

Variegated Golden Tortix

Archips xylosteanus



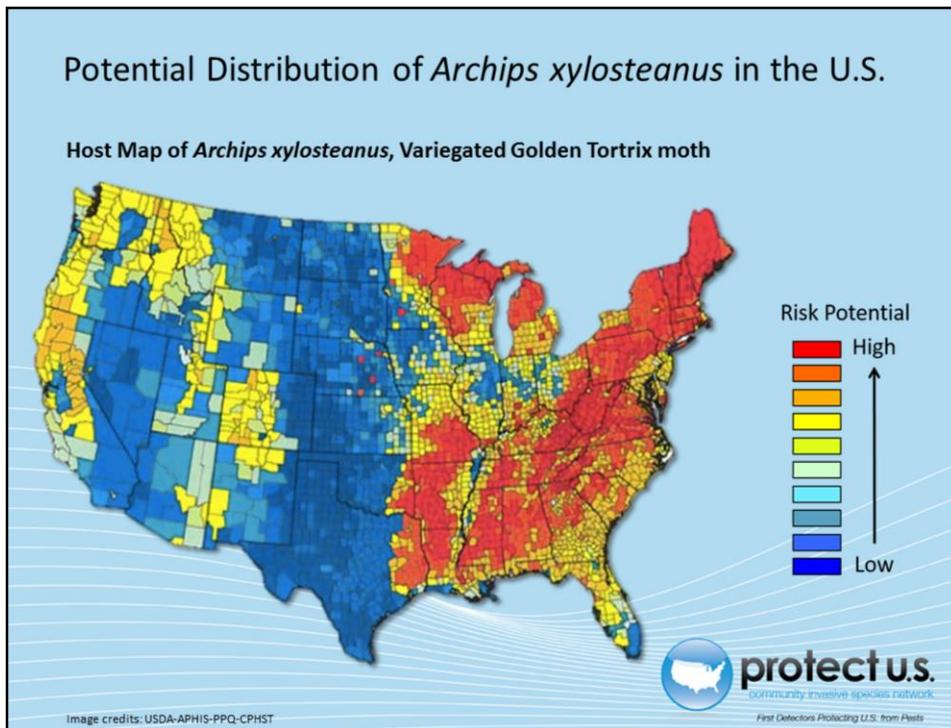
Variegated Golden Tortrix

- Type of leaf-roller known to damage oaks, peaches, apples, and cherries.
- Polyphagous pest that targets fruit and ornamental trees.
- Other common names: apple variegated Tortrix, golden variegated moth, apple leaf roller.
- Distributed in Europe, Asia, and North Africa but not yet established in the United States.



The variegated golden tortrix or *Archips xylosteanus* is a species of leaf roller that causes damage to oaks, peaches, apples, cherries, and many other fruit and ornamental trees every year. It is currently present in Europe, Asia, and North Africa. The pest has not yet established in the United States, but it does have a climate suitable to support it. Some other common names include the apple variegated Tortrix, the golden variegated moth, and the apple leaf roller.

Information sources: 4, 5



The variegated golden tortrix is a pest throughout Europe, Asia and North Africa. The map depicts the potential areas in which the pest could establish in the United States with red being a higher risk and blue being a lower risk. *Archips xylosteanus* has not yet been discovered in the United States but it could eventually become a pest in the fruit growing areas of the country. The pest has already established in North America in St. John's, Newfoundland which due to geographic proximity increases the risk of movement of the pest into the U.S. It is predicted that the pest could establish via overseas shipments to the United States with a suggested entry point at Maine. There is a fear that the variegated golden tortrix would severely damage the cherry, peach, pear and citrus industries as well as Eastern forests.

Information sources: 4, 5

Pest of fruits, oaks, and a variety of other tree species



Image credits: English oak (*Quercus robur*) L. - Robert Vidiki, Doronicum Kft. - Bugwood.org, #5396144; sweet cherry (*Prunus avium*) (L.) L. - Robert Vidiki, Doronicum Kft. - Bugwood.org, #5396283; apple (*Malus domestica*) Borkh. Bill Cook, Michigan State University - Bugwood.org, #1219160



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The variegated tortrix is a polyphagous pest of many different plants. The main concern of its establishment in the United States is fruit trees as they can target hosts such as apples, cherries, peaches, and citrus. They are also known to cause damage to many other trees including some *Quercus* species.

Maple (*Acer* L.)
 Alder (*Alnus* Mill.)
 Birch (*Betula* L.)
 Common filbert (*Corylus avellana* L.)
 European honeysuckle (*Lonicera periclymenum* L.)
 Honeysuckle (*Lonicera* L.)
 St. Johnswort (*Hypericum* L.)
 Giant dogwood (*Cornus controversa* Hemsl. ex Prain)
 Japanese chestnut (*Castanea crenata* Siebold & Zucc.)
 Chestnut (*Castanea* Mill.)
 Sawtooth oak (*Quercus acutissima* Carruth.)
 European turkey oak (*Quercus cerris* L. Daimyo)
 Honeysuckle (*Lonicera* sp.)
 Oak (*Quercus dentata* Thunb.)
 English oak (*Quercus robur* L.)
 Bao li (*Quercus serrata* Thunb.)
 Daimyo oak (*Quercus dentata* Thunb.)
 Holm oak (*Quercus ilex* L.)
 Oak (*Quercus* L.)
 European Ash (*Fraxinus excelsior* L.)
 Fir (*Abies* Mill.)
 Hawthorn (*Crataegus* L.)
 Peach (*Prunus persica* L. Batsch)
 Apple (*Malus domestica* Borkh.)
 Paradise apple (*Malus pumila* Mill.)
 Apricot (*Prunus armeniaca* L.)
 Sweet cherry (*Prunus avium* L.)
 Sour cherry (*Prunus cerasus* L.)
 Poplar (*Populus* sp.)
 Japanese flowering cherry (*Prunus serrulata* Lindl.)
 Chinese pear (*Pyrus pyrifolia* Nakai) (*Pyrus ussuriensis* Maxim.)
 Raspberry (*Rubus* L.)
 European mountain ash (*Sorbus aucuparia* L.)
 Citrus (*Citrus* L.)
 Large gray willow (*Salix cinerea* L.)
 Willow (*Salix* L.)
 Basswood (*Tilia* L.)
 Japanese elm (*Ulmus davidiana* Planch.)
 Elm (*Ulmus* L.)
 Dog rose (*Rosa canina* L.)
 Nightshade (*Solanum* L.)
 European blackberry (*Rubus fruticosus* L.)
 Hazelnut (*Corylus* L.)
 Beech (*Fagus* L.)

Information sources: 4, 5

Larval Damage to Host Leaves



Image credits: apple variegated Tortrix (*Archips xylosteanus*) (Linnaeus) - Milan Zubrik, Forest Research Institute - Slovakia - Bugwood.org, #5378056; apple variegated Tortrix (*Archips xylosteanus*) (Linnaeus) - Milan Zubrik, Forest Research Institute - Slovakia - Bugwood.org, #1370046



The variegated golden tortrix larvae will cause damage to the leaves of hosts. They will feed on the leaves and take shelter in the rolled leaves. Several hosts have been put onto the Threatened and Endangered Species lists as a direct result of *Archips xylosteanus*. These include Virginia round-leaf birch (*Betula uber*), highlands scrub hypericum (*Hypericum cumulicola*), scrub plum (*Prunus geniculata*), Hinckley oak (*Quercus hinckleyi*), Chapmon rhododendron (*Rhododendron chapmanii*), erubia (*Solanum drymophilum*), popolo ku mai (*Solanum incompletum*), and popolo 'aiakeakua (*Solanum sandwicense*).

Information Sources: 4, 5

Identification

- Adults
 - Wingspan 18-24mm
 - Pale pink forewings with dark reddish-brown markings
 - Pale gray-brown hindwings
 - Females are larger and darker than males



Image credits: apple variegated Tortrix (*Archips xylosteana*) (Linnaeus) - Gyorgy Csoka, Hungary Forest Research Institute - Bugwood.org, #5410939; Todd M. Gilligan and Marc E. Epstein, Tortix: Tortricids of Agricultural Importance, USDA APHIS ITP, Bugwood.org, #5462326; Todd Gilligan, Screening Aids, USDA APHIS ITP, Bugwood.org, #5541375



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Adults emerge in June or August and are very active around dusk. The forewings have a pale pink color with dark reddish-brown markings. The wingspan of the average adult variegated golden tortrix 18-24mm. The hindwings are a pale grayish brown and are not visible from the resting position. Adults have lightly colored fringes on the tips of the wings and body. *Archips xylosteanus* females are about 9-11mm in length while the males are slight smaller at around 7-10mm. Also, females tend to be darker in the coloration of the forewing markings than the males. Unlike the females, the males have a forewing costal fold.

Information sources: 2, 4, 5

Lookalikes - Adults

Some commonly mistaken species of *Archips*:



Archips crataegana



Archips podana



Archips rosana



Archips grisea

Image credits: brown oak Tortrix (*Archips crataegana*) (Hübner) - Todd M. Gilligan and Marc E. Epstein, TortNi: Tortricids of Agricultural Importance, USDA APHIS ITP - Bugwood.org, #5482310; black-shield leaf roller (*Archips grisea*) (Robinson) - Todd M. Gilligan and Marc E. Epstein, TortNi: Tortricids of Agricultural Importance, USDA APHIS ITP - Bugwood.org, 5482318; large hick-tree tortrix (*Archips podana*) (Scopoli) - Eric LaSosa, Washington State Department of Agriculture - Bugwood.org, #5015078; rose Tortrix moth (*Archips rosana*) (Linnaeus) - Todd M. Gilligan and Marc E. Epstein, TortNi: Tortricids of Agricultural Importance, USDA APHIS ITP - Bugwood.org, 5482318



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The variegated golden tortrix may look very similar to other species of *Archips* including *Archips betulana*, *Archips crataegana* (brown oak tortrix), *Archips grisea* (black shield leaf roller), *Archips magnoliana*, *Archips oporana* (pine twist), *Archips podana* (fruit tree tortrix), and *Archips rosana* (rose tortrix). These can be distinguished by an expert entomologist based on genitalic dissection. Furthermore, the immature stages of all of these species are indistinguishable from one another.

Information sources: 4

Identification



- Pupae
 - Dark brown to black
 - Found on rolled leaves

Image credit: apple variegated Tortrix (Archips xylosteana) (Linnaeus) - Gyorgy Csoka, Hungary Forest Research Institute - Bugwood.org_#5430941



Larvae will pupate in June and emerge as adults after a few weeks. They can be found in rolled leaves or stuck between damaged leaves.

Information sources: 2, 4, 5

Identification

- Larvae
 - Light green to dark greenish-blue
 - Black warts
 - Dark brown head
 - White lines near head



White line separating the head and prothoracic shield

Image credits: apple variegated Tortrix (*Archips xylosteana*) (Linnaeus) - Gyorgy Csoka, Hungary Forest Research Institute - Bugwood.org, #5410940; apple variegated Tortrix (*Archips xylosteana*) (Linnaeus) - Fabio Stergulic, Università di Udine - Bugwood.org, #1297014



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Eggs hatch around April and the larvae immediately begin feeding on host tissues. Initially, they will feed on buds on the undersides of leaves. Although they will continue to feed on the leaves, they can also feed on the flowers and fruits of certain trees. As they feed, they will roll the leaves to create a shelter to reside in when not feeding. They continue to damage the host until around June when they pupate.

Larvae are light green in its first instar and then turn dark greenish-blue as it matures. Larvae have a dark brown head and the head and prothoracic shield are separated by a white line. Moreover, they have two rows of black warts along their backs along with light colored hairs. The leg are also dark brown to black in color.

Information sources: 2, 3, 4, 5

Identification

- Eggs
 - Green to dark brown
 - Cylindrical
 - Shingle-like clusters of 20-60 eggs
 - Covered in brownish purple secretions



Females lay eggs directly on the bark of host trees

Image credits: English oak (Quercus robur) L. - Gil Wojciech, Polish Forest Research Institute - Bugwood.org, #1261044



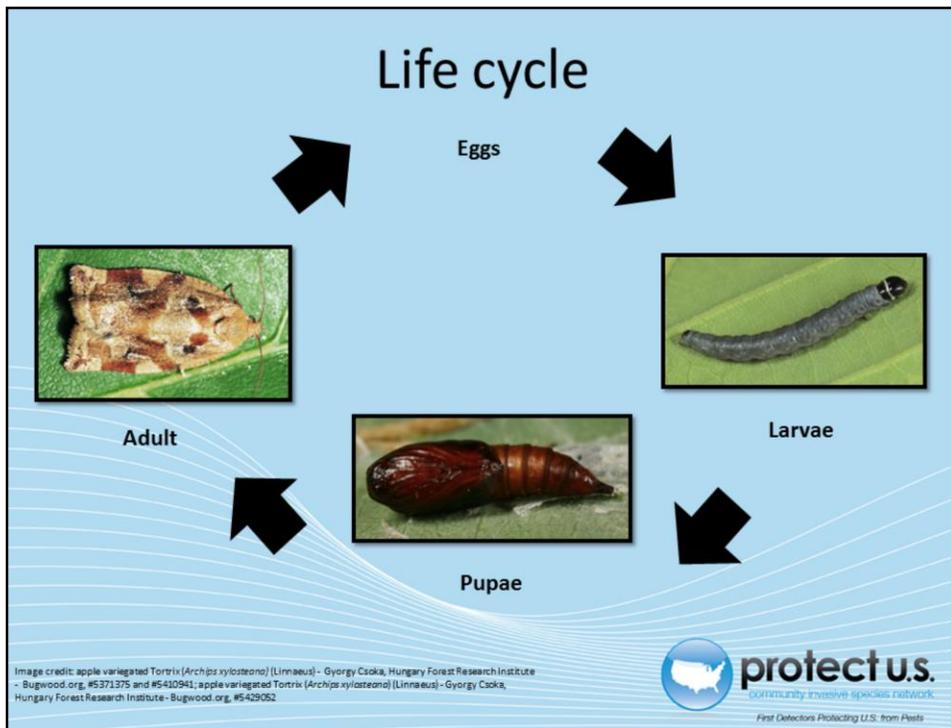
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Eggs are typically laid on the bark of trees in late autumn and they then overwinter until Spring. They are cylindrical and laid in shingle-like clusters of 20-60 eggs. Initially, the eggs are green and then turn dark brown as they develop. Furthermore, they are covered with a brown to purple secretion in order to camouflage them on the tree's bark. They are typically found on the trunk of the host tree.

Information sources: 2, 4, 5



Archips xylosteanus completes one generation every year. Adults lay eggs on host bark in August and they do not hatch until the following Spring. Around April, larvae emerge and begin eating host tissues causing the most damage in this stage of their life cycle. First and second instar larvae are more likely to attack buds or flower buds while later instars will cause damage directly to the host leaves. In June, pupation will occur after 35-45 days of larval feeding. Shortly after, adults emerge in late June or August and begin mating and laying eggs. Adult females will lay their eggs about 2-3 days after mating and lay on average 150 eggs. The next generation will then follow.

Information sources: 2, 4, 5

Monitoring



- Wing traps
 - Mix of Z11-14Ac and E11-14Ac
- Scouting

Image credits: viburnum borer (*Synanthedon viburni*) Engelhardt - David Parsons, University of Wisconsin-Bugwood.org, #2131007



Pheromone traps can be used to monitor for the variegated golden tortrix. Cooperative Agriculture Pest Survey (CAPS) approves the use of wing traps with a combination of Z-11 tetradecenyl acetate and E-11 tetradecenyl acetate as a lure. Multiple sources have had success using different combinations of the two lures. A ratio of 8:2 of Z- 11 TDA: E-11 has been successful in the past. Another combination of 12:1 respectively has shown success. The traps are typically effective for about 4 weeks at a time. If trapping multiple species, it is best to place traps at least 20m apart.

Scouting is a very general method of monitoring and can be very beneficial. This includes visual detection of problems with a host such as leaf damage or dieback.

Information Sources: 2, 5

Chemical Control

- Oxadiazine
- Insect Growth Regulators
- Methoxyfenozide
- Tebufenozide
- Fenoxycarb
- Organophosphates
- Spinosad
- *Bacillus thuringiensis*



Image credits: melaleuca (*Melaleuca quinquenervia*) (Cav.) Blake - Albert (Bud) Mayfield, USDA Forest Service - Bugwood.org, #2199092



Chemical control of the variegated golden tortrix is usually broad insecticides for leaf-rollers. Some of the common chemicals include Oxadiazine, Insect Growth Regulators, Methoxyfenozide, Tebufenozide, Fenoxycarb, Organophosphates, and Spinosad. *Bacillus thuringiensis* is a natural bacterium that can be used to treat for the pest as well.

Oxadiazine, specifically Indoxacarb, works through oral or contact and directly affects the nervous system of leaf rollers.

Insect growth regulators (IGR) mimic insect hormones and will interrupt biological processes to prevent growth and maturity.

Methoxyfenozide is a compound that accelerates the molting process and causes death to larvae. It may also have effects on the adults as well. This chemical control is beneficial because it has a low risk of affecting natural enemies and bees.

Tebufenozide is a chemical specific to lepidopteran and has no effects on other insects such as bees. 1-2 applications in the spring are recommended when leaf-roller populations are present.

Fenoxycarb is a specific type of IGR that can act as a juvenile hormone mimic. It results in premature molting and often death or sterility. It is a broad-spectrum insecticide that can have negative effects on beneficial insects so it should be used with caution. It is recommended to apply before and after flowers blossom on host plants.

Organophosphates are rarely recommended and may or may not lower leaf-roller populations. The chemical will disrupt calcium balance and cause paralysis and death in a variety of insects. It is a broad-spectrum insecticide that has recently shown higher resistance overall. Its use is being phased out as a result.

Spinosad is a selective broad-spectrum insecticide. It affects leaf-rollers but not codling moths or predatory mites and bugs. It shows best results on overwintered bugs or summer generations.

Information sources: 5

Biological Control

- Hymenoptera
 - Trichogrammatidae
 - Encyrtidae
 - Braconidae
 - Ichneumonidae
 - Chalcididae
- Diptera
 - Tachinidae



Image credits: Trichogramma wasp (Trichogramma ostriniae) (Pang & Chen, 1974) - Peggy Grab, USDA Agricultural Research Service - Bugwood.org, #5526014; Encyrtid wasp (Copidosoma spp.) Ratzburg, 1844 - Joseph Berger - Bugwood.org, #2100052; Ichneumonid wasp (Pimpla spp.) Fabricius, 1804 - USDA Forest Service - Region 2 - Rocky Mountain Region, USDA Forest Service - Bugwood.org, #1441162



There are some natural predators of the variegated golden tortrix. A wide variety of Hymenoptera including Trichogrammatidae, Encyrtidae, Braconidae, Ichneumonidae, and Chalcididae and one family of Diptera: Tachinidae.

Egg parasitoids include many species of Hymenoptera.
 In the family Braconidae - *Copidosoma*.
 In the family Trichogrammatidae - *Trichogramma* sp..

Larval parasitoids are the most common for leaf-rollers.
 In the family Braconidae - *Apanteles* sp.; *Apanteles albipennis* Nees; *Apanteles viminetorum* Wesm.; *Chremylus rubiginosus* Nees; *Clinocentrus* sp.; *Meteorus pallidipes* Wesm.; *Microbracon crassipes* Thomson; *Microgaster* sp.; *Oncophanes lanceolator* Nees.
 In the family Ichneumonidae - *Blaptocampus nigricornis* Wesm.; *Lissonota* sp.; *Phytodietus* sp. *nr segmentator* Grav.; *Tranosema arenicola* Thoms.
 Larval parasitoids also include some species of Diptera in the family Tachinidae including *Cadurcia casta* (Rondani); *Cestonia cineraria* Rondani, 1861; *Pseudoperichaeta nigrolineata* (Walker); *Steiniomyia bakeri* Townsend.

A few larval/pupal parasitoids exist for the variegated golden tortrix as well.
 In the family Ichneumonidae - *Phaeogenus eurydoxae* Uchida; *Triclistus globulipes* Desv.
 In the family Chalcididae - *Brachymeria lasus* (Walker)

Some strictly pupal Hymenoptera parasitoids also naturally control this pest.
 In the family Ichneumonidae - *Anilisatus carbonarius* Thoms.; *Apechthis rufata* Gmel.; *Exochus decoratus* Holmgr.; *Itoplectis maculator* Fabricius; *Phytodietus segmentator* Gravenhorst; *Pimpla maculator* F.
 In the family Chalcididae - *Brachymeria obscurata* Walker; *Brachymeria observator* Walker; *Neocopidosoma komabae* Ishic.

Lastly, another general parasitoid of *Archips xylosteanus* includes *Neocopidosoma komabae* Ishic. in the family Encyrtidae.

Information Sources: 5

Cultural Control

- Sanitation
- Mulching



Image credits: mulching - Joseph OBrian, USDA Forest Service - Bugwood.org, #5056009; Organic mulch - Andrew Koester, International Society of Arboriculture - Bugwood.org, 5375241



General sanitation is important in taking care of most plants. Removal of rolled leaves can help lower populations of the variegated golden tortrix. This is most effective when most effective leaves are removed but due to the size of many host plants it is hard to effectively use this technique.

Mulching is another method to help lower pest populations. As a whole, mulching can provide a habitat for natural parasitoids of the variegated golden tortrix.

Information Sources: 5

Suspect Sample Submissions

- Contact your State Department of Agriculture or University Cooperative Extension laboratory
 - <http://www.npdn.org/home>
- PPQ form 391, Specimens for Determination
 - https://www.aphis.usda.gov/library/forms/pdf/PPQ_Form_391.pdf

The image shows a detailed form titled 'PPQ Form 391, Specimens for Determination'. It is a multi-section document with various fields for data entry, including checkboxes and dropdown menus. Key sections include:

- SECTION 1: SPECIMENS FOR DETERMINATION** - Fields for collector name, date, and location.
- SECTION 2: REASON FOR IDENTIFICATION** - Multiple choice options for why the sample is being submitted.
- SECTION 3: IDENTIFICATION INFORMATION** - Fields for the name of the specimen and the quantity of units.
- SECTION 4: PLANT DISTRIBUTION** - Checkboxes for different parts of the plant (e.g., leaves, stems, roots).
- SECTION 5: PEST DISTRIBUTION** - Checkboxes for different types of pests (e.g., insects, nematodes).
- SECTION 6: IDENTIFICATION METHOD** - A table with columns for pest name, number, larvae, pupae, adults, eggs, and other details.
- SECTION 7: IDENTIFICATION** - Fields for the name of the pest and the name of the person who identified it.

An example of a PPQ form for sample submissions

Image credits: https://www.aphis.usda.gov/library/forms/pdf/PPQ_Form_391.pdf



If a suspect pest has been located in the United States, a sample should be submitted for proper identification. Contact your local diagnostic lab to ship in a sample for identification. Information regarding your local diagnostic lab is available at National Plant Diagnostic Network (NPDN) website. The diagnostic lab information and available contacts are divided by state.

<http://www.npdn.org/home>

The sample specimen should be submitted along with accompanying documentation using the PPQ form 391.

https://www.aphis.usda.gov/library/forms/pdf/PPQ_Form_391.pdf

Your local diagnostic lab is part of your local cooperative extension service or your state department of agriculture. Your local lab will also have a specific form. All local labs may not be a member of NPDN. However, all labs should report new pest and pathogen detections to local regulatory officials.

Communications



- Contact your State Plant Health Director
 - https://www.aphis.usda.gov/aphis/ourfocus/planthealth/ppq-program-overview/ct_sphd



- Contact your State Plant Regulatory Official
 - <http://nationalplantboard.org/membership/>

image credits: <http://www.usda.gov/wps/portal/usda/usdahome>; <http://nationalplantboard.org/>



Remember that new pest and pathogen records must be reported to your State Plant Health Director (SPHD) and your State Plant Regulatory Official (SPRO). The SPRO is a State Department of Agriculture Employee and the SPHD is a USDA-APHIS-PPQ employee.

The link to your SPRO is on the National Plant Board (NPB) website. It has an interactive map and when you click on your state it will take you to another page with contact information. The NPB is a cooperative organization that includes membership from all State Departments of Agriculture.

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- United States Department of Agriculture, National Institute of Food and Agriculture (USDA NIFA)
- United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA APHIS PPQ)
- Cooperative Agriculture Pest Survey (CAPS) Program
- National Plant Board (NPB)
- States Department of Agriculture
- Extension Disaster Education Network (EDEN)
- Center for Invasive Species and Ecosystem Health (Bugwood)
- National Plant Diagnostic Network (NPDN)
- U.S. Department of Homeland Security (DHS)
- U.S. Forest Service (USFS)



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