Annual Report 2017

Wisconsin DATCP

Bureau of Plant Industry

Contents:

Program Descriptions 2
Export Certification 4
Seed 5
Corn 6
Soybeans 8
Cereal Crops 9
Fruits & Vegetables 10
Potatoes 11
Apiary 12
Nursery & Ornamentals 13
Christmas Trees 16
Forests 17

Plant Industry Bureau Programs

Description & Major Duties	2017 Highlights
[1]**The Apiary Program** monitors the apiculture industry to prevent the introduction and spread of harmful honeybee parasites and diseases. Inspection services are offered to all beekeepers, though emphasis is placed on migratory bee colonies and package-bees entering Wisconsin in spring from states such as Alabama, California, Florida, Georgia, Louisiana, Mississippi, Missouri, Tennessee and Texas, and those hives leaving in fall that require apiary health certification.	• **210 beekeepers visited** • **4,214 hives inspected** • **69 apiary inspection certificates issued for 29,901 migratory hives**
[2]**The Christmas Tree Program** licenses and inspects Christmas tree growers, certifying trees as being reasonably free of damaging insects and diseases. The program provides a service to interstate and international shippers of Christmas trees who require an inspection certificate prior to shipping. Growers who sell Christmas trees locally also benefit by receiving inspections to inform them of pests and diseases affecting their trees. Staff inspect Christmas trees for signs of regulated pests, such as pine shoot beetle, and search adjacent fence rows and wood lots for evidence of gypsy moth life stages. Staff also inspect wreath and roping producers in the state who request plant health certificates.	• **673 fields inspected** • **17 gypsy moth egg mass finds** • **15 pine shoot beetle finds**
[3]**The Export Certification Program** inspects and certifies plant products for interstate or international shipment. Program staff maintain knowledge of commodity-specific plant pest regulations and assist customers in understanding import standards for over 200 countries. The program ensures the safe export of pest-free Wisconsin agricultural products.	• **$720.4 million in plant products certified for export** • **10,497 phytosanitary certificates issued**
[4]**The Firewood Certification Program** regulates the movement of firewood into Wisconsin and within the state's borders to limit the spread or introduction of invasive insects and diseases. Transporting firewood into state parks and other state-managed lands from locations farther than 10 miles away is prohibited, unless the firewood has been treated and is obtained from a certified firewood dealer.	• **31 firewood dealers certified** • **80 total dealers certified since 2007**
[5]**The Forest Pests Regulatory Program** works with members of the forest products industry to facilitate compliance with state and federal quarantine regulations related to the movement of certain forest products. They work with individual businesses and enter into compliance agreements, which have limited exemptions to certain parts of the regulation, in exchange for implementing practices designed to mitigate risk.	• **30 emerald ash borer compliance agreements issued** • **18 gypsy moth compliance agreements issued**
[6]**The Gypsy Moth Program** is a cooperative effort between WIDATCP, WIDNR, USDA-APHIS, USDA-FS, and UW. The program's mission is to detect and treat potential problem infestations of the gypsy moth and to slow its spread across the state. Trapping surveys help pinpoint the locations of significant gypsy moth populations and determine potential spots for treatment the following season.	• **51 sites sprayed totaling 154,508 acres** • **109,333 male moths caught**

[7]**The Nursery Program** provides regulatory inspection of licensed retail and wholesale nurseries to ensure the production and sale of healthy, insect- and disease-free plants. Inspectors enforce licensing requirements and issue certificates needed to facilitate the movement of nursery stock in trade.	• **635 nursery growers inspected** • **689 nursery dealers inspected** • **125 Plant Health Certificates issued for out-of-state shipment**
[8]**The Plant Industry Bureau Laboratory** provides plant disease diagnostic services to the Christmas Tree, Nursery, and Pest Survey Programs, among others. The PIB Lab also designs and leads statewide disease surveys, performs testing for phytosanitary certification necessary for domestic and international export of certain plants, and differentiates disease from chemical injury for the Environmental Enforcement Section of the Agrichemical Management Bureau.	• **2,035 field crop, nursery stock, and soil samples analyzed** • **1,145 disease and nematode problems diagnosed**
[9]**The Potato Program** The Potato Program includes surveys for Potato Rot Nematode (PRN), late blight response, and oversight of Wisconsin's seed certification program. This program has played a major role in preventing the spread of PRN since 1953. To date, PRN has never been intercepted in shipments of commercially grown potatoes or seed potatoes from Wisconsin. The program targets first-year seed production fields for priority sampling, in addition to fields with a history of infestation. Previously infested fields are released from quarantine after two successive potato crops that show no evidence of PRN.	• **485.4 acres inspected** • **14 fields certified for production or released from quarantine**
[10]**The Pest Survey Program** conducts field surveys to detect new or exotic plant pests and to assess the distribution, abundance, or incidence of endemic insects, plant diseases, and nematodes affecting Wisconsin. Information acquired through these surveys is used to alert growers and agriculture professionals to pest occurrence and outbreaks, determine pest trends influencing agricultural and management practices, and to certify Wisconsin plants and plant products entering trade are free from regulated pests. The program also participates in plant disease and insect survey projects in cooperation with the USDA and UW.	• **3 state records for new pest species detections** • **67 of 72 counties represented in annual survey efforts**
[11]**The Seed Program** monitors and enforces labeling, germination, and purity requirements to assure quality agricultural seed is sold in Wisconsin. Seed that does not conform to state standards may be removed from the marketplace and sellers may be subject to other penalties. Field inspectors in the program perform a range of duties, such as evaluating labels for compliance, issuing stop sale orders, and collecting official samples for analysis.	• **742 seed labeler licenses issued** • **181 license-holders inspected** • **410 samples collected**

A note about program roles: The various Plant Industry Programs function both independently and in collaboration with each other to perform a wide scope of duties. To help highlight these roles, superscripted numbers have been designated to each program (see above), and will be used throughout the report to describe respective lead, and supporting roles for a given annual highlight.

For example, the pine shoot beetle survey is…

Led by the **Christmas Tree Program (2)**, who plan and implement inspections...

… and supported by the **Pest Survey Program (10),** who identify and confirm insect samples

Pine shoot beetle[2,10]**:** Christmas Tree inspectors found
Christmas tree fields this year. Finds were concentrate
of the state, agreeing with historical geographic trends

Export Certification

Phytosanitary certificates[3,2,7,8,10]: In 2017, DATCP certified a total of $720.4 million in plant products for export, including an estimated $358.0 million in products originating from Wisconsin. Staff issued 10,497 total phytosanitary certificates, representing a 9.5% increase from 2016 and the second highest total in the program's history (Fig. 1). This total included 10,158 certificates for products destined to foreign markets and 339 certificates for interstate shipment.

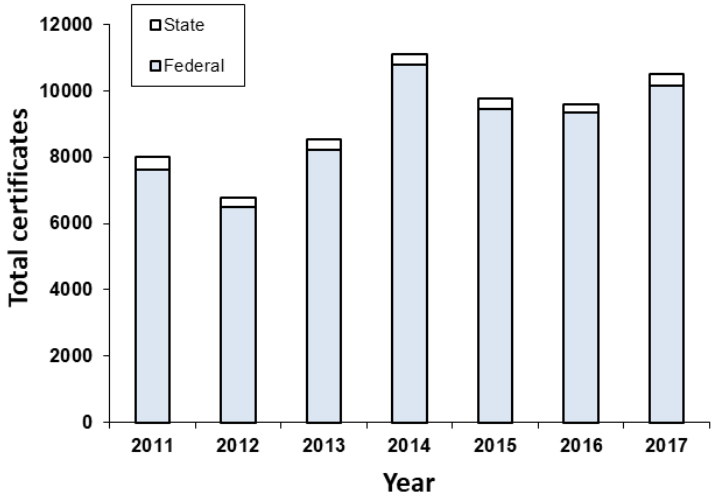


Figure 1: Total annual state and federal phytosanitary certificates issued (2011-2017)

Top commodities[3,2,7,8,10]: Wood products accounted for the largest percentage of export certificates, followed by soybean and corn products (Fig. 2). China and Southeast Asia represented the two most frequent shipping destinations, accounting for 28% and 19% of total certificates issued, respectively (Fig. 3). These patterns were generally consistent with those of previous years.

Seed field inspections[3,8]: Crops grown for seed export (e.g. corn, garden bean, onion, soybean, and tomato) are inspected by DATCP during the growing season for pests and diseases of regulatory significance. Field inspection services are provided to seed companies and growers requesting assistance to meet the Phytosanitary requirements of their international customers. In 2017, 90 seed production fields on 1770 acres were inspected, and samples were collected and tested for a range of bacterial, fungal, and viral diseases.

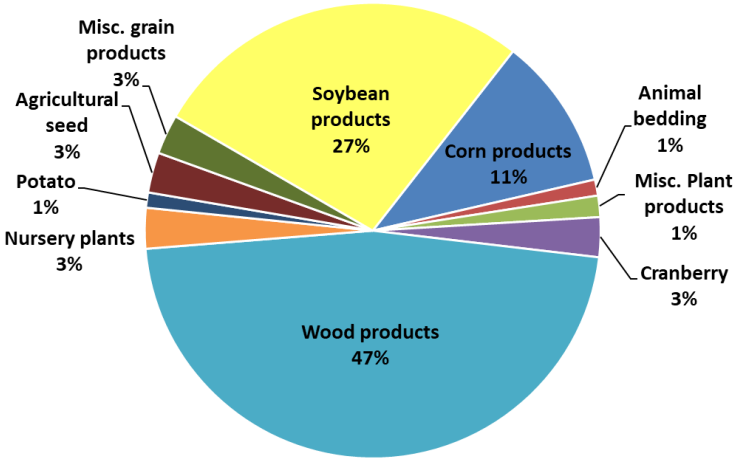


Figure 2. Proportion of certificates issued to a given commodity type

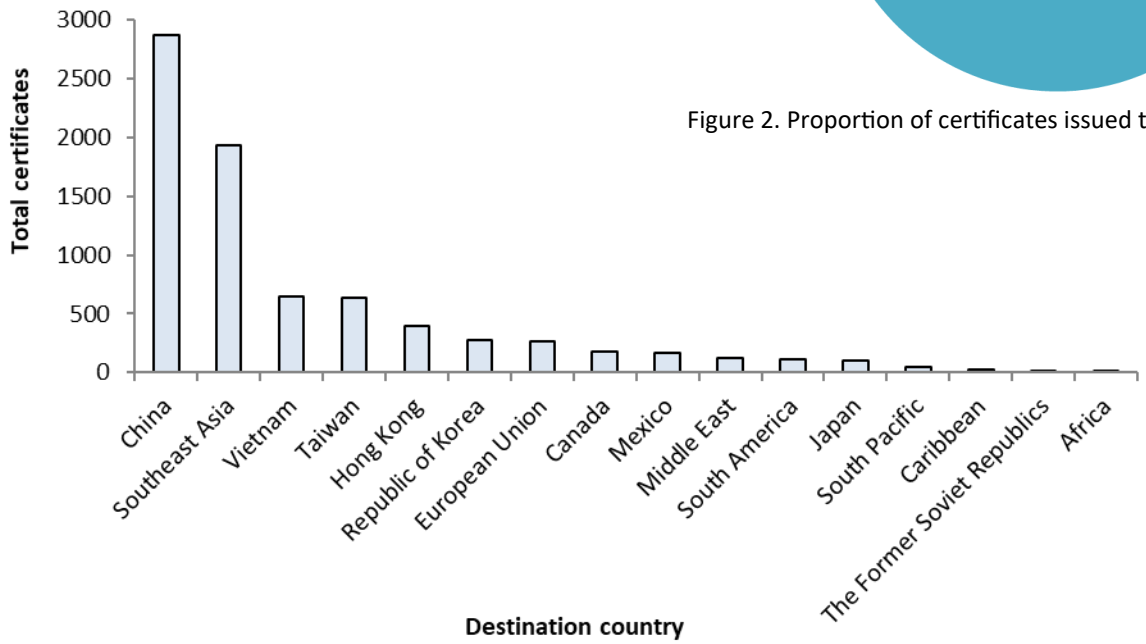


Figure 3: Total phytosanitary certificates issued and country destinations

Seed Inspections[11]: DATCP inspects all licensed seed labelers in the state on a three-year rotation while targeting labelers that historically exceed the state violation average. An average of 31% of the licensed labelers have been sampled annually over the Seed Program's 16 year history. During the 2017 season, the Seed Program targeted three companies with poor compliance records for priority sampling in addition to companies who had not been sampled in the past two years. Also targeted for 2017 sampling were grasses, mixtures and legumes.

In 2017, the program issued licenses to a record total of 742 seed labelers (Table 1). Staff inspected 181 license-holders, collecting 410 total samples from 115 labelers. Inspectors documented five technical, ten minor, and seven serious violations for a total of 22 violations. Compliance actions prescribed for violations included the return of four lots to labelers and the grinding of one lot for feed. Two lots were planted before compliance actions could be enforced. The 5.37% total violation rate of 2017, though slightly higher than that of 2016, is among the lowest in program history and indicates a continuing trend of improvement in labeling compliance.

Year	Number of Labelers	Number of Samples	Number of Violations	% Violation	% Labelers Inspected	% Labelers Sampled
2002	695	319	66	20.69%	25%	12%
2003	691	349	66	18.91%	33%	11%
2004	700	406	53	13.05%	37%	14%
2005	691	340	44	12.94%	36%	15%
2006	689	333	37	11.11%	30%	14%
2007	685	332	40	12.05%	36%	17%
2008	690	242	24	9.92%	33%	11%
2009	675	280	27	9.64%	34%	15%
2010	685	308	38	12.34%	33%	15%
2011	725	336	33	9.82%	23%	13%
2012	729	335	38	11.34%	30%	12%
2013	725	375	30	8.00%	26%	14%
2014	730	341	18	5.30%	29%	12%
2015	725	343	16	4.66%	33%	14%
2016	728	374	18	4.8%	28%	16%
2017	742	410	22	5.37	24%	16%

Table 1: Seed inspection results (2002-2017)

Regulatory Update[11]: A new rule has been proposed that will add Palmer Amaranth and Waterhemp to the list of prohibited noxious weed seeds in Wis. Admin. Code ATCP 20.01(27). This rule has been introduced as an emergency rule and the final permanent rule is expected to be finalized in 2018.

Pest updates

Corn rootworm[10]: Adult corn rootworm counts decreased to the lowest level since surveys for this pest began in Wisconsin in 1971. The annual survey conducted from July 28-August 16 found a state average of just 0.2 beetle per plant, less than half of last year's average of 0.5 per plant and far below the 0.75 beetle per plant economic threshold used to inform rootworm management decisions for the following season. Numbers declined across all nine crop districts as compared to 2016, with district averages ranging no higher than 0.3 per plant. Only 24 of the 229 (10%) cornfields sampled had above-threshold averages of 0.8-2.9 beetles per plant, while 54 (24%) had below-threshold averages in the range of 0.1-0.7 per plant (Fig. 4). No corn rootworm beetles were observed in 151 (66%) of the fields.

Reasons for the historic decrease in beetle abundance are unclear but likely include a combination of factors such as heavy spring rains that led to saturated soils during larval hatch in June, the significant use of pyramided Bt-rootworm (Bt-RW) hybrids, and the practice of overlaying soil insecticides on Bt-RW hybrids during planting. The low beetle pressure documented this season may have resulted in fewer eggs being deposited into cornfield soils, and an overall lower risk of larval root damage next summer.

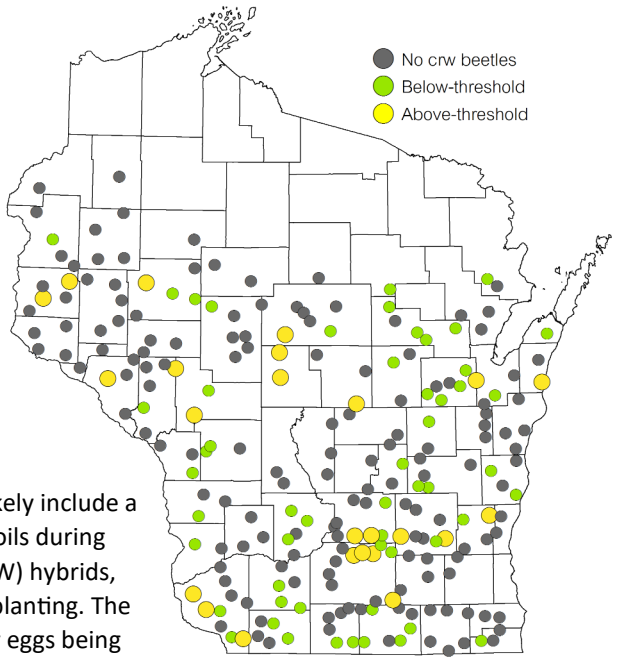


Figure 4: 2017 Corn rootworm densities

European corn borer[10]: The fall European corn borer population declined to 0.03 larva per plant, tying 2012 and 2014 as the second lowest state average in the survey's 76-year history (Fig. 5). The lowest average of 0.02 larva per plant was recorded in 2015. Minor population reductions from 2016 were found in six of the state's nine agricultural districts, while an insignificant increase was noted in the east-central area. The northeast and southeast district averages remained unchanged at 0.0 and 0.04 larva per plant, respectively. One hundred and ninety-six of the 229 (86%) fields examined showed no evidence of corn borer infestation. Results of the 2017 survey suggest that Wisconsin corn producers are maintaining a high Bt use rate which continues to provide overall effective suppression of the European corn borer.

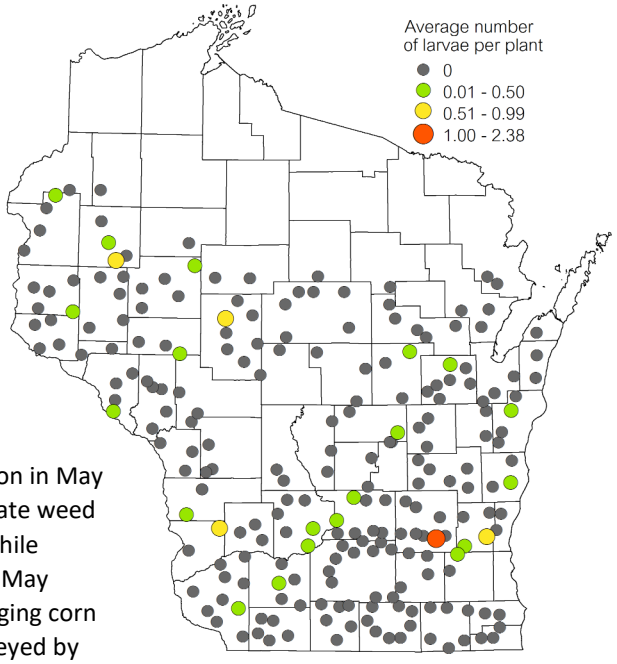


Figure 5: 2017 European corn borer densities

Black cutworm[10]: Many corn acres were under a high threat of infestation in May and June. Delayed spring tillage and planting, wet field conditions, and late weed control all favored black cutworm oviposition and larval development, while repeated heavy flights of 200-635 moths per week throughout April and May signaled an elevated risk for widespread damage. Larval feeding in emerging corn became noticeable by early June, but most injury observed in fields surveyed by DATCP was light and involved less than 1-2% of plants. Although the spring cumulative count of 3,228 moths in 45 traps was substantially larger than last year's capture of 1,835 moths in 43 traps, economic injury (>3% of plants damaged) was rare.

Pest Updates (Continued)

Western bean cutworm[10]: Moth counts increased from 2016 and larval injury to corn was slightly more common in 2017 (Fig. 6). The state trapping program captured a total of 1,856 moths in 70 traps (27 per trap average) from June 18-August 23, which was larger than last year's 1,530 moths in 75 traps (20 per trap average) and also higher than the 13-year survey average of 23 moths per trap. Larval infestations were found in approximately 10% of the 458 corn sites surveyed in August and September, compared to 9% last year.

Corn earworm[10]: The late-season trapping survey captured a cumulative total of 2,760 moths in 15 traps. Nearly one-half of the moths (1,284) were collected at the Ripon monitoring location, most of which arrived during the last two weeks of September. Compared to 2016 when 6,402 moths were captured in 16 traps, this year's migration was much smaller, with the heaviest flights (>250 moths) limited to three sites in Columbia, Dodge and Fond du Lac counties. Twelve other pheromone traps in Dane, Grant, Manitowoc, Marathon, Rock, Vernon, Waushara and Wood counties all captured fewer than 100 moths from August through September. Corn earworm flights ended about October 9.

Figure 6: Western bean cutworm larvae and damage

Disease Updates

Exotic corn leaf blight survey[8,10]: Program staff sampled 125 cornfields spanning 30 counties from July 21-September 29, 2017 in an effort to detect two new corn diseases: Xanthamonas blight (*X. vasicola vasculorum*) and tar spot (*Phyllachora maydis*). Despite reports of Xanthamonas Blight in Colorado, Illinois, Iowa, Kansas, Minnesota, Nebraska, Oklahoma, South Dakota, and Texas in 2016, the disease was not detected in any Wisconsin samples in 2017. Tar spot was reported twice by UW in 2017, marking its second consecutive year of detection in Wisconsin. First reported in the Midwest 2015, this disease originates from Mexico, Central America, and South America, where tar spot lesions are colonized by another fungus called *Monographella maydis*. This second fungus is more injurious than tar spot, and has yet to be found in Wisconsin.

Figure 7: Northern corn leaf spot lesions

In addition to these diseases of interest, the survey detected a number of more common corn foliar blights, including common rust (*Puccinia sorghi*), gray leaf spot (*Cercospora zeaemaydis*), northern corn leaf blight (*Setosphaeria turcica*), northern corn leaf spot (*Cochliobulus carbonum;* Fig. 7), and anthracnose (*Colletrotrichum graminicola*). A few cases of septoria leaf blotch, phyllosticta leaf spot, phaeosphaeria leaf spot, and smut were also detected.

Other seed corn diseases[,10,2]: The Plant Industry Laboratory tested 52 seed corn samples to verify shipments destined to international markets were free of injurious diseases. Six samples (11.5%) from Dane, Eau Claire, and Fond du Lac Counties tested positive for Goss's wilt, a bacterial disease associated with substantial yield loss. No samples tested positive for Stewart's wilt, a bacterial disease that has not been detected in Wisconsin since 2010. Virus screening also detected no evidence of high plains virus (HPV), wheat streak mosaic virus (WSMV) or Maize chlorotic mottle virus.

New Finds

Soybean leafminer[10]: This red and black leaf mining beetle was collected by a DATCP specialist from La Crosse County soybeans on August 1. Although UW-Madison Insect Research Collection (IRC) records had documented finds in five other Wisconsin counties since 1975 (Dane, Grant, Rock, Sauk and Waukesha), the soybean leafminer had not previously been found on soybeans in the state. This insect feeds on various legumes and most of the 15 IRC records were from tick trefoil. It is not known to cause direct economic damage but can transmit bean pod mottle virus and contribute to the spread of this pathogen in soybean fields.

Pest Updates

Soybean Aphids[10]: Densities were the lowest since the first detection of soybean aphid in Wisconsin 17 years ago (Fig. 8). The annual survey found a statewide average count of six aphids per plant, a slight decline from eight aphids per plant in 2016. Two hundred and twenty-eight soybean fields in the R2-R6 growth stages were sampled from late July through August. Aphid populations were below 50 aphids per plant in 96% of the fields and only 4% had moderate averages in the range of 51-100 per plant. A single Green Lake County field had the survey's highest average of 163 aphids per plant, while no fields sampled by DATCP had an above-threshold count of 250 per plant. Results of the survey confirm that aphid densities were low in most fields this season and insecticidal control was generally unwarranted.

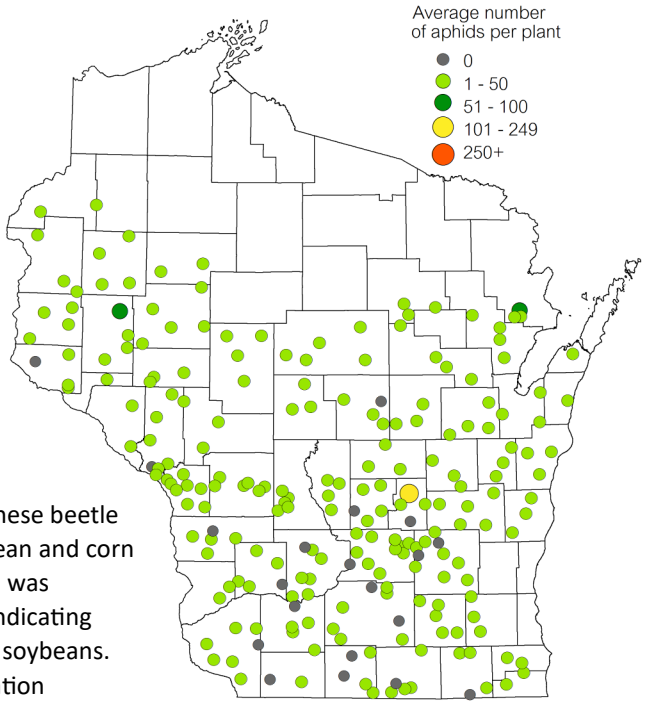


Figure 8: 2017 soybean aphid densities

Japanese Beetle[10]: Once primarily a fruit and landscape pest, the Japanese beetle has become a serious threat to Wisconsin's agronomic crops that soybean and corn growers must factor into their pest management programs. Defoliation was observed in about 87% of the fields examined in late July and August, indicating that Japanese beetle injury was more prevalent than ever in Wisconsin soybeans. Last season, 74% of sampled fields had some degree of feeding. Defoliation estimates were mostly below the 20% treatment threshold for reproductive soybeans, though chemical intervention was justified in some instances.

Disease Updates

Soybean Phytophthora root rot survey[8,10]: Fifty-five soybean fields were surveyed for root rot from June 9-30, 2017. Twenty seedling roots were sampled from each field and submitted for molecular testing. Thirteen (24%) samples were infected with *Phytophthora sojae*, a fungus-like pathogen that is known to cause damping-off in seedlings. This was substantially less than the 38% incidence found in 2016. One Outagamie County field tested positive for *Phytophthora sansomeana,* making it the 10th Wisconsin county to document the pathogen since it was first reported in Wisconsin in 2012. This disease is reported to be pathogenic on soybean and corn. The survey also documented four other *Phytophthora* species: *P. pini, P. sp. "personii", P. inundata* and *P. iranica*. So far no significant impact on soybean production has been associated with these diseases.

Pythium, a root rot pathogen closely related to Phytophthora, was detected in 96% of fields tested in 2017. Data going back to 2011 show 96-100% of fields are infected with this pathogen each year. A remarkable diversity of Pythium species is known to occur in soybean fields. Pythium also often occurs in mixed infections with other pathogens, complicating control strategies. Generally Phytophthora and Pythium disease pressure is higher under wet spring conditions, with Pythium favored by cooler and Phytophthora by warmer temperatures.

Disease Update

Cereal and corn cyst nematodes[8,10]: During 2017, PIB Lab staff analyzed samples from prior growing seasons (2015 and 2016) for exotic cereal cyst nematodes. Nematodes are microscopic worm-like creatures that parasitize crops and decrease their health and productivity. Females of this group of nematodes form pinhead-sized cysts containing eggs that can remain in the soil for decades. Upon hatching, nematodes feed on small grains, causing stunted growth, reduced tillering, chlorotic leaves, and shallow, bushy roots. This survey specifically targeted nematode species that could potentially impact trade and yield if they were accidentally introduced to Wisconsin.

During 2015 and 2016, 15-20 soil cores were collected from a total of 180 wheat, oat, and corn fields for molecular testing. These fields spanned 19 counties that contain the majority of wheat acreage in the state (Fig. 9).

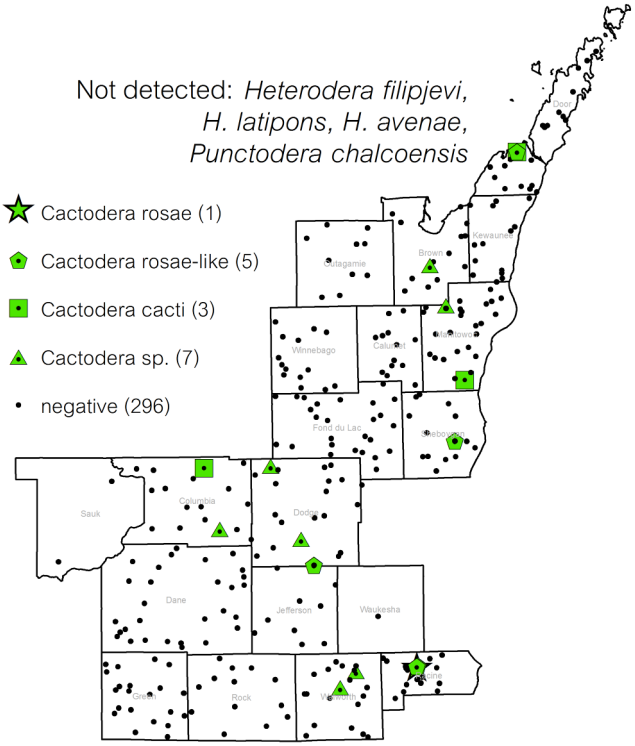


Figure 9: cyst nematode detections and sample locations during 2015 and 2016 field surveys.

Three targeted exotic cereal cyst nematodes, *Heterodera filipjevi*, *Heterodera latipons* and *Punctodera chalcoensis* were not detected, and have yet to be detected in Wisconsin (Table 2). Roughly a quarter of fields tested contained other cyst nematode species. Soybean cyst nematode (*Heterodera glycines*), an economically significant pest of soybeans, was found in 15% (2015) and 19% (2016) of fields. These fields were most likely planted with soybeans as a rotational crop at some point in time. Other cyst nematodes in the genus *Heterodera*, including clover cyst (*H. trifolii*) were detected in 7% (2015) and 6% (2016) of fields. Clover cysts infest clovers and legumes but not corn or cereals. They are not an economically significant pest, but can be confused with soybean cyst nematode. There were no finds of *Heterodera avenae*, which would be the most likely cereal cyst nematode to occur in Wisconsin cereal fields. *Cactodera* cysts were found in 6% (2015) and 4% (2016) of fields surveyed. *Cactodera* species such as *C. cacti, C. weissii* and *C. milleri* have been documented in Wisconsin and are usually found on non-crop hosts such as weeds.

	2015		2016	
Cyst nematode species detected	**Number of fields infested**	**Percent of samples**	**Number of fields infested**	**Percent of samples**
Soybean cyst (*Heterodera glycines*)	29	15%	22	19%
Soybean cyst-like (*Heterodera* spp.) including Clover cyst (*H. trifolii*)	14	7%	7	6%
Cactus cyst-like (*Cactodera* spp.)	12	6%	4	4%
Cereal cyst (*Heterodera avenae*)	0	0%	0	0%
Exotic cereal cyst (*Heterodera filipjevi*)	0	0%	0	0%
Mediterranean cyst (*Heterodera latipons*)	0	0%	0	0%
Mexican corn cyst (*Punctodera chalcoensis*)	0	0%	0	0%
Total positive samples	55	28%	29	25%

Table 2: cyst nematode detection rates during 2015 and 2016 field surveys

Pest Updates

Brown marmorated stink bug[10]: Established populations of this invasive pest now occur in at least seven Wisconsin counties. Dane, Milwaukee, Rock and Waukesha have been generally infested for 2-5 years, while Brown, Jefferson, and Walworth Counties were added to the list in 2017. Citizen reports indicate the actual distribution of brown marmorated stink bug (BMSB) in the state is much wider. Specimens have been confirmed by the UW and DATCP from 20 counties since 2010, with most reports concentrated near Madison, Waukesha and Green Bay. Densities in the Madison, Milwaukee and Waukesha areas are high enough that BMSB can be considered an urban nuisance.

Blueberry maggot[10]: A third season of survey work to determine the distribution of the blueberry maggot (Fig. 10) in Wisconsin resulted in no additional detections. In 2016, a new state record was established when adult flies were collected for the first time in Adams and Sauk Counties. This year's survey consisted of yellow sticky traps set at 26 sites in 11 counties. The baited traps (enhanced with ammonium acetate) were placed in wild blueberries and checked every three weeks from June through August. Suspect blueberry maggot flies were captured in Marinette County, but USDA identifiers were unable to provide a definitive identification. Currently the blueberry maggot fly is known to be present in only Adams and Sauk counties in central Wisconsin and it remains unclear if the species occurs more widely in the state.

Figure 10: Blueberry maggot larvae

Spotted wing drosophila[10]: The first flies of 2017 were captured on June 5 by the UW in Dane County, and most of the 16 DATCP monitoring sites recorded flies before the end of the month. The exponential population increase typical of SWD began during the week of July 5-11 when counts surged to 400-600 flies per trap in Trempealeau County (raspberry and mulberry), and one-half of survey traps reported catch rates of 50 or more flies. Peak activity and trap counts occurred at most sites from August 1-15. High counts for the season ranged from 800-1,000 flies per trap in Sauk County raspberries. Spotted wing drosophila continues to dramatically impact small fruit production in Wisconsin, causing insecticide use to soar, shortening pick-your-own seasons, and forcing many berry growers out of business.

Figure 11: Spotted wing drosophila trap

Japanese beetle[10]: Reports indicated higher-than-normal populations in 2017. Beetles appeared by June 10 and a decline was not noted until mid-September. The largest numbers invaded orchards and vineyards during the latter half of July into August.

Rose chafer[10]: These beetles were numerous this season and reports of severe damage to grapes, strawberries, fruit trees and landscape plants were common. Chafer feeding began by early June and continued for 6-7 weeks. Significant feeding on flower buds and flowers in vineyards required chemical intervention before activity subsided in mid-July.

Disease Updates

Potato rot nematode[9,8]: DATCP staff inspected fourteen potato fields totaling 485.4 acres in 2017, finding no signs of PRN (Fig. 12). Thirteen of these fields were new to seed potato production and required preliminary inspection for certification. The remaining field had a history of PRN and was released from quarantine after a being found PRN-free for a second consecutive year. There are 3049 total acres in Wisconsin with a history of PRN, 95% of which are located in Langlade County (Table 3).

Late blight[10]: The state's earliest case of late blight in 2017 was confirmed by the UW Plant Pathology Department on Waukesha County tomatoes on July 26. Additional cases of the disease were identified in August and September in 12 counties: Columbia, Clark, Crawford, Dane, Iowa, Jefferson, Kenosha, Pierce, Polk, Portage, St. Croix and Waushara. Compared to 2016 when only four counties had confirmed reports, late blight was more prevalent and widely distributed in Wisconsin this season. Characterization of the pathogen strains found that US-23 was the most common genotype, detected in nine counties, while US-8 was identified from six counties. Nearly all late blight that developed in the U.S. this year was the US-23 genotype, which is more virulent on tomato than potato and a primary reason why late blight has recently become a more severe disease of tomato.

County	Current Status	Acres	Fields
Forest	Released, not used for potato	15	1
Kenosha	Released, not used for potato	1	1
Langlade	Infested	397.3	18
Langlade	Released, not used for potato	197.77	9
Langlade	Released, certified seed	1736.44	50
Langlade	Released, table stock	538.04	23
Langlade	Released, table stock, seed pending	6	1
Lincoln	Released, certified seed	37	1
Manitowoc	Released, certified seed	9.3	1
Marathon	Infested	8.4	1
Marathon	Released, certified seed	64.5	2
Portage	Released, table stock	38.2	1

Table 3: History of potato rot nematode in Wisconsin and current status (1953-2017)

Figure 12: Potato rot nematode feeding sites

Pest and disease update[1]: 2017 inspections revealed a slight decrease in winter mortality from 48% in 2015-16 to 46% in 2016-17, which aligns with the 45% national average for backyard beekeepers. Varroa mite was detected in 64% of sampled hives, compared with 68% last season (Table 4). Other pests and diseases found include American foulbrood in 0.1% of hives, chalkbrood in 4.2% of hives, European foulbrood in 0.2%, deformed wing virus in 19.8%, sacbrood in 5.8%, and small hive beetle (SHB) in 10.2% of hives. SHB incidence increased from 7.5% last season and is well above the five-year average of 5.0%, which should alert beekeepers to the need for early detection and effective management of this emerging pest. Inspectors issued 69 apiary inspection certificates for 29,901 migratory hives, primarily destined for California, Florida and Texas to be used for pollination services.

Year	2013	2014	2015	2016	2017
Total hives opened	1184	1152	1190	2208	4214
Varroa mite	71%	85%	71%	68%	64%
Small Hive Beetle	1.4%	2.6%	3.1%	7.5%	10.2%
American Foulbrood	0.9%	0.7%	1.1%	1.2%	0.1%
European Foulbrood	2.1%	0.8%	3.6%	0.3%	0.2%
Chalkbrood	1.7%	2.3%	3.1%	2.8%	4.2%
Sacbrood virus	1.4%	1.3%	0.1%	0.4%	5.8%
Deformed wing virus	1.0%	1.0%	6.8%	7.3%	19.8%

Table 4: Incidence of apiary pests and diseases (2013-2017)

National Honeybee Health Survey (NHBS)[1]: Wisconsin participated in this national survey for the seventh consecutive year. Inspectors collected and sent live bee samples, bees in alcohol and comb debris samples from 24 apiaries to the USDA Bee Research Lab for parasite and virus analysis. Wax samples from 10 of those apiaries were also collected and submitted for pesticide analysis. Results from the 2017 survey are pending. To date, no *Tropilaelaps, Nosema apis* or *Apis mellifera capensis* have been found. American and European foul brood, *Nosema ceranae* and various viruses, including varroa destructor virus, k-wing and sacbrood, varroa mites and chalkbrood, were found.

Figure 12: An apiary inspector samples for varroa mites

New Finds

Ambrosia beetle[7,10]: The exotic ambrosia beetle species *Anisandrus maiche* was detected for the first time in the state. Ambrosia beetle adults were collected from honey locust liners at an Ozaukee County nursery in July. The infested nursery stock displayed visually characteristic frass toothpicks along the main stem. In addition to *A. maiche*, the black stem borer (*Xylosandrus germanus*) and nectria canker were also detected on the declining nursery stock. Later in the season, another 13 *A. maiche* beetles were identified in exotic beetle trapping survey collection samples from Milwaukee, Kenosha, Rock and Walworth counties.

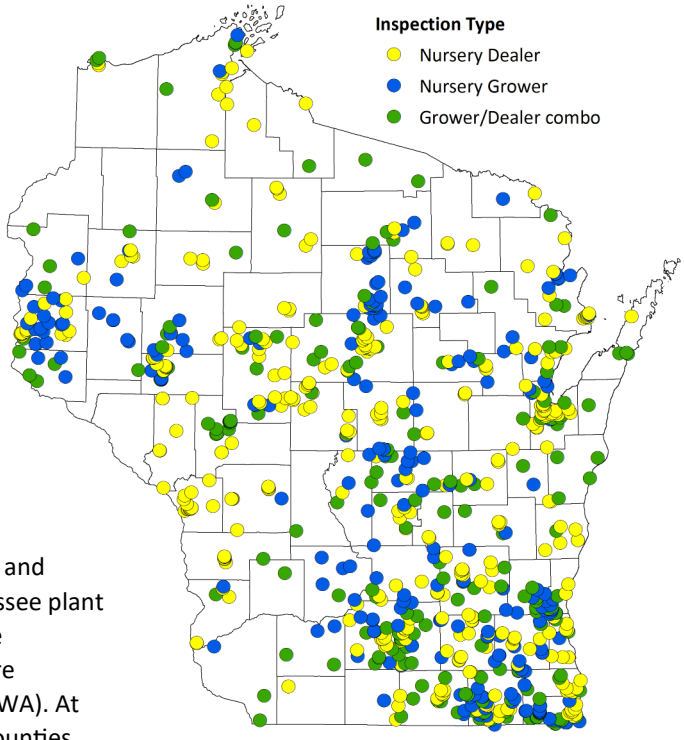


Figure 13: Nursery Program staff inspected 635 nursery growers and 689 nursery dealers in 2017

Hemlock woolly adelgid[7,10,5]: In early 2017, a licensed WI nursery and three WI landowners purchased hemlock seedlings from a Tennessee plant wholesaler (Fig. 14). DATCP received a report from the Tennessee Department of Agriculture in April that some of the seedlings were possibly infested with hemlock woolly adelgid (*Adelges tsugae*; HWA). At this point, the seedlings had been distributed to locations in 12 counties and most were planted in the ground. By May 1st, DATCP inspectors had collected all TN sourced hemlock seedlings from nursery and private landowner locations. Recovered seedlings were examined by DATCP for HWA prior to incineration. Laboratory screening found 47 of the 822 seedlings positive for HWA; all positive seedlings originated from a single nursery shipment. In addition to HWA, two nonnative armored scales, elongate hemlock scale (*Fiorinia externa*) and circular hemlock scale (*Nuculaspis tsugae*) were also detected on hemlock seedlings. While neither scale pest has been found in Wisconsin, both are established in a handful of eastern states.

Nursery stock dealers and growers are reminded that DATCP has enacted an exterior quarantine (ATCP 21.16) regulating the entry of hemlock plant material from states infested with HWA. This aphid-like insect has caused widespread mortality of eastern and Carolina hemlock trees from Maine to Georgia and now occurs in 19 states, including neighboring Michigan where there are active populations in five southwestern counties. Eradication of HWA may be possible if an infestation is detected early, but preventing introduction of HWA into the state is preferred. Nursery operators should closely inspect hemlock trees purchased from out-of-state plant suppliers. Any nursery importing hemlock from an infested state must have a compliance agreement with DATCP.

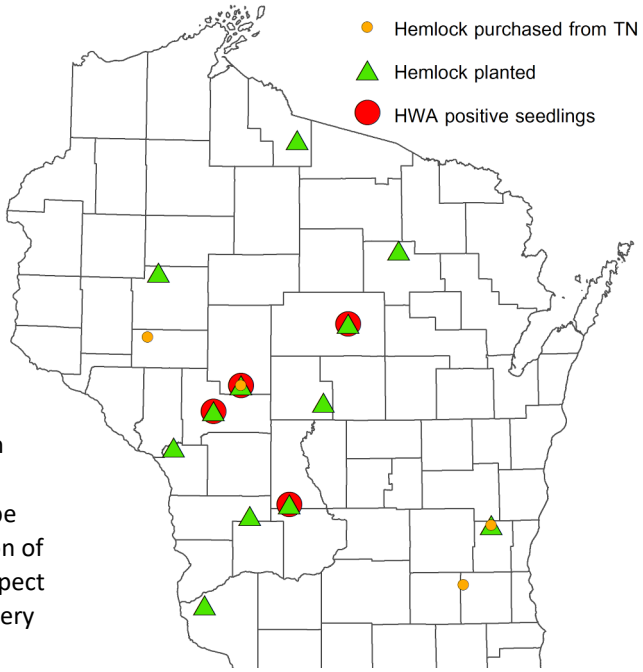


Figure 14: Hemlock woolly adelgid infested seedlings recovered in 2017

New Finds (Continued)

Thrips setosus[7,10]: After conducting follow-up inspections at 51 nurseries who received hosta stock potentially infested with invasive *Thrips setosus* from a Michigan nursery, inspectors submitted suspect insect specimens from 17 nurseries. Two suspects from Kenosha County and two from Waukesha County were determined by APHIS identifiers to be *T. setosus*. *T. setosus* had never been found in WI before this traceforward. As of 10/02/17 this pest has been deregulated.

Bacterial wetwood pathogen[7,8]: Molecular sequencing revealed that a bur oak (*Quercus macrocarpa*) from a Kenosha County nursery was infected with *Gibbsiella greigii*. This pathogen was discovered in 2014 as the cause of decline symptoms in black oak (*Q. kelloggii*) and coast live oak (*Q. agrifolia*) in southern California, and had not been detected in Wisconsin prior to this year. Symptoms included extensive bleeding, vertical cracks and necrotic underlying tissue (Fig. 15).

Figure 15: "Staining" on bur oak infected with bacterial wetwood (*Gibbsiella greigii*)

Figure 16: Viburnum leaf beetle feeding damage

Pest Updates

Lily leaf beetle[7]: The invasive lily leaf beetle (*Lillioceris lilii*; LLB*)*, was found on lily foliage at a nursery in Marathon County in 2014. This was the first confirmed report of LLB in Wisconsin and a new state record. It was then found in Lincoln and Portage counties in 2016 and Wood County in 2017.

Viburnum leaf beetle[7]: Larvae were found in June on viburnum shrubs near Oshkosh in Winnebago County. Winnebago was the fifth Wisconsin county in which viburnum leaf beetle has been detected since 2009, following Milwaukee, Ozaukee, Washington, and Waukesha Counties. The infestation, confirmed by the UW, was thought to have originated from a local population and not from newly purchased nursery stock.

Disease Updates

Sudden oak death[7,8]: Twelve rhododendron samples were tested for *Phythophthora ramorum*, the causal agent of sudden oak death (SOD). All were negative for this regulated disease. Eight of the samples were "trace forwards" from nurseries with confirmed SOD-infested stock. Sudden oak death has not been found in Wisconsin to date.

Boxwood blight[7,8]: A major concern to the nursery industry and boxwood growers, this fungal disease was not found in any of the 11 boxwood samples submitted for testing in 2017. The symptoms were instead determined to be caused by either *Volutella* blight, *Fusarium*, or *Verticillium* wilt. Boxwood blight was identified for the first time in the U.S. in 2011, and since then has been found in 18 states, including Illinois and Ohio.

Impatiens downy mildew[7,8]: Several impatiens plants from a Sheboygan County grower tested positive for impatiens downy mildew (IDM; Fig. 17) on May 22. The affected varieties, 'Accent TM Premium Red,' 'Accent TM Premium White,' and 'Double Impatiens Silhouette Salmon,' were promptly removed from sale. The UW Plant Disease Diagnostic Clinic also confirmed one case of IDM from Marinette County in late June.

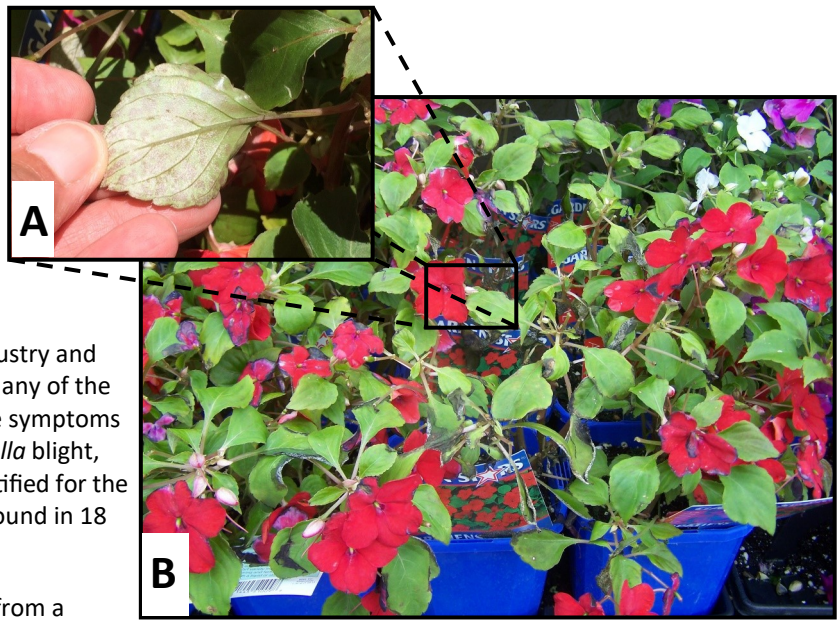


Figure 17: (A) white, fluffy fungal fruiting bodies on leaf undersides, and (B) wilt-like symptoms caused by impatiens downy mildew

Disease Updates (Continued)

Viruses in ornamentals[7,8]: Nursery inspectors submitted 140 plant samples to the Plant Industry Lab for virus testing. The symptomatic plant samples were screened for up to 11 viruses, including two group tests for potyviruses and ilarviruses. Sixty-four percent of the plant samples (90 of 140) tested positive for at least one plant virus (Table 5). Greenhouse producers, nurseries and retailers cooperated with inspectors by removing all infected plant material from sale.

Figure 18: Lupine infected with cucumber mosaic virus (CMV)

Potyviruses were the most common disease-causing virus group with 45 positives. Iris severe mosaic virus, a disease transmitted by probing aphids and mechanical inoculation (i.e., cutting tools), accounted for 41 of the 45 potyvirus positives. One iris cultivar, 'Mt. Fujiyama,' was infected with the tospovirus impatiens necrotic spot virus. Colocasia, Thermopsis, Tradescantia and Wisteria were also found to be infected with viruses in the potyvirus group. *Wisteria macrostachya* varieties "Betty Mathews" and "Summer Cascade" infected with potyvirus have previously been identified as having wisteria vein mosaic virus.

Tobacco rattle virus accounted for the next highest number of positives with 13, followed hosta virus X with 10 positives, viruses in the ilavirus group with seven positives, and cucumber mosaic virus with six positives. The ilarvirus group test picked up a tobacco streak virus (TSV) in Astilbe var. "Deutschland" and alfalfa mosaic virus (AMV) in Ajuga sold as baskets. In addition, three lilacs var. "President Grevy" were confirmed for lilac leaf chlorosis virus (LLCV).

Virus	Total Tests	Total Positives	Percent Positive
Arabis mosaic virus (ArMV)	11	1	9.1%
Clematis chlorotic mottle virus (ClCMoV)	8	2	25%
Cucumber mosaic virus (CMV)	44	6	13.6%
Hosta virus X (HVX)	24	10	41.7%
Lilac leaf chlorosis virus (LLCV)	3	3	100%
Ilarvirus group	27	7	25.9%
Impatiens necrotic spot virus (INSV)	39	2	5.1%
Potygroup viruses	58	45	77.6%
Tobacco mosaic virus (TMV)	38	0	0.0%
Tobacco rattle Virus (TRV)	39	13	33.3%
Tomato spotted wilt virus (TSWV)	38	0	0.0%

Table 5: Results of 2017 virus survey in ornamental plants

Regulatory Update

NR40 Invasive Species Rule[7]: Invasive plants prohibited or restricted in Wisconsin under the Chapter NR 40 Invasive Species Rule were documented by inspectors at 208 nursery locations this season, with 32 activity reports issued for violations. The most frequently intercepted invasives were Japanese barberry (*Berberis thunbergii*), woodland forget-me-not (*Myosotis sylvaticum*), Amur maple (*Acer ginnala*), bishop's goutweed (*Aegopodium podagraria*), burning bush (*Euonymus alatus*), and ribbon grass (*Phalaris arundinacea*; Fig. 19). The phase-out period for selling restricted herbaceous plants and woody vines that were added to the list in 2015 will expire on May 1, 2018.

Figure 19: Ribbon grass (*Phalaris arundinacea*)

Pest Updates

Pine shoot beetle[2,10]: Christmas Tree inspectors found signs of pine shoot beetle (Fig. 20) in 15 Christmas tree fields this year. Finds were concentrated in the southeastern part of the state, agreeing with historical geographic trends. Later in the season, two more beetles were identified in exotic beetle trapping survey samples collected from municipal brush drop-off sites, industrial sites and commercial port locations in Milwaukee and Ozaukee counties.

Gypsy moth (in Christmas tree fields)[2]: In addition to growing fields, Christmas tree inspectors routinely search adjacent fence rows and wood lots for evidence of gypsy moth life stages. In 2017, inspectors found gypsy moth in 17 fields, marking a two field increase from 2016 (Table 6). Christmas trees grown within 100 feet of a gypsy moth egg mass find cannot be shipped outside the gypsy moth quarantine zone. (Note: statewide Gypsy Moth Program summary can be found on p. 19)

Christmas tree lot inspections[2,10]: Inspectors visited 64 Christmas tree lots throughout Wisconsin this past December. Insects and diseases were detected in 73 cases, and included balsam twig aphid, native hemlock scale (*Abgrallaspis ithacae*), pine needle scale (*Chionaspis pinifoliae*) and eastern / western pine gall rust. Elongate hemlock scale (*Fiorinia externa*) was also found at two locations, both on trees or wreaths that were shipped here from out-of-state. If established, this introduced invasive insect could negatively impact hemlocks and other conifers in Wisconsin.

Year	Fields Inspected	Fields with Gypsy Moth	Fields with Pine Shoot Beetle
2010	663	20	1
2011	689	18	3
2012	702	6	6
2013	767	10	0
2014	667	11	2
2015	679	10	6
2016	553	15	5
2017	673	17	15

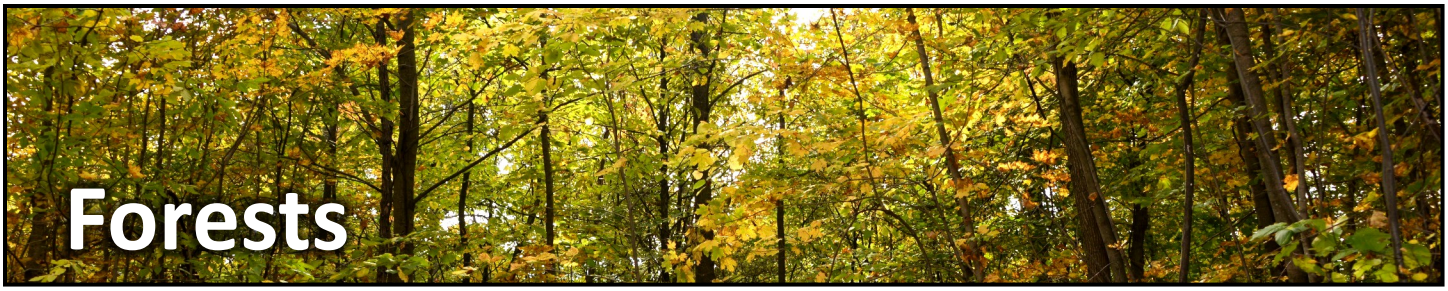
Table 6: Incidence of gypsy moth and pine shoot beetle finds during annual Christmas tree inspections

Figure 20: Circular hole cause by pine shoot beetle (entrance or exit)

Top ten most common...

Pests[2,10]: Christmas tree inspectors most commonly found signs of balsam twig aphid (186), followed by white pine weevil (73), balsam gall midge (38), Eastern spruce gall adelgid (32), aphids (26), Zimmerman pine moth (21), pine needle scale (19), ants (11), Pales weevil (9), root collar weevil (7), and spruce gall midge (7).

Diseases and abiotic stressors[2,8]: Christmas tree inspectors most commonly found signs of white pine blister rust (62), followed by *Rhizosphaera* on fir (51), *Rhizosphaera* on spruce (50), broom rust on fir (35), deer damage (29), *Lirula* needlecast (26), root rot (26), frost injury (19), pine gall rust (18), brown spot (17).



New Finds

Velvet longhorned beetle[10]: DATCP and the USDA APHIS confirmed the first detection of velvet longhorned beetle (*Trichoferus campestris*; VLB; Fig. 21), in two Milwaukee County survey traps on July 13. The beetle had been intercepted last year in rustic hickory-style log furniture manufactured in China, but never found in the Wisconsin landscape. Velvet longhorned beetle infests a wide range of forest, orchard and urban trees and may have the potential to become a pest in the state.

Figure 21: Velvet longhorned beetle adult

The VLB specimens were collected as part of a national survey program for exotic woodborers and bark beetles. Seventy-nine total traps were hung at municipal brush drop-off sites, industrial sites and commercial port locations in Brown, Dane, Douglas, Eau Claire, Fond du Lac, Kenosha, Manitowoc, Marinette, Milwaukee, Ozaukee, Racine, Sauk, Sheboygan and Waukesha Counties. Traps were monitored bi-weekly from May through September, and 572 samples were collected and screened for target species in the laboratory. Aside from the two VLB finds mentioned above, 77 remaining traps were negative for 10 targeted species of exotic longhorned, metallic woodboring, bark and ambrosia beetles.

Beech bark disease[8]: PIB Lab and DNR Forest Pathology collaborated to confirm the first detection of the beech bark disease fungal pathogen (*Neonectria ditissima;* BBD) in Wisconsin. BBD is a major threat to American beech (*Fagus grandifolia*) in eastern North America. The disease is an insect-fungus complex, in which canker fungi (*Neonectria spp.*) infect trees through cracks created by feeding of an invasive woolly beech scale (*Cryptococcus fagisuga*). The scale insect was introduced to Nova Scotia on infested beech trees in 1890. It reached Michigan in 2000 and was first discovered in Door County in 2009, where it has since led to notable loss of beeches. While the scale has been found in other counties where beech grow, no beech die-offs have been reported in those locations (Dodge, Forest, Kewaunee, Marinette, Manitowoc, Menominee, Oconto, Ozaukee, Sheboygan and Washington).

Pest Updates

Emerald ash borer[10]: The 2017 EAB detection survey was a collaborative, interagency effort between DATCP, the USDA Animal and Plant Health Inspection Service (APHIS), the Department of Natural Resources (DNR), the Ho-Chunk Nation, Menominee Tribal Enterprises and county forest partners. 1,436 baited purple traps were set across 37 counties and tribal lands, with a majority located in non-quarantined counties in the northern half of the state (Fig. 22). Beetles were captured on a total of 10 traps located in Douglas, Green Lake, Marinette, Waupaca and Waushara counties, as well as tribal lands in Jackson and Vernon counties.

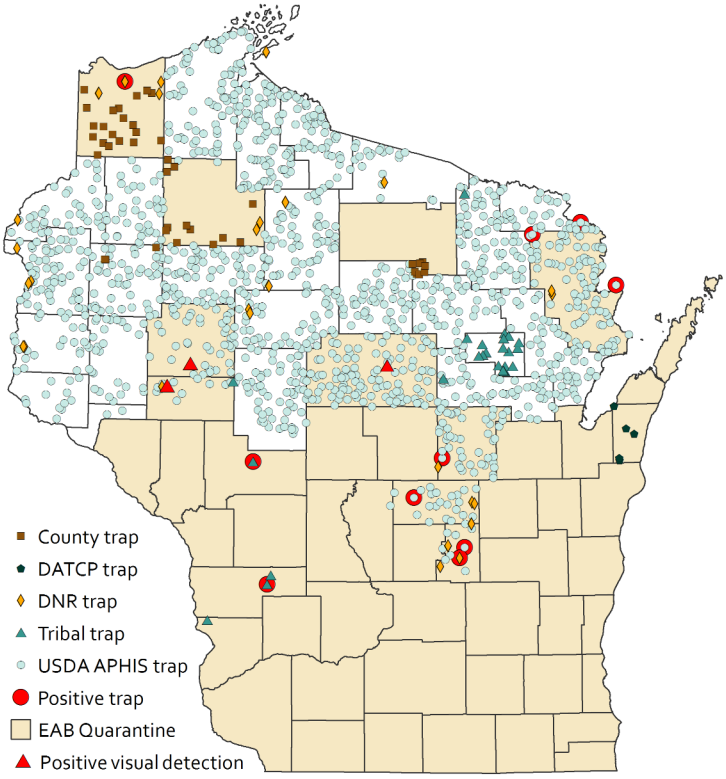


Figure 22: 2017 emerald ash borer detection survey results

Emerald ash borer[10] (continued): In addition to purple trap detections, 110 new EAB locations were reported by homeowners, municipal staff and tree care companies in Chippewa, Eau Claire, Iowa and Marathon counties, for a total of 120 new detections in 2017. This total surpasses that of 2016 and contributes to a cumulative sum of 394 municipal detections in 48 counties since 2008 (Fig. 23). Most new detections continue to occur near known infested areas in the southern half of the state where EAB is already well established. In contrast, EAB finds in the north are spatially limited and less numerous despite a more abundant ash resource. Since first detected in 2008, EAB has been found in just over 21% of Wisconsin cities, towns and villages and remains the greatest threat to Wisconsin's urban and forestland ash trees.

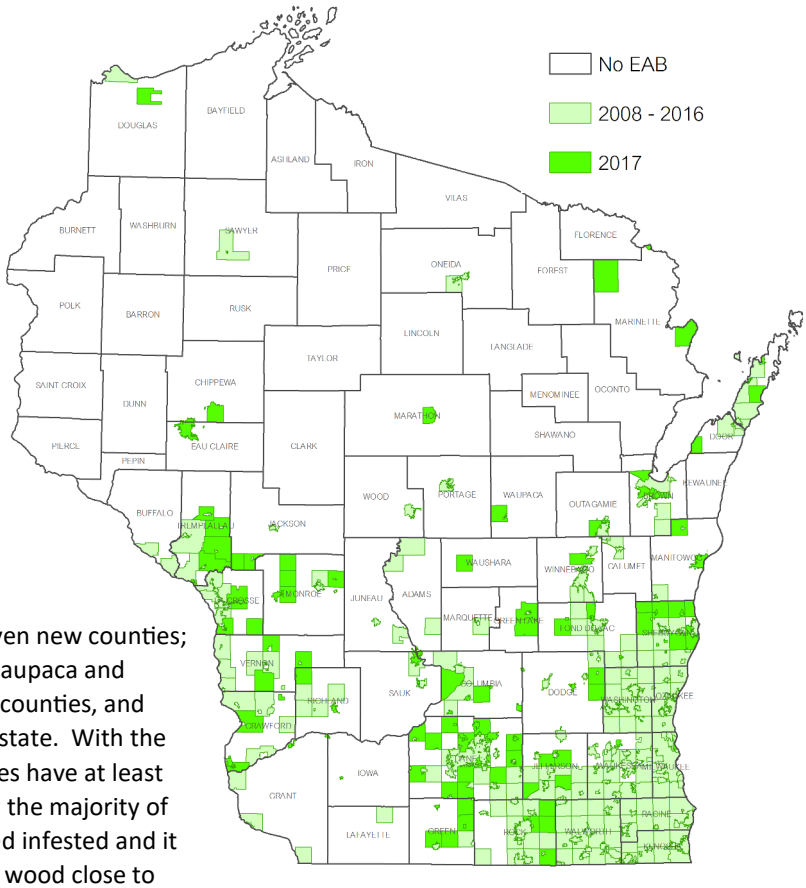


Figure 23: Emerald ash borer detections (2008-2017)

DATCP expanded the EAB quarantine in 2017 to include seven new counties; Chippewa, Eau Claire, Green Lake, Marinette, Marathon, Waupaca and Waushara. The EAB quarantine now includes 49 Wisconsin counties, and encompasses about half of ash tree volume growing in the state. With the exception of Kewaunee County, all EAB quarantined counties have at least one detection. Despite the quarantined area encompassing the majority of counties, only 20% of statewide acreage has been confirmed infested and it is always a good idea to only use certified firewood or burn wood close to where you buy it to avoid spreading EAB and other wood inhabiting pests and diseases.

Walnut twig beetle[10,5]: In an effort to protect the black walnut resource, and lumber and veneer industries in the state, early detection efforts targeting the insect component of thousand cankers disease (TCD) continued for the sixth consecutive year. Thousand cankers disease is native to the western United States and affects black walnut trees as a result of the combined presence of the walnut twig beetle (WTB), *Pityophthorus juglandis*, and fungus *Geosmithia morbida*. Although a handful of eastern states have also reported TCD, neither the walnut twig beetle nor the fungus have been found in Wisconsin since DNR and DATCP detection surveys began in 2012 (Fig. 24). In addition to early detection surveys, statewide external quarantine regulations enacted in 2011 restrict the movement of potentially infested walnut material into the state.

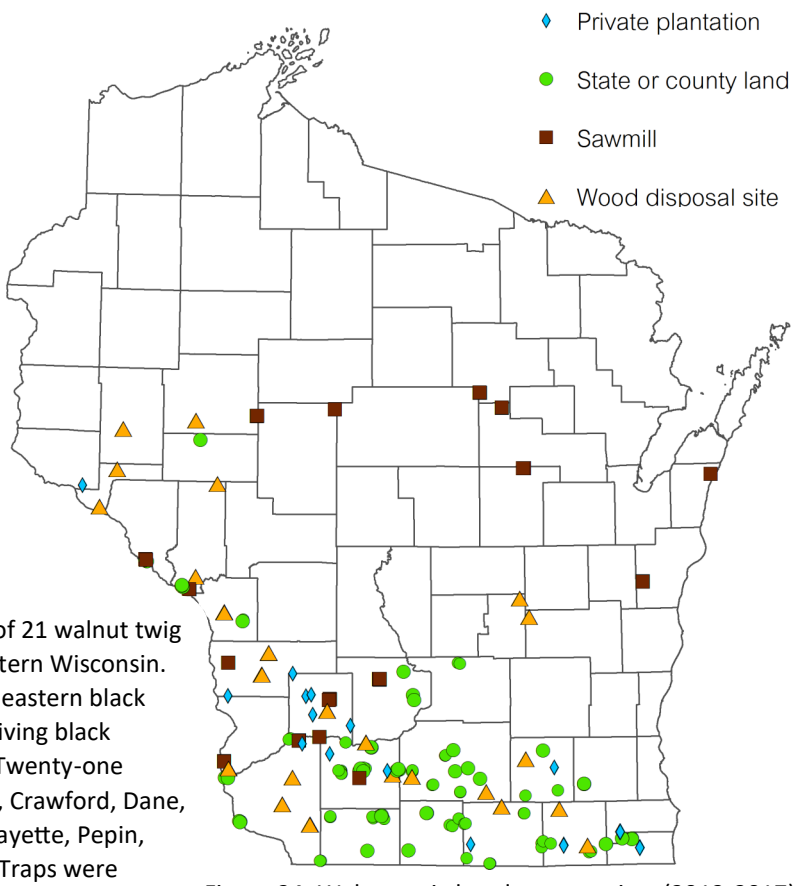


Figure 24: Walnut twig beetle survey sites (2012-2017)

Detection survey efforts in 2017 included the deployment of 21 walnut twig beetle baited traps across 17 counties in southern and western Wisconsin. Trapping survey locations were within the natural range of eastern black walnut and included brush disposal sites and sawmills receiving black walnut logs from eastern states where TCD is established. Twenty-one baited Lindgren funnel traps were set in Buffalo, Chippewa, Crawford, Dane, Dunn, Fond du Lac, Grant, Green Lake, Iowa, La Crosse, Lafayette, Pepin, Richland, Rock, Sauk, Trempealeau and Vernon Counties. Traps were monitored bi-weekly and 167 samples were collected and screened for walnut twig beetles in the laboratory. No walnut twig beetles were found at any trap location.

Mountain Pine Beetle[10,5]: Survey work to detect the mountain pine beetle (MPB), *Dendroctonus ponderosae*, a tree-killing pest of pine trees in the western United States, was completed in Sawyer and Barron counties in 2017. Six baited multi-funnel traps were placed at three forest products facilities in July and August. Twelve total samples were collected and screened for MPB in the laboratory. No MPB were detected at any survey locations. MPB threatens the state's native red, jack, and eastern white pine forests, and commercial pine resource as historically western populations slowly spread eastward. MPB could have a devastating impact on Wisconsin's pine forests and pine-based industries if it were to become established in the state. In April 2017 exterior quarantine regulations for the mountain pine beetle were enacted, thus restricting import of firewood, pine wood or plant parts, and dimensional pine lumber with bark attached from infested areas into the state.

Gypsy Moth

Climate[6]: Conditions during larval development were normal in terms of temperature, but extremely wet across the state, particularly in southern WI. Conditions across the state were good for *Entomophaga maimaiga* and NPV infection, with mortality from both being present in populations in the southern regions. Severe weather has likely played a role in gypsy moth survivorship this year. Multiple intense June and July rainfall and storm events in central and southern WI may have affected pupal and adult survivorship. Summer 2017 precipitation totals were roughly 40% higher than average in the southern half of the state. Additionally, extreme cold winter temperatures this year may affect egg mass overwintering mortality, with egg masses above the snow line being particularly susceptible.

Trapping[6]: Male moth counts increased by 24% in 2017 from the previous year. The state trapping program recorded a total capture of 108,008 male moths in 10,878 traps (Fig. 25). Another 1,329 moths were collected in traps set at the Ports of Green Bay, Marinette and Milwaukee, for an official total of 109,333 gypsy moths caught in the state this year. Program coordinators attribute the higher trap counts to increasing populations in generally infested areas of eastern and central Wisconsin. In contrast, counts in the still largely uninfested western counties were at or below last year's totals. The season's highest counts were in Bayfield (14,354 moths), Monroe (9,989 moths), Sauk (9,561 moths), and Juneau Counties (9,109 moths). No surveyed county reported zero moths.

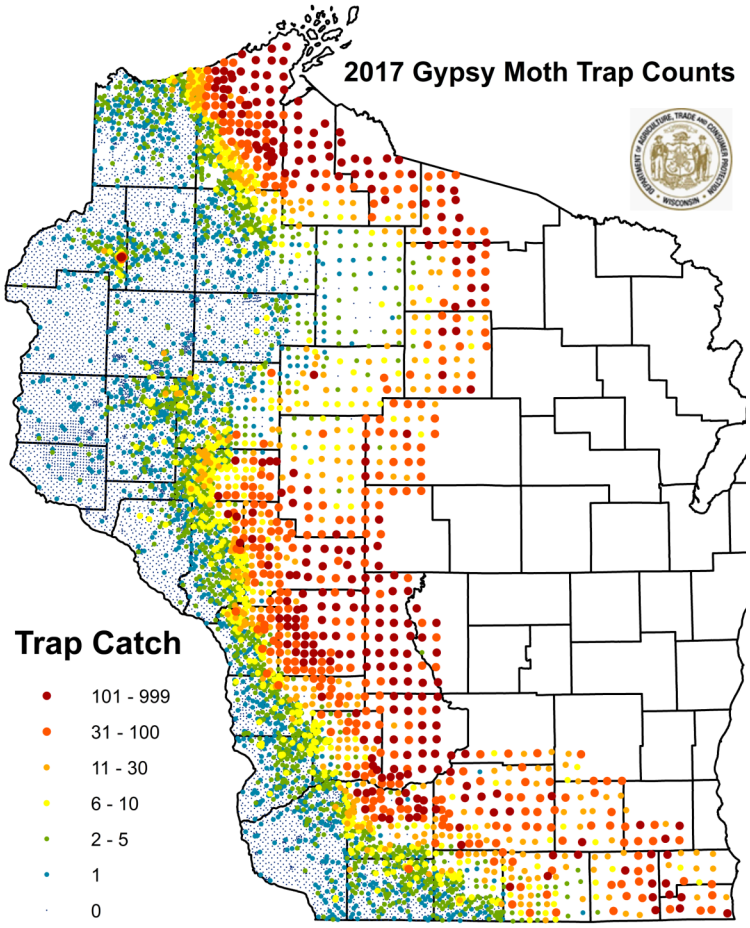


Figure 25: 2017 male gypsy moth trap catches. Each dot represents one trap. Dot size is proportional to trap catch totals.

Treatment[6]: The Slow the Spread (STS) Program treated 51 sites, totaling 154,508 acres. Al's Aerial Spraying of Ovid, MI applied all Btk and mating disruption (MD) products. Btk applications began May 15th and ended May 31st. Foray 48B was applied to 22,792 acres at 32 sites in 15 counties. No Gypchek was applied in 2017. The Forest Service mating disruption applications occurred from June 26th–July 17th. A total of 131,716 acres across 19 sites in 9 counties were treated with MD in western Wisconsin. The mating disruption project has moved entirely to a liquid formulization treatment product, SPLAT Gypsy Moth-Organic. Post-treatment evaluations indicated treatments were highly effective; there was only one treatment failure and four treatments were evaluated as partially successful.

Firewood

Certification[4]: DATCP certified 31 firewood dealers in 2017. Firewood is certified upon completing one of two approved treatment methods: heat treatment or seasoning. Heat treatment requires heating the firewood to an internal temperature of at least 140°F (60°C) for at least 60 minutes, while seasoning requires firewood to be stored on the dealer's premises for at least two years before it can be sold or distributed as certified firewood in Wisconsin. Firewood from certified dealers can be transported further than the 10 mile limit imposed on untreated dealers.