DEPARTMENT OF AGRICULTURE

Status of Invasive Fruit and Vegetable Pests in Minnesota

2024 Annual Report

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Minnesota Department of Agriculture

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Pathways Survey for Invasive Pests of Fruits and Vegetables

The Pathways Survey, funded by the United States Department of Agriculture (USDA) Plant Protection Act 7721, focuses on agricultural systems near urban areas, such as community gardens, fresh market produce farms, apple orchards, and vineyards. In addition, high tunnels were surveyed for diseases of tomatoes, peppers, and cucumbers. These sites were chosen because high tunnels can be sheltered areas where invasive diseases have the potential to overwinter and become established.

Some of the most important invasive species currently impacting Minnesota urban agricultural include brown marmorated stinkbug and Swede midge. These invasive species were first found in urban areas before spreading into more rural areas of the state. Thus, agricultural systems in and around urban areas can be considered part of a system of pathways by which invasive species become established and spread.

Urban agricultural systems make good survey sites due to the high diversity of crops. This provides opportunities to monitor a broad range of invasive insects and plant pathogens. The Minnesota Department of Agriculture (MDA) works with partners, including the USDA Animal and Plant Health Inspection Service (APHIS) Plant Protection and Quarantine (PPQ) and the University of Minnesota (U of M), to determine which insects and diseases to include in the survey.

Some key criteria for including an invasive pest in the survey are:

- The likelihood of an organism reaching Minnesota due to proximity to existing infestations or ease of movement.
- The prevalence and importance of potential hosts in Minnesota.
- Climatic suitability, particularly the likelihood of overwintering survival.

Survey

The 2024 Agricultural Pathways Survey was conducted from mid-May through September, with sites visited approximately every two weeks. A total of 32 orchards, 23 gardens, 18 vineyards, 14 high tunnels, and five residential areas were surveyed across 29 counties. In addition to sites in rural areas, survey sites in the Twin Cities and surrounding suburbs, Grand Rapids, Duluth, St. Cloud, Alexandria, Crookston, and Rochester were included to monitor for people driven pathways for possible introduction of new pests.

There were 12 insect pests (Table 1) and 16 plant disease pests (Table 2) in the Agricultural Pathways Survey. On each site visit, a visual inspection was conducted on a portion of the plants. Plant samples were collected and submitted to the MDA Plant and Seed Analysis Laboratory (MDA-PSA Lab) for further analysis when disease symptoms of target plant pathogens were found. Insect traps were checked at each site visit, and samples were collected and submitted to the MDA-PSA Lab. Insects were then screened, and if suspects were found, those with national implications were submitted to the USDA for final identification.

Seven orchard sites and five vineyard sites were located within the endangered rusty patched bumble bee (RPBB) habitat zones, so adjustments in trapping had to be made. White wing traps were eliminated at these vineyard sites, as no alternative is approved for the survey.

Table 1. Insect Pests in the Agricultural Pathways Survey.

Scientific Name	Common Name	Survey Site Type	Survey Method
Halyomorpha halys	Brown marmorated stink bug	Vegetable gardens, Orchards, Vineyards	Visual observation
Adoxophyes orana	Summer fruit tortrix moth	Orchards	Lure and trap
Epiphyas postvittana	Light brown apple moth	Orchards	Lure and trap
Lycorma delicatula	Spotted lanternfly	Orchards	Visual observation
Trichoferus campestris	Velvet longhorned beetle	Orchards	Lure and trap
Acrolepiopsis assectella	Leek moth	Vegetable gardens	Lure and trap
Neoleucinodes elegantalis	Tomato fruit borer	Vegetable gardens	Lure and trap
Phthorimea absoluta	Tomato leafminer	Vegetable gardens	Lure and trap
Lobesia botrana	European grapevine moth	Vineyards	Lure and trap
Depressaria depressana	Purple carrot seed moth	Vegetable gardens	Visual observation
Thrips parvispinus	Thrips	High tunnels	Visual observation
Cryptoblabes gnidiella	Christmas berry webworm	Vineyards	Lure and trap

Table 2. Plant Disease Pests in the Agricultural Pathways Survey.

Scientific Name	Common Name	Survey Site Type	Survey Method
Candidatus Phytoplasma mali 16SrX-A	Apple proliferation	Orchards	Visual observation
Candidatus Phytoplasma ziziphi	Jujube witches' broom	Orchards	Visual observation
Gymnosporangium yamadae	Red star rust	Orchards	Visual observation
Monilinia fructigena	Apple brown rot	Orchards	Visual observation
Clavibacter michiganensis subsp. *michiganensis*	Bacterial wilt and canker of tomato	Vegetable gardens	Visual observation
Cucumber Green Mottle Mosaic Virus	CGMMV	Vegetable gardens	Visual observation
Pseudoperonospora cubensis	Cucurbit downy mildew	Vegetable gardens	Visual observation
Ralstonia solanacearum race 3 biovar 2	Bacterial wilt	Vegetable gardens	Visual observation
Phyllachora maydis	Tar spot	Vegetable gardens	Visual observation
Tomato Brown Rugose Fruit Virus	ToBRFV	High tunnels	Visual observation
Candidatus Phytoplasma australiense 16SrXII-B	Australian grapevine yellows	Vineyards	Visual observation
Candidatus Phytoplasma solani 16SrXII-A	Stolbur disease	Vineyards	Visual observation
Candidatus Phytoplasma vitis 16SrV-C	Flavescence dorée	Vineyards	Visual observation
Pseudopezicula tetraspora	Angular leaf spot	Vineyards	Visual observation
Pseudopezicula tracheiphila	Rotbrenner disease	Vineyards	Visual observation
Xylella fastidiosa	Pierce's disease	Vineyards	Visual observation

Insect Finds

Brown Marmorated Stink Bug

Brown marmorated stink bug (BMSB) (*Halyomorpha halys*) was first introduced to the United States in the mid-1990s from eastern Asia. It became a serious problem for fruit growers in the mid-Atlantic states in 2009. Currently, BMSB is known to occur in most states, as well as in Canada. It is a generalist pest that feeds on many plants, including some economically important to Minnesota. It is considered both an agricultural and nuisance pest in Minnesota.

Brown marmorated stink bug was first identified in Minnesota in 2010, and it continues to be detected throughout the state. To date, it has been found in 33 counties with most detections in the greater Twin Cities metropolitan area. The insect is now considered established in the seven-county metropolitan area. The MDA tracks the distribution and abundance of BMSB across Minnesota in multiple ways, including citizen reports and field surveys.

Traps were set at orchard sites in late May and remained through September. Additional traps ran alongside other Ag Pathways traps at 71 sites covering 25 counties. There were 32 survey sites with BMSB detections in 12 counties.

Figure 1. Adult brown marmorated stink bugs are approximately ½ inch long.

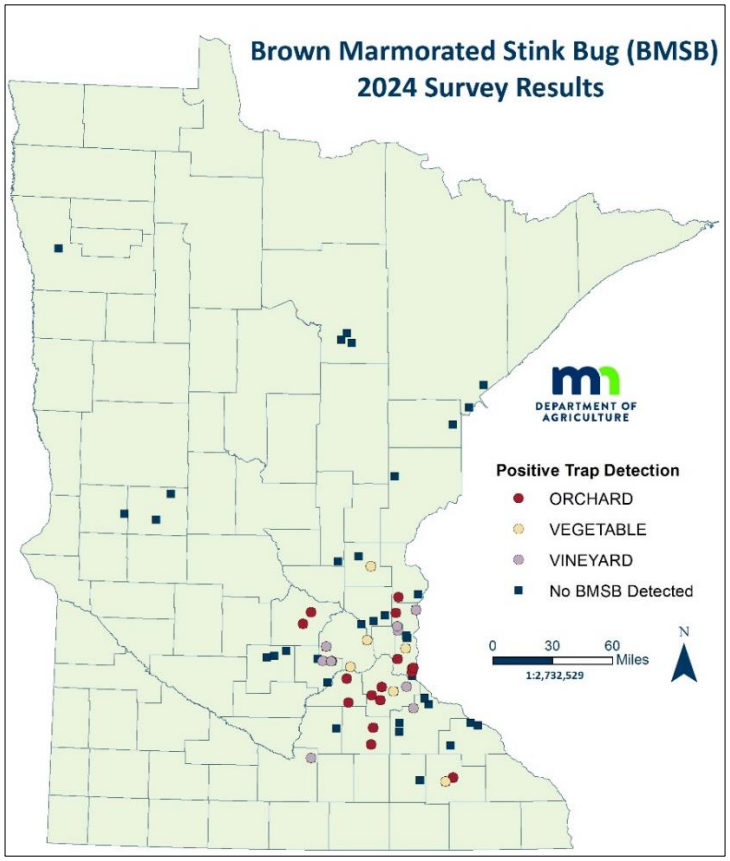
Figure 2. A brown marmorated stink bug sticky trap in a Minnesota apple orchard.

The MDA partners with the U of M through data sharing and research. The U of M evaluates and understands the community of natural enemies present in agricultural settings that may impact BMSB population dynamics. The MDA organizes a monitoring network for BMSB to better track its distribution and abundance. An interactive map of up-to-date BMSB detections in Minnesota is available on the MDA's BMSB webpage.

A large increase in reports and trap catches of BMSB in 2023, including trapped nymphs, indicates growing activity and establishment in the Twin Cities metropolitan area. It is also becoming more common for sites to have detections across multiple years. This information provides an opportunity to closely monitor the buildup of BMSB populations in urban and residential settings and their transition to agricultural settings. Detailed monitoring can provide information that could help avoid the reactive use of insecticides by agricultural producers.

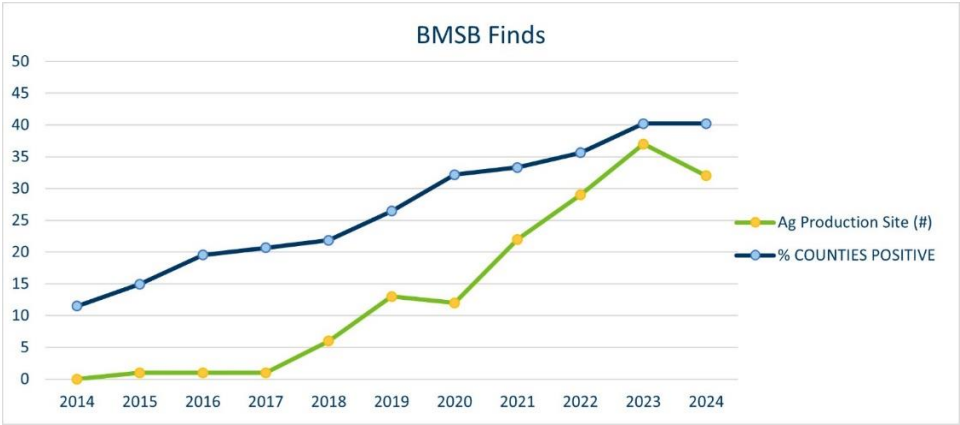
In addition to monitoring BMSB, the MDA placed yellow sticky cards from mid-June through late September for *Trissolcus japonicus,* a non-native wasp species that parasitizes BMSB eggs. The MDA collected 111 cards from 13 locations where BMSB nymphs had been detected in previous years. The cards were screened throughout December, and suspect *T. japonicus* were removed for further identification.

Figure 3. 2024 BMSB survey locations and results.



In 2022, four wasps were identified by a specialist at the Florida Department of Agriculture as the BMSB egg parasitoid *Trissolcus japonicus*. This was the first find in Minnesota. These specimens came from residential sites in St. Paul and Roseville, where reproducing populations of BMSB are well-documented. The other specimens identified were *T. euschisi* and *T. thyantae*. In 2023, *T. japonicus* were detected at a residential site in St. Paul and two residential sites in Roseville. In 2024, *T. japonicus* was detected at a residential site in St. Paul and at a residence in Wyoming, MN. *T. japonicus* has also been detected in other states that have BMSB populations.

Figure 4. Percent of Minnesota counties with BMSB detections and the number of agricultural production sites with BMSB detections since 2014.



Disease Finds

Red Star Rust

Red star rust (formerly known as Japanese apple rust), caused by the fungus *Gymnosporangium yamadae*, is native to Japan, China, and Korea. This disease was first identified in the U.S. in 2009 in several northeastern states, and it was reported in Wisconsin in 2021 and in Minnesota in 2022. In 2024, the MDA identified red star rust in Carver, Scott, McLeod, and Washington counties. Infected apple trees were present in commercial apple orchards and nurseries. This was the first detection in McLeod County.

The red star rust fungus infects apple, crabapple, and juniper at different stages of its life cycle. The most common symptom on apple and crabapple trees are bright red, orange, or yellow leaf spots. Some susceptible varieties of apple will drop infected leaves, resulting in yield loss. Small (<0.4 inches in diameter) woody galls form on juniper twigs. These galls produce a bright orange, gelatinous mass full of fungal spores in wet spring weather. Spores produced on infected junipers are carried by wind and rain to infect apple and crabapple leaves in spring. In fall, chestnut brown powdery spores produced on infected apple and crabapple leaves are carried by wind to infect nearby junipers.

Figure 5. Red and orange leaf spots caused by red star rust on a Zestar apple tree.

Figure 6. Bright red leaf spot with long finger-like spore producing structures emerging from the lower leaf surface on a crabapple tree infected with red star rust.

Tomato Brown Rugose Fruit Virus

Tomato brown rugose fruit virus (ToBRFV) is an invasive plant virus that infects tomatoes and peppers. Leaves of diseased plants have a mottled or mosaic pattern and may be puckered or distorted. Fruit ripens irregularly and may have rough, brown (rugose) skin, making them completely unmarketable. This virus was first described in Jordan in 2015 and has since been found in multiple countries around the world. ToBRFV can be carried to new areas on infected seed and transplants. A small number of infected plants can result in widespread disease problems because the virus easily moves from plant to plant on workers' hands and tools.

Figure 71. Irregular patterns of dark and light green on the youngest leaves of a tomato plant are symptoms of infection with ToBRFV.

In 2024, the MDA scouted 14 farms in 11 counties with high tunnel production of tomatoes and peppers for ToBRFV. The virus was detected at three sites in three different counties. All growers were provided management information to prevent spread of the virus until the end of harvest. At the end of the season, all infected plants were destroyed, and the appropriate steps were taken to eradicate the virus from the site. More information about ToBRFV can be found on the MDA ToBRFV website.

North American Grapevine Yellows

Grapevine yellows is a group of diseases caused by phytoplasmas, small bacteria that live in the plant's vascular system and spread from plant to plant by insects, such as leafhoppers and planthoppers. These diseases cause leaves to curl backward at the edges, become stiff and brittle, and turn yellow (in white grapes) or red (in purple grapes). Fruit clusters shrivel up or fail to develop. Infected plants decline over several years and eventually die.

The MDA surveyed for three invasive phytoplasmas in grapes in 2024. None of the targeted invasive diseases were found in any vineyards. However, two phytoplasmas known to infect grapes in the U.S. were found in Carver and Goodhue counties. *Candidatus* Phytoplasma asteri causes aster yellows disease and can infect many common garden flowers, vegetables, and weeds. It was first reported in grapes in Minnesota in 2023. *Candidatus* Phytoplasma pruni causes X-disease in *Prunus* spp. like chokecherry, plums, and cherries. This is the first report of *Candid.* P. pruni in grapes in Minnesota.

The disease caused by these two phytoplasmas in grapes is known as North American grapevine yellows (NAGY). It has been reported in Kansas, Virginia, New York, North Carolina, and several other Mid-Atlantic states. Unlike other states where NAGY has been reported, Minnesota vineyards commonly grow cold hardy hybrids of grapes. At this time, it is unknown how Minnesota grape varieties will be impacted by NAGY.

More information about North American grapevine yellows can found in this Virginia Tech Extension publication.

Figure 8. Grape leaves infected with North American grapevine yellows showing yellowing and backward curling.

Ginger Wilt

In 2023 and 2024, high tunnel ginger growers reached out to the MDA for assistance in diagnosing an unknown wilt affecting their crop. The plants first had yellow leaves that wilted and turned brown. The entire stem would then fall over from the base. When dug up, ginger rhizomes were discolored, soft, mushy, and had a bad smell. The MDA worked with the USDA to diagnose a bacterial plant pathogen, *Ralstonia pseudosolanacearum*, the causal agent of ginger wilt, which had never previously been identified in the continental U.S.

Figure 9. Infected ginger plants are wilted and tan colored.

The MDA then collaborated with Dr. Devanshi Khokhani, U of M plant pathologist, to collect and test, soil, compost, crop residue, and plants for the presence of *R. pseudosolanacearum*. This bacterial plant pathogen is common in subtropical and tropical areas. It is unknown if it can survive Minnesota winter temperatures.

All affected growers were provided with information about how to dispose of plant material, clean equipment, and winterize high tunnels to prevent survival of the pathogen. The MDA will continue to survey for ginger wilt in 2025.

Figure 20. Rhizomes of plants infected with ginger wilt are discolored, soft, mushy, and eventually shrivel.

Outreach

The Report a Pest reporting system allows people to report pests using an online form, by phone, email, or via EDDMapS (www.eddmaps.org). It is a citizen participation tool that raises awareness and makes early detection campaigns more efficient. This summer saw fewer reports of invasive species, with over 700 reports across all methods. As emerald ash borer becomes more common in metro areas, citizens now contact their municipalities for more information, reducing reports to the MDA.

The Report a Pest online form was updated to include new species and now prompts citizens to input an address, picture, and contact information. This update has reduced the number of email correspondences needed to correctly identify invasive species and has streamlined the tracking process by automatically assigning reports to the appropriate MDA staff based on the species or question selected. The benefits of this activity include the development of broader public awareness of invasive pests and better early detection of quarantine pests.

The MDA started a podcast, *Smarty Plants*, as an outreach tool to highlight the responsibilities and activities of the Plant Protection Division. Through engaging discussions with subject matter experts, researchers, and agency leaders, the podcast explores topics such as noxious weed regulation, pest management, emerging plant diseases, and more. The number of podcast listeners has grown exponentially over the past decade. The medium offers an exciting opportunity for public entities to connect with stakeholders in a new, engaging, and informative way. Listen online at Smarty Plants.

Figure 11. The Smarty Plants podcast was highlighted at the MDA's State Fair exhibit area.

Through a grant from the USDA Plant Protection Act 7721, the MDA conducted two online advertising campaigns in 2024. The first campaign focused on tree of heaven and spotted lanternfly early detection in southeastern Minnesota counties. The second campaign focused on engaging the public in detection of invasive insects and how to report sightings through the Report a Pest system. This campaign used a short video on Facebook and TikTok.

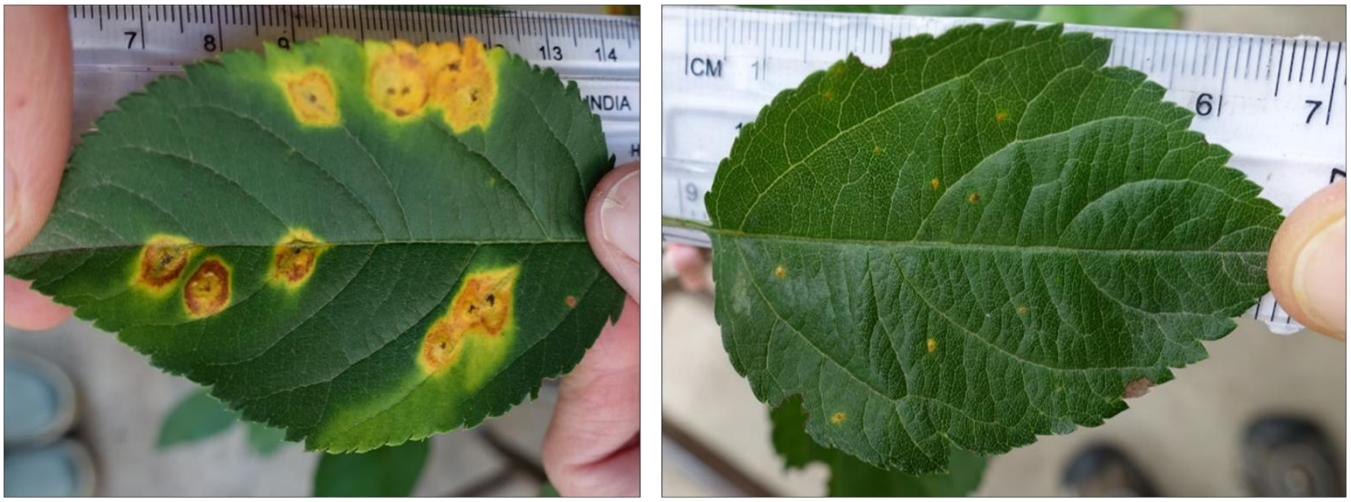
Collaborative Research Projects

Red Star Rust

The detection of red star rust (*Gymnosporangium yamadae*) in Minnesota in 2022 revealed many gaps in information about how to manage this novel disease. In response, the MDA Plant Protection Division and the U of M Departments of Horticulture and Plant Pathology received funding and began work on a Specialty Crop Block Grant, "Identifying Best Management Practices for Red Star Rust, Invasive Pathogen of Apple & Nursery Crops." The goals of this project are to test commonly grown Minnesota apple and crabapple cultivars for resistance or susceptibility to red start rust, identify fungicides that can protect junipers from infection, and monitor for spores to refine spray recommendations for Minnesota's climate. All management information will be shared with nurseries, landscape professionals, and apple growers. Research is being conducted at the U of M Horticulture Research Station.

Figure 12. Trial to test juniper susceptibility and fungicide sprays.

Figure 13. Difference in red star rust disease response on crabapple varieties 'Sutyzam' Sugar Tyme® (left) and 'Bob White' (right) leaves 10 weeks after infection. Photos by T. Enzenbacher.



Evaluating Biological Control of Brown Marmorated Stink Bug in Minnesota

The samurai wasp, *Trissolcus japonicus*, is a parasitic wasp native to Asia. It is known for attacking the brown marmorated stink bug (BMSB), an invasive pest that feeds on a variety of field, vegetable, and fruit crops. The arrival of this wasp in the United States in 2014 garnered research attention because of its potential to suppress BMSB populations, but also because *T. japonicus* has been documented to attack several native stink bug species.

In 2022 and 2023, surveys detected *T. japonicus* individuals in St. Paul, MN. This led to a MITPPC funded project lead by Dr. George Heimpel and Sabrina Celis (Figure 14) with the U of M, looking at the benefits and risks of *T. japonicus* in the state, beginning with surveys for the wasp, BMSB, and native stink bugs in Minnesota apple orchards. The MDA is collaborating on this project through monitoring and collecting BMSB and suspect samurai wasps throughout the state.

In 2024, two *T. japonicus* individuals were found more than 30 miles from the initial detection site. This shows that while populations are currently low, *T. japonicus* is likely present in more of the state than currently recognized. Low parasitism of BMSB by native parasitoids indicates that there is an opportunity for a more effective parasitoid like *T. japonicus* to exert stronger control on BMSB populations. Eight species of native stink bugs were also detected in our surveys. The results of these surveys and additional lab studies will be used to determine if the benefits of having this wasp attack BMSB outweigh the potential risk to native species.

Figure 14. Checking *Trissolcus japonicus* traps at a local Minnesota orchard. Minnesota Invasive Terrestrial Plants and Pests Center, University of Minnesota.

For More Information

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