DEPARTMENT OF AGRICULTURE

Status of Invasive Forest and Landscape Pests in Minnesota

Plant Protection Division

Prepared February 2021

Emerald Ash Borer

Emerald ash borer (EAB) was discovered in four new counties (Carver, Mower, Rice and Sibley) in Minnesota in 2020. While any new county detection is disappointing, the rate of spread in Minnesota continues to be much slower than the national average (Figure 1).

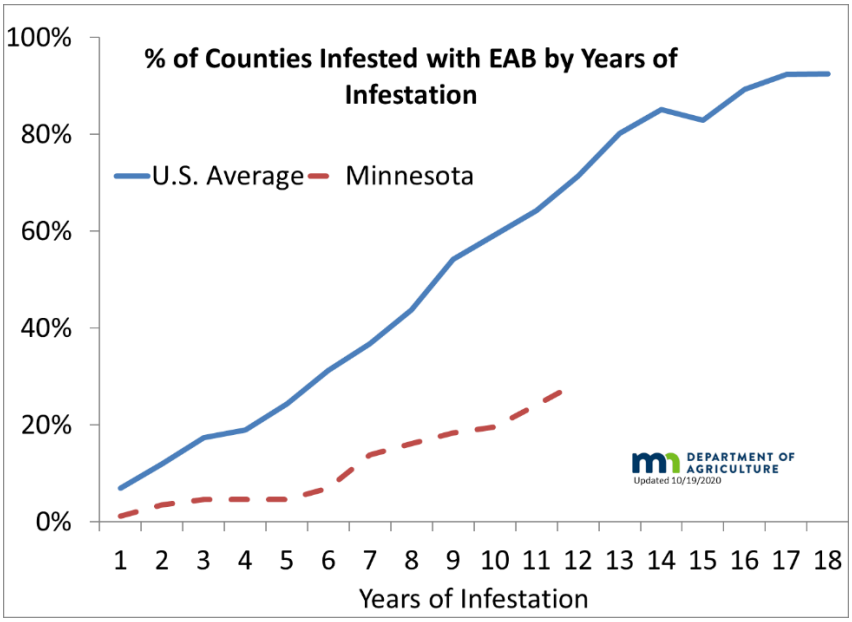

Figure 1. Rate of EAB spread to new counties in Minnesota vs the U.S.

Survey

In follow-up on citizen reports to the Minnesota Department of Agriculture (MDA) Arrest the Pest hotline, EAB infestations were discovered in a number of new locations within regulated areas as well as four new county level detections (Figure 2). New county detections all received a delimit visual survey by MDA staff to understand the extent and severity of the infestations. All known EAB-infested areas can be viewed online: www.mda.state.mn.us/eabstatus.

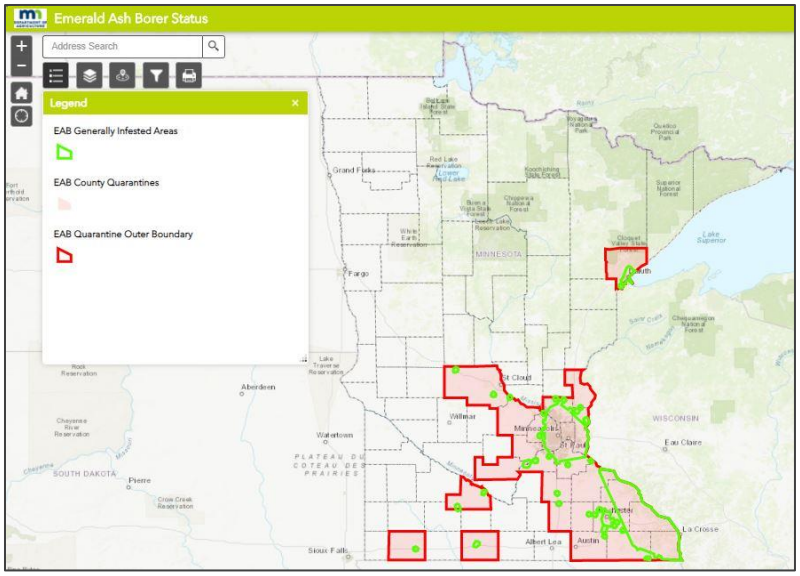

Figure 2. EAB-infested counties in Minnesota as of December 14, 2020.

Outreach

With support from the United States Forest Service (USFS), 13 EAB field workshops and two management webinars were held during 2020. The EAB field workshops were held in the cities of Medford, Minnetonka, and Lino Lakes with over 80 people in attendance. A number of in-person workshops and meetings were reduced or canceled due to COVID-19. Over 175 individuals from local governments, tree care services, and the public attended two separate webinars hosted by the MDA. One event focused on forest management of EAB and the second on community forest management and state grant opportunities for EAB. The webinars were recorded and made available for viewing afterwards. Additional field workshops and webinars are planned for March and April 2021. To register for the free hour-long workshops, webinars, or viewing of previously recorded webinars, please visit www.mda.state.mn.us/eab.

Two EAB informational meetings were held virtually in September and November for the public and local resource managers in Carver, Mower, Rice and Sibley counties to address the new county level finds. Several EAB informational webinars including updates on the pest's regulatory status in Minnesota are being planned for spring 2021.

Through a grant from the United States Department of Agriculture (USDA) Plant Protection Act 7721 (formerly known as the USDA Farm Bill), the MDA also conducted an advertising campaign in 2020 to highlight the risk of moving invasive species via firewood (Figure 3). Advertising occurred during the summer and fall through a variety of media, including online, billboards, streaming television, radio, and print.

Figure 3. A print advertisement used in the 2020 advertising campaign.

Biological Control

With support from the Environment and Natural Resources Trust Fund (ENRTF) and the USDA EAB Parasitoid Rearing Facility, the MDA released 16,847 parasitic wasps at seven EAB-infested sites in southeast Minnesota, the Twin Cities, and Rockville during 2020. Since this project began in 2010, over 626,000 wasps have been released at 47 EAB-infested sites in Minnesota. Two species, *Oobius agrili* and *Tetrastichus planipennisi*, have been in use since 2010, and an additional species, *Spathius galinae*, was made available in 2016.

Figure 4. Cup of adult parasitoid wasps for release at EAB biological control sites.

Intensive sampling at two locations of known establishment was completed for the third and final year. Whole tree sampling and bark sampling were utilized to gain information on the ability of the wasps to reproduce and reduce the EAB populations in EAB-infested locations. The University of Minnesota will analyze data collected by the MDA to determine the percentage of parasitism by each parasitic wasp species as well as develop efficacy curves for each sampling technique.

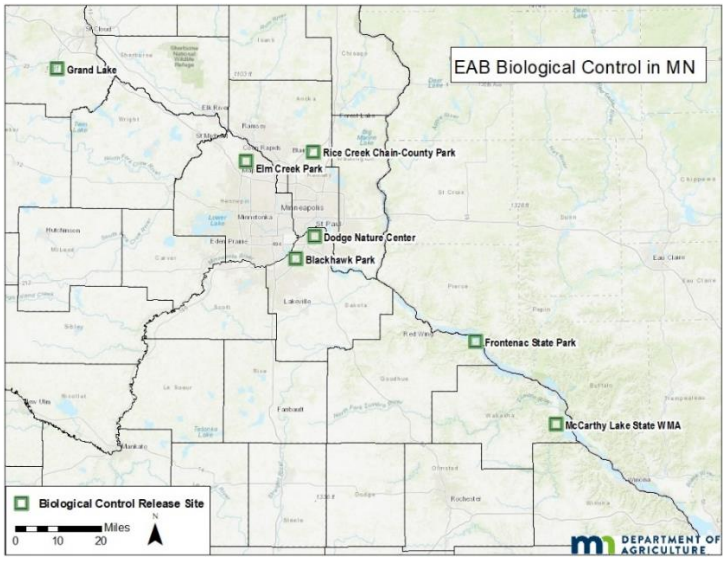

Figure 5. Map of EAB biocontrol sites that received wasp releases in 2020.

Regulatory

During 2020, Carver, Mower, Rice and Sibley counties were formally quarantined. Once an emergency quarantine is put in place, public meetings are held and a 45-day opportunity for comment follows before the quarantine is formalized. Due to in-person meeting restrictions caused by the pandemic, virtual public meetings were held instead. The most current quarantine information can be found at www.mda.state.mn.us/pestregs.

In December 2020, the USDA announced that as of January 14, 2021, it will no longer regulate emerald ash borer. However, the state of Minnesota will continue regulation of this pest. The MDA will continue its work monitoring for EAB in un-infested areas, quarantining newly infested counties, and regulating the movement of wood products around the state. The MDA will also take on some of the work previously carried out by the USDA by limiting the movement of ash and firewood from other states into Minnesota. The updated quarantine is available at www.mda.state.mn.us/plants-insects/emerald-ash-borer-quarantine.

The MDA now has nine USDA or MDA certified firewood producers in the state (Figure 6). A list of certified firewood producers can be found at www.mda.state.mn.us/firewood.

Figure 6. Example of the MDA certified firewood logo.

Gypsy Moth

The MDA's Gypsy Moth Program consists of three parts: a state-wide trapping survey, treatments for population management, and quarantine enforcement. For more information visit www.mda.state.mn.us/gypsymoth.

Survey

In 2020, a total of 21,692 pheromone baited gypsy moth detection traps were set in Minnesota by the MDA and other cooperators. A north central area was added to include municipalities and high-risk sites. The results map shows the locations of the 21,692 traps set with the MDA's project area, positive trap locations, and the total number of moths trapped per county (Figure 7).

The survey season ran May through October, and the final statewide gypsy moth count was 4,149 moths in 2,087 positive traps. This is almost eight times as many moths as were trapped in 2019. More detailed viewing of survey results can be found at www.mda.state.mn.us/gmresults2020.

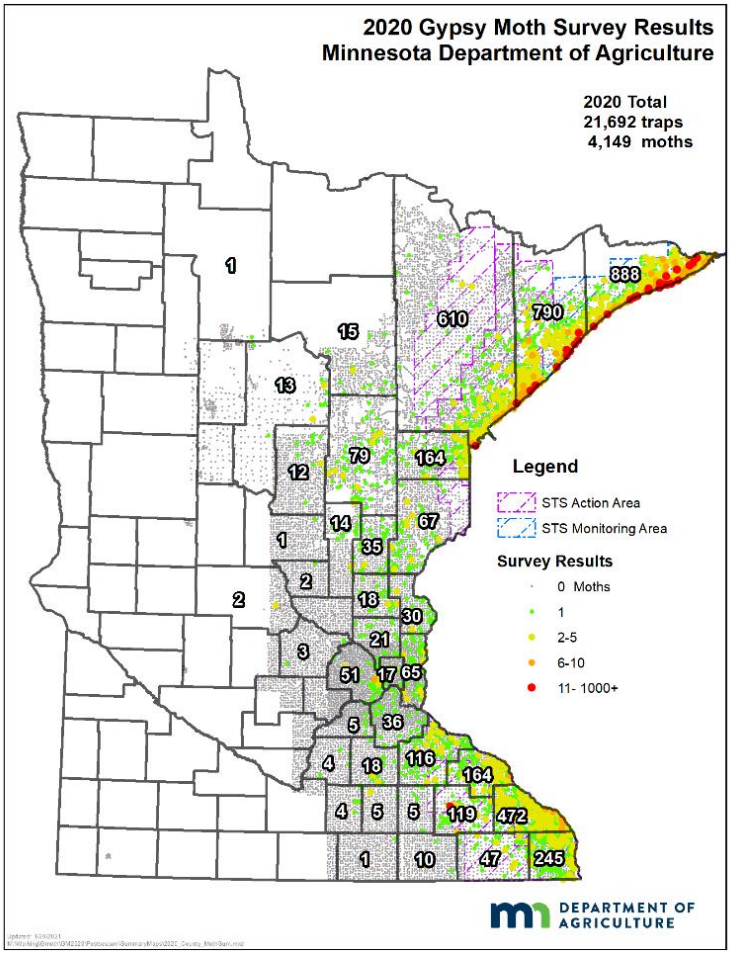

Figure 7. Locations of gypsy moth traps and male moth catches in 2020.

2021 Survey Plans

The MDA trapping survey will continue to focus on the eastern half of Minnesota, with special attention paid to both the Slow The Spread (STS) area and high-risk sites, such as nursery, mills, parks, and urban communities. The goal is to maintain 20,000 early detection survey traps across the state in 2021 with a buffer zone of the trapping survey area extending west into the eradication area of the state. Minnesota's 2021 proposed trapping zones can be viewed in Figure 10 along with the proposed treatments.

Treatments

The MDA's 2020 gypsy moth treatment areas were in both the uninfested area of the state and the STS action area (Figure 8). The MDA determined areas for gypsy moth treatments based on alternate life stage surveys conducted in the fall of 2019 and through the analysis of trapping survey results with the STS Program Decision Algorithm.

The MDA had treatment blocks in portions of Minneapolis, Hokah, and Oak Center. All three treatment blocks were treated with the product Foray 48B, which is a biological insecticide containing the active ingredient *Bacillus thuringiensis* var. kurstaki (Btk). The Minneapolis block was located in the uninfested zone and had the management goal of eradication. The Hokah and Oak Center treatment blocks were located in the STS action area and also had the goal of eradication because of the isolated population. The three treatment blocks each had two aerial applications of Btk spaced 4-8 days apart. The second applications for Hokah and Oak Center were conducted only four days after the first due to high temperatures and increased insect development.

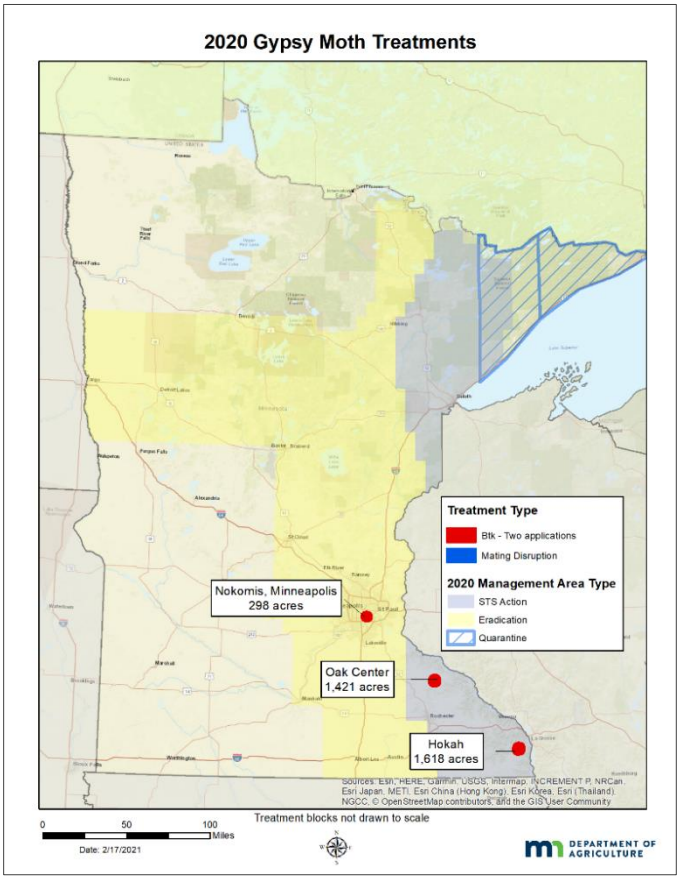

Figure 8. Locations of 2020 gypsy moth treatments.

2021 Treatment Plans

A nursery site in Rochester had high trap catches during 2020 midseason survey trap inspections. MDA staff inspected the nursery and were able to identify infested stock originating from a gypsy moth regulated area. The nursery took immediate action by burning the heavily infested burlap that was around the infested trees. The nursery is under an MDA Compliance Agreement and will be responsible for a treatment in the spring.

Figure 9. Gypsy moth life stages found on burlap wrapped around the root balls of infested oak trees at a nursery.

A large receiving mill in Carlton County, will be treating for elevated trap catches that led to finding alternate life stages, including fresh egg masses on-site. The MDA is working with the mill on a treatment plan for the spring of 2021.

Three other areas of concern where alternate gypsy moth life stages (egg masses, pupae, shed larvae skins) were found in the fall of 2020 have been identified as proposed larvicide treatment sites for 2021.

- A rural site northwest of La Crescent in the same location as the 2017 Pine Creek mating disruption treatment area (Winona County; southeast Minnesota STS Action Area)
- A hybrid residential/railroad land site in New Duluth (St. Louis County; northeast Minnesota STS Action Area)
- A site just east of Loring Park in downtown Minneapolis (Hennepin County; State Eradication Area)

The sites listed above are all proposed Btk (*Bacillus thuringiensis var. kurstaki*) treatments with the exception of the nursery which will treat with MIMIC. The Pine Creek and New Duluth sites fall within the 2021 proposed STS Action Area so would fall under STS Foundation funding via the USDA USFS and will be treated via aircraft. The Loring Park, Minneapolis site is in the State Eradication Area and would be funded by the USDA APHIS. The Loring Park site is being proposed for a ground application.

The MDA and STS program staff also determined boundaries for ten proposed mating disruption treatment blocks within the STS Action Areas of southeastern and northeastern Minnesota (Figure 10).

For more detailed descriptions of the 2021 proposed gypsy moth treatments, please visit the MDA's gypsy moth treatment webpage at www.mda.state.mn.us/gmtreatments.

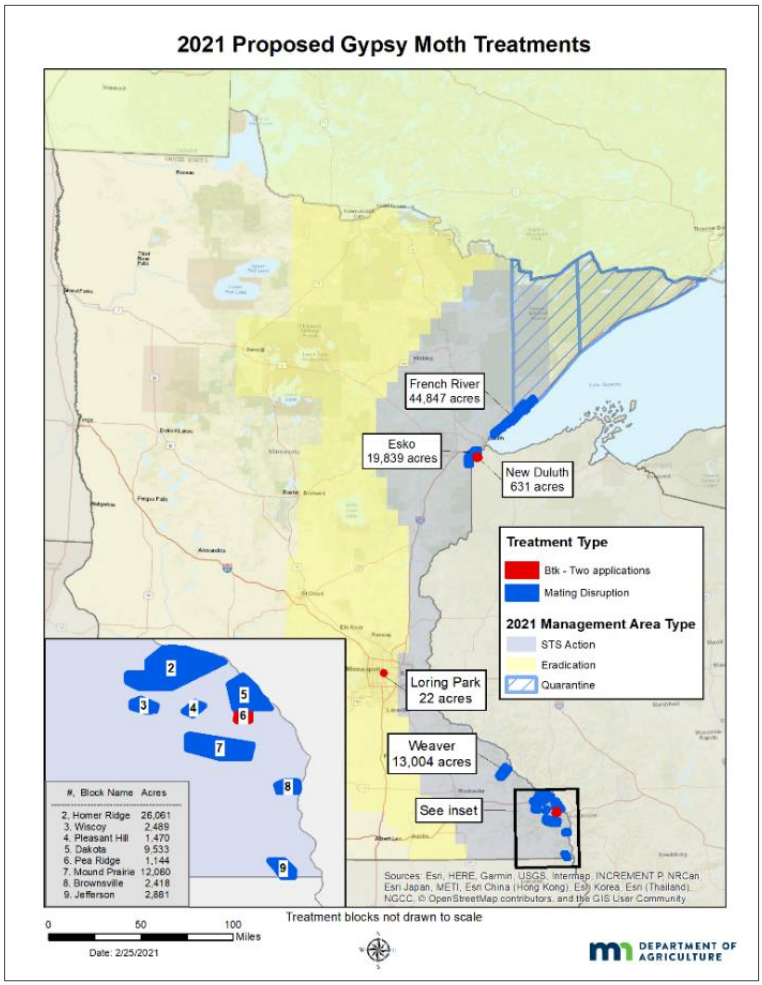

Figure 10. Proposed 2021 gypsy moth treatments.

Regulatory

Quarantine Compliance

The MDA establishes compliance agreements with entities that wish to move regulated articles out of gypsy moth quarantine areas (Figure 11). The majority of regulatory activities occur in Cook and Lake counties, which were quarantined in July 2014. Cook and Lake counties are also under a parallel federal quarantine for gypsy moth.

Limited permits are required for the transport of pulpwood to approved receiving facilities, and they expire annually. Gypsy moth receiving facility and holiday greenery compliance agreements are also renewed annually.

The Gypsy Moth Regulatory Program at the MDA is a multi-faceted program that relies on strong cooperative relationships with other state agencies and units within the MDA. The MDA cooperates with the Minnesota Department of Natural Resources to provide outreach at high-risk sites such as state parks, state forests, and public campgrounds. Outreach materials are also provided to privately owned campgrounds across Minnesota. The MDA cooperates with the Minnesota State Patrol to conduct commercial vehicle saturations. During these commercial vehicle saturations, log trucks are pulled over and their documentation is inspected to ensure quarantine compliance. The Plant Pest Regulatory Coordinator works closely with the Nursery Unit to ensure that nurseries and Christmas tree growers adhere to the federal gypsy moth quarantine.

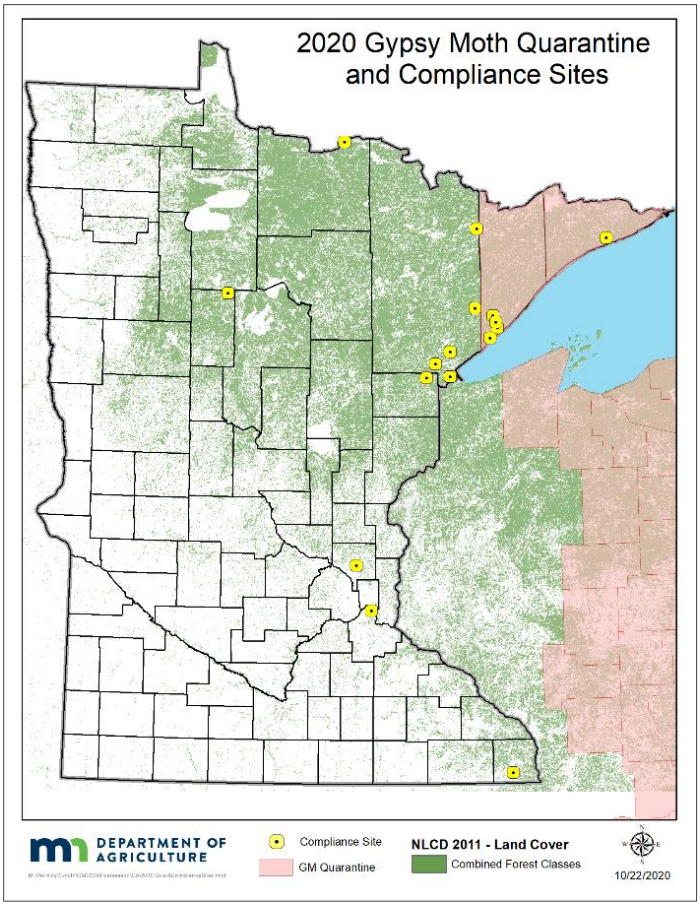

Figure 11. Locations of gypsy moth compliance sites and quarantined counties.

Lily Leaf Beetle – New Landscape Pest Detection

The lily leaf beetle (*Lilioceris lilii)*, an invasive insect that feeds on lilies and fritillaries, was found for the first time in Minnesota in 2020. The insect was discovered in St. Paul on an Asiatic lily and reported to the MDA. Reports came in throughout July and it was determined that lily leaf beetle was more widespread than previously thought. The insect has probably been present in Minnesota for several years. Multiple reports came in from St. Paul, Fridley, Bloomington, and Red Wing.

The beetle is native to Europe and Asia and is currently found in Canada, the northeastern United States, and the states of Washington and Wisconsin. The larvae cause significant damage to true lilies (*Lilium spp.*) as well as fritillaries (*Fritillaria spp.*). It is reported that adult beetles occasionally feed on other plants including hollyhocks, hostas, lily of the valley, potato, and Solomon's seal. Lily leaf beetles do not cause damage to daylilies, canna lilies, or calla lilies. Adults and larvae can cause damage by eating the leaves and buds (Figure 12). Often they will consume all the leaves leaving only bare stems.

Figure 12. Lily leaf beetle damage on Asiatic lily. Christy Schaefer

Lily leaf beetles are distinctive-looking beetles that will be recognizable in multiple stages of development. Look for bright red beetles, reddish eggs laid in lines on the undersides of leaves, and bumpy, black larvae also on the undersides of leaves. The larvae cover themselves with their own excrement, likely to protect themselves from predators and parasitoids. Adults are a distinct scarlet red with black head, antennae, and legs, and measure about ½ inch long (Figure 13).

Since this was the first reported discovery of lily leaf beetle in Minnesota, the MDA would like to better understand where this insect may be in the state and how big of an issue this is to homeowners. Residents can report suspected lily leaf beetles to the MDA's Arrest the Pest line at arrest.the.pest@state.mn.us or 1-888-545-6684. If possible, please include clear photos.

Figure 13. Lily leaf beetle adult feeding on lily. Michelle DeLaundreau

European Chafer Beetle – New Landscape Pest Detection

The European chafer beetle (*Amphimallon majale)*, an insect that can cause major damage to turf grass, was also found in August 2020 for the first time in Minnesota.

A resident of south Minneapolis first noticed large swarms of beetles in their yard at dusk and reported the find to a University of Minnesota Extension entomologist who suspected the beetles were European chafers and reported them to the MDA. The MDA worked with the USDA to confirm the identity of the insect since it had never been found in Minnesota before.

The European chafer beetle was discovered in the United States in 1940 in New York state and is currently found in the northeastern United States, as well as Michigan and Wisconsin. The majority of the finds in Minnesota in 2020 were concentrated in the south Minneapolis area. It is probable that this insect has been here for several years and is more widespread than is currently known.

The grub of the European chafer can cause more damage to turf than Japanese beetles because it spends a longer portion of the summer feeding on turf. However, adults do not eat at all, so they do not defoliate other plants like Japanese beetles are known to do. Home lawns, golf courses, and turf growers could be significantly impacted if the European chafer beetle becomes established in Minnesota.

The adult insects are about a half-inch long and tannish in color (Figure 14). They are similar to the common June bugs found in Minnesota in early summer but are generally a bit smaller and lighter in color. The beetles emerge from the soil between mid-June and early July, and are active on warm evenings for several hours just before and after sunset. The white grubs can range from ¼-inch to 1-inch long with a dark brown head and noticeable legs.

Figure 14. Adult European chafer beetle. Michael Reding, USDA ARS. Bugwood.org

Exotic Bark and Woodboring Beetles

The introduction of wood boring insects is a continuous threat to the United States. There are several pathways for these types of insects to reach the U.S. such as solid wood packing material and rustic wood furniture. Some of our most serious invasive pests (e.g., emerald ash borer and Asian longhorned beetle) have been introduced via this pathway. Other pests, whose impact has still yet to be determined, such as *Callidiellium villosulum* and the velvet longhorned beetle (*Trichoferus campestris),* have also been introduced through these pathways.

The MDA continued its fourth year of exotic bark and woodboring beetle survey funded by the Plant Protection Act 7721 (formerly known as the Farm Bill). Pests of concern include the velvet longhorned beetle, European spruce bark beetle (*Ips typographus*), and 12 others (Figure 15). The purpose of this project was to survey for the presence of exotic woodborers that could affect a wide variety of forests in Minnesota. Survey sites included areas with preferred host trees near population centers where introduced insects could possibly become established such as campgrounds, city and county parks, nature/history centers, and cemeteries.

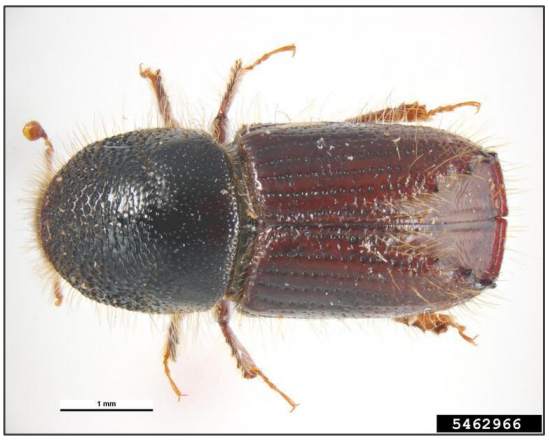

Figure 15. Adult European spruce bark beetle. Pest and Disease Image Library, Bugwood.net

Survey

Field work for the Forest Pests Survey began the week of May 18, 2020. Survey staff set USDA-approved funnel traps and cross-vane panel traps at 49 sites in 19 Minnesota counties (Figure 16). A total of 185 traps were set statewide with 1-6 traps at each site depending on host species presence. Traps were placed in different areas of the sites to avoid any intermingling of pheromones that might inhibit attraction to the traps. Each trap was checked biweekly by survey staff, and baits were changed as needed. The MDA surveyed for 14 exotic bark and woodboring insects; 12 were surveyed with traps and two were surveyed visually.

All trap catches have been screened. Three positive detections of velvet longhorned beetle (VLB) were confirmed from traps in Dakota, Goodhue, and Olmsted counties. Goodhue and Olmsted counties are first detections. No other target pests were found in 2020.

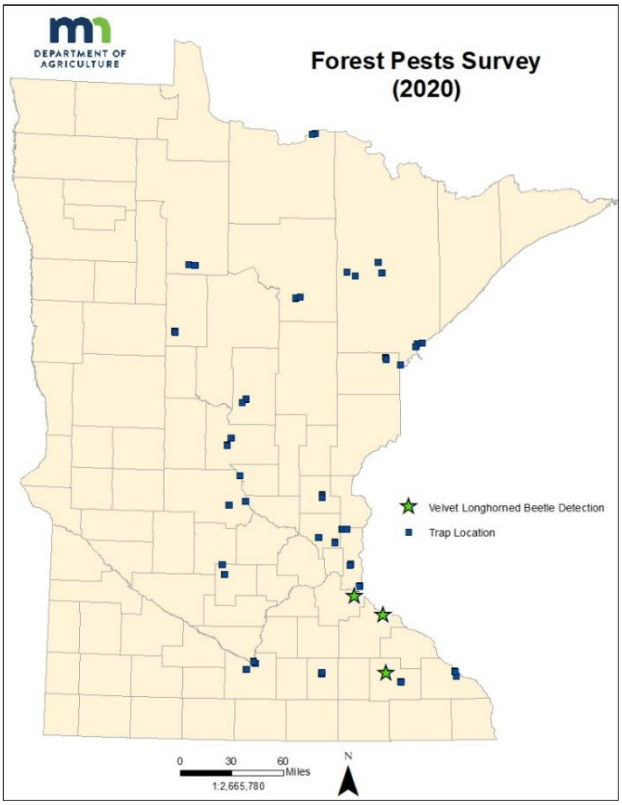

Figure 16. Map of 2020 Forest Pests survey site locations and positive detections.

Invasive Tree Disease Survey

In 2020, the MDA conducted a survey for three tree diseases with the potential to cause significant damage to trees in forests, landscapes, Christmas tree farms, and nurseries. These diseases were Chalara ash dieback caused by *Hymenoscyphus fraxineus*, Scots pine blister rust caused by *Cronartium flaccidum*, and Elm yellows caused by *Candidatus* Phytoplasma ulmi.

Staff surveyed for disease symptoms at 48 sites in 19 counties. At each site, host trees were identified, and an approximate number of trees was recorded. Pine trees were more common in the northern half of the state, elm trees were more common in the southern half of the state, and ash trees were found throughout all sites.

Scots Pine Blister Rust

Scots pine blister rust is caused by the fungus *Cronartium flaccidum* and occurs only in parts of Europe and Asia. This rust fungus infects several species of pine trees including Scots, Austrian, ponderosa, and mugo pines, which are important in landscapes, forests, and as Christmas trees. *Cronartium flaccidum* infects pine needles and then grows into branches and the trunk. The disease causes reduced and deformed growth and eventual death of the tree. Native red and white pines are resistant. Many popular garden plants like peony, verbena, and delphinium are alternate hosts to *C. flaccidum*. Introduction of this invasive fungal pathogen could occur through imported nursery stock.

Host trees for Scots pine blister rust were identified at 28 sites, with an approximate total of 944 trees at the sites. Pines at each site were inspected every two weeks in June and early July, when spore filled pustules were most likely to be present. No trees with scots pine blister rust were found in the 2020 survey.

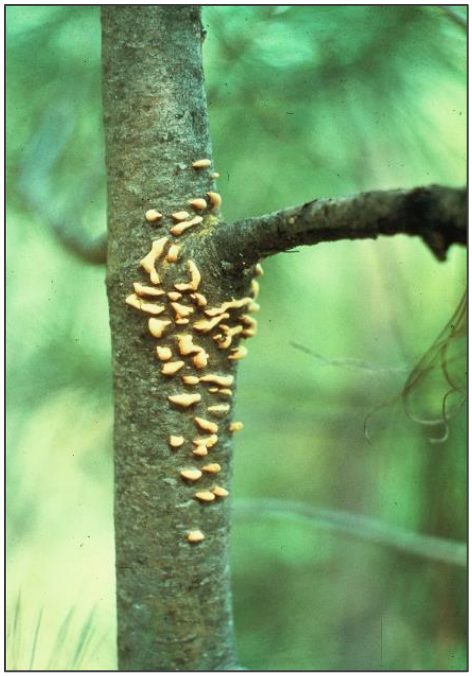

Figure 17. Like the white pine blister rust in this picture, scots pine blister rust causes branch and stem cankers that release spores from pustules in cracks in the bark. USDA Forest Service - Forest Health Protection Intermountain Region, Bugwood.org

Chalara Ash Dieback

Chalara ash dieback, caused by the fungus *Hymenoscyphus fraxineus*, is causing widespread ash mortality in several European countries. It has not yet been detected in the United States. Green, white, and black ash can all be infected by *H. fraxineus*. This fungus spreads short distances by windborne spores and long distances on diseased ash plants, including nursery stock. Symptoms include brown, black, or wilted leaves hanging from branches, blackened leaf stems, diamond shape lesions on stems or branches that are centered on a branch or leaf entry point, and small fruiting bodies on blackened leaf stalks on the ground.

Host trees for Chalara ash dieback were found at 46 sites, with an approximate total of 2,380 trees at the sites. Ash trees at each site were inspected every two weeks from late July through early September, when symptoms were most likely to be found. Only trees with diamond shaped cankers at the base of a dead branch, brown or necrotic leaves with black veins, or fruiting bodies growing from blackened stalks of fallen leaves were sampled (Figure 18). No trees with Chalara ash dieback were found in the 2020 survey.

Figure 18. Diamond shaped canker on a young ash stem from Chalara ash dieback. ©Crown copyright. Forest Research

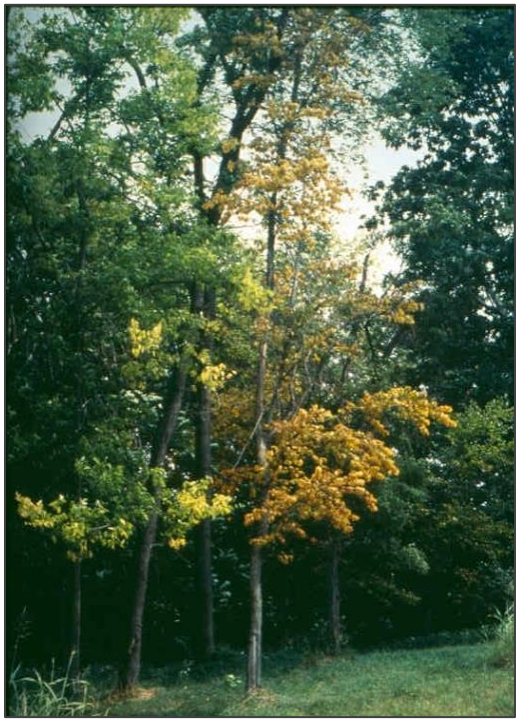

Figure 19. Young elm tree infected with elm yellows. PA dept. of conservation, natural resources, and forestry, bugwood.org

Elm Yellows

Elm yellows is caused by the phytoplasma *Candidatus* Phytoplasma ulmi, a bacterium that lives only in the vascular system of elm trees and the leaf hoppers and spittle bugs that spread it. All species of American elm are susceptible to elm yellows, including the Dutch elm disease resistant varieties that are being widely planted in landscapes to replace ash trees removed due to emerald ash borer. The canopy of infected trees turns completely yellow, leaves bend downward without wilting, and the tree dies (Figure 19). There is no treatment for elm yellows.

There are three historical records of elm yellows occurring in southern Minnesota. These reports, however, are from prior to 1975 and modern diagnostic techniques to confirm infection by a phytoplasma were unavailable at that time. There are no reports of elm yellows in Minnesota since that time, and the current status of this disease in the state is unknown.

Host trees for elm yellows were found at 35 sites, with an approximate total of 1,012 trees at the sites. Elm trees at each site were inspected every two weeks from late July through early September, when laboratory tests were most likely to be successful. Only symptomatic trees were sampled. Young twigs with multiple leaves were collected and tested with PCR for the presence of phytoplasmas. No trees with elm yellows were identified in the 2020 survey.

Elongate Hemlock Scale

The elongate hemlock scale (*Fiorina externa* Ferris) was found for the third consecutive year in Christmas trees and holiday greenery in Minnesota. The trees and greenery were imported into Minnesota from the southeastern U.S. where this insect is established. In 2020, much lower levels of infestations were observed as some dealers sought out stock that was from uninfested parts of the country.

The University of Minnesota with help from the MDA, has received a USDA Specialty Crop Block Grant to study the cold tolerance of the elongate hemlock scale (EHS). The purpose of the project is to determine the insect's potential for establishment and long-term survival in Minnesota. The MDA started a host survey of local compost and holiday greenery disposal sites across the state to determine if these areas would be suitable for elongate hemlock scale establishment or could act as refugia.

Figure 20. Cut Christmas trees imported to Minnesota and inspected for elongate hemlock scale.

This pest is believed to have been introduced from Japan and was first found in New York in 1908. It is currently established in the eastern United States but not in Minnesota. This insect is potentially a threat to our native conifer species such as spruces and firs. Elongate hemlock scale is reported to develop and reproduce on 43 species of native and exotic conifers. Primary hosts include hemlocks (*Tsuga* sp.), firs (*Abies* sp.), and spruce (*Picea* sp.), which include several species that are native to the United States.

The elongate hemlock scale is a small insect that secretes a waxy coating for defense and feeds on the sap of plants. They have piercing/sucking mouthparts they insert into the host plant for feeding. Once they begin feeding, most species of scales remain stationary on the plant (Figure 21). This insect typically overwinters as an egg or a female carrying eggs. The life cycle consists of immobile adults and mobile immatures called "crawlers." Crawlers are capable of dispersing and establishing new populations via birds or the wind. The life stages broadly overlap, so crawlers may be found throughout spring and summer. Males and females look quite different because the males have wings.

Figure 21. Adult and immature elongate hemlock scale on the underside of a fir needle.

Detection of EHS is very difficult, but the female, which will normally be seen if an infestation is present, is dark brown and longer than wide. Adult females are typically found on the underside of the needles (Figure 22). Signs of elongate hemlock scale include a yellow banding on the top of infested needles which can lead to premature needle drop. The crowns of infested trees may have a thin appearance.

Figure 22. Fir needles heavily infested with elongate hemlock scale.

For More Information

Angie Ambourn
Supervisor, Pest Detection and Export Certification Unit
angie.ambourn@state.mn.us
651-201-6073

Natasha Northrop
Survey Supervisor, Gypsy Moth Program
natasha.northrop@state.mn.us
651-201-6692

Danielle DeVito
Pest Mitigation and Regulatory Coordinator, Gypsy Moth Program
danielle.devito@state.mn.us
507-384-1129