannii*, has been causing the decline of beech trees of all ages in Northeast US and parts of Canada (Fig. 10). Affected trees show characteristic leaf striping and deformation, reduced vigor, and eventual death. The nematode has been detected in the following locations and is continuing to spread: CT, MA, ME, MI, NH, NJ, NY, OH, PA, RI, VA, and Canada. In collaboration with the IDNR and the Michigan and Wisconsin Departments of Agriculture, we are participating in a survey to determine if BLD is present within the states and to delimit its spread in Michigan. The survey will be conducted 2023 – 2026 with samples collected from October to March. Samples are still being collected and processed for 2023-2024, but all samples have been determined to be BLD negative to date (Jan. 2024).

Extension and Teaching Activities

The PPDL staff participates in multiple in-person training events throughout the state each year. In 2023 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 the Purdue Extension Master Gardener Program. John Bonkowski and Tom Creswell presented a total of 22 talks, reaching more than 1600 participants. 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. 11 Turf and Landscape field day

Stakeholder Survey Results

Each year the PPDL surveys clients to document impact, better understand client needs and improve our service. For 2023 sample submitters report that because of information provided in our lab reports they were able to ‘Understand the problem better’ (76%), ‘Diagnose this problem’ (53%), ‘Diagnose similar problems’ (30%) or ‘Avoid this problem in the future’ (26%).

Comments included: ‘I was able to build confidence in my own diagnosis with a backup by a very reputable source’, ‘I was able to provide unbiased diagnoses to our clientele’ and ‘The information provided other means of addressing the issue beyond the use of pesticides that I was not aware of’.

In response to a question on pesticide use practices clients say reports helped them: ‘Choose the best pesticide, timing or rate’ (81%), ‘Avoid unnecessary pesticide use’ (46%) and ‘Understand how to apply the pesticide’ (16%). Client satisfaction results reflect a very high average Net Promoter Score® of 80 for the year, with respondents saying they were satisfied/very satisfied with turnaround time (94%), the value of the service (91%), and quality of the recommendations (87%).

Dissatisfaction was reported by several clients with the billing/payment process, so the PPDL will be focusing on that as an area for improvement in 2024.

Journal Publications

- Natural host range, putative vector, and diversity of *Lindera* severe mosaic-associated virus, a recently identified emaravirus. John Hammond, Dimitre Mollov, Ronald Ochoa, Ramon L. Jordan, Todd Rounsaville, Emily Johnson, Samuel Grinstead, Karen K. Rane, Tom C. Creswell. Poster, APS Plant Health 2023. <https://www.ars.usda.gov/research/publications/publication/?seqNo115=360928>
- Strawberry Cultivar Susceptibility to *Neopestalotiopsis* leaf spot in Indiana. W Guan, J Bonkowski, T. Creswell, D Egel. Plant Health Progress, 2023. (Editors pick Oct 30, 2023) <https://doi.org/10.1094/PHP-05-22-0049-RS>
- Characterization of Virulence Phenotypes of *Heterodera glycines* during 2020 in Indiana. R. Critchfield, J. King, J. Bonkowski, D. Telenko, T. Creswell, L Zhang. J. Nematology, 2023 Feb; 55(1), doi: 10.2478/jofnem-2023-0039
- Variation in Isolate Virulence and Accession Resistance Associated with *Diaporthe aspalathi*, *D. caulivora*, and *D. longicolla* in Soybean. K. Mohan, B. Kontz, P. Okello, T. Allen, G. Bergstrom, K. Bissonnette, J. Bonkowski, C. Bradley, J. Buck, M. Chilvers, A. Dorrance, L. Giesler, H. Kelly, A. Koehler, H. Lopez-Nicora, D. Mangel, S. Markell, D. Mueller, P. Price III, A. Rojas, M. Shires, D. Smith, T. Spurlock, R. Webster, K. Wise, D. Yabwalo, and F. Mathew. 2023. Plant Health Progress 24:4; p482-487. <https://doi.org/10.1094/PHP-04-23-0041-RS>

Purdue Landscape Report newsletter articles

- Inonotus dryadeus* – butt and root rot of oaks. John Bonkowski. October 24, 2023. <https://www.purduelandscapereport.org/article/inonotus-dryadeus-butt-and-root-rot-of-oaks/>
- Early Fall Color – A Symptom of Stress. John Bonkowski. September 12, 2023. <https://www.purduelandscapereport.org/article/early-fall-color-a-symptom-of-stress/>
- New Invasive Predator of Honeybees. Bob Bruner, Tom Creswell & Cliff Sadof. September 12, 2023. <https://www.purduelandscapereport.org/article/new-invasive-predator-of-honeybees/>
- Boxwood Browning, Blights, and Cankers – 2023 Update. John Bonkowski. July 25, 2023. <https://www.purduelandscapereport.org/article/boxwood-browning-blights-and-cankers2023-update/>
- Anthraco-nose on Creeping Phlox. Tom Creswell. June 27, 2023. <https://www.purduelandscapereport.org/article/anthracnose-on-creeping-phlox/>
- Phoma stem blight of Vinca. John Bonkowski. June 6, 2023. <https://www.purduelandscapereport.org/article/phoma-stem-blight-of-vinca/>
- Oak Leaf Tatters – a spring ritual. Tom Creswell. May 23, 2023. <https://www.purduelandscapereport.org/article/oak-leaf-tatters-a-spring-ritual/>
- Rose Rosette. Tom Creswell. April 11, 2023. <https://www.purduelandscapereport.org/article/rose-rosette/>
- Early Season Samples: Spruce Needle Loss and Boxwood Leaf Spots. John Bonkowski. March 28, 2023. <https://www.purduelandscapereport.org/article/early-season-samples-spruce-needle-loss-and-boxwood-leaf-spots/>
- Cedar Quince Rust. Tom Creswell. February 28, 2023. <https://www.purduelandscapereport.org/article/cedar-quince-rust/>



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