

Pest management for home blueberry plants

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INTRODUCTION

Blueberries grown in Minnesota have few serious insect pests and diseases. Gardeners who use Integrated Pest Management (IPM) practices may never have a need to apply pesticides to their plants. IPM is a sustainable approach that allows gardeners to reduce pests to a tolerable level by using the best balance of cultural, physical, biological, & chemical management strategies. IPM takes into account the level of damage a pest is capable of causing, as well as the possible risks to humans and the environment associated with each pest management strategy.

In order for IPM to be effective, home gardeners must be able to recognize common blueberry pests and the damage they cause. Gardeners can find additional help identifying common pest problems by using the online diagnostic tools ['What insect is this?'](#) and ['What's wrong with my plant?'](#). Gardeners can also send a sample to the [UMN Plant Disease Diagnostic Clinic](#).

Cultural controls can be quite effective in protecting blueberries from most insect pests and diseases. The first step is proper care of the plants. Information on caring for blueberries is found in the University of Minnesota Extension publication "[Growing blueberries in the home garden.](#)" Good cultural practices such as soil preparation, pruning and cultivar selection all contribute to healthy blueberry plants.

In IPM, pesticide sprays are used only when cultural controls are not effective or as a supplement to cultural controls. If using pesticides, gardeners should choose an effective product that has the lowest possible impact on human health, non-target organisms like bees and the environment. Information on the correct way to apply specific pesticides can be found on the product label. If pesticides are necessary, always use them exactly as directed by the product label as mandated by federal law. Home gardeners can also learn about pesticides safety at the [Pesticide Environmental Stewardship](#) website or the [National Pesticide Information Center website.](#)

Preventing pests before and during the establishment year

The key to growing healthy blueberries is to plant in the correct soil type or to properly amend the soil before planting. Blueberry plants can live up to 50 years, and healthy blueberry plants are easy to maintain after they have been established. Blueberries need more soil and site preparation than most other fruit. Always get a soil test when choosing a site and amend the soil according to the soil test. Soil samples can be sent to the [University of Minnesota Soil Testing laboratory.](#)

Blueberry plants prefer a sandy, acidic soil, with a pH less than 5.5. They will grow better in all sites if acidic peat is added to the planting soil. Planting blueberries in sheltered areas helps to protect plants from winter injury. Choose a site that is sheltered but receives full sun as too much shade will decrease blossom production and yield. Information on soil preparation can be found in the publication "[Growing blueberries in the home garden.](#)"

Weeds

Weeds can stunt blueberry plants and reduce yields. Perennial weeds that can choke out blueberry plants include quackgrass, Canada thistle and raspberries. If quackgrass or Canada thistle are growing in the site to be planted to blueberries, kill the weeds the summer before planting. Both quackgrass and thistles are hard to kill by hoeing and pulling. These weeds are extremely difficult to remove from an established blueberry planting. The easiest way to kill quackgrass is to spray the area with glyphosate in late fall. The best way to kill thistle is to spray with glyphosate or clopyralid when the weeds are forming flower buds in late June. Avoid planting blueberries next to a raspberry patch. Raspberries spread through underground runners or through tipping and can easily crowd out blueberry bushes. Remove any wild brambles from the area before planting.

Annual weeds need to be controlled after planting. During the planting year, pre-emergent herbicides can harm blueberry plants. By using a combination of hand weeding and a woodchip or pine needle mulch, gardeners can avoid the potential harm from herbicides while improving the soil for the blueberries. Wood chip mulches and pine needles slowly decay, releasing nutrients into the soil and should be augmented once a year. Sawdust mulches are not recommended, because sawdust can tie up soil nitrogen, causing the plants to be stunted. Landscape fabric can be used to reduce weed problems in the first few years. Some hardy blueberry cultivars can spread underground through rootsuckers, including the cultivars Northland, NorthSky and NorthCountry. The landscape fabric will prevent the blueberries from spreading by root suckers.

Once a blueberry patch is established, few weeds sprout through the mulch, and those weeds that do sprout are easy to remove by hand. Trees and shrubs can be a problem in established blueberry fields. Birds can deposit seeds from a variety of trees and shrubs including chokecherry, honeysuckle, raspberry and elderberry. Always remove tree seedlings before the root systems become too large. The best time to kill or remove tree seedlings is from the middle of summer to late fall. By the second year, the trees are often too large to pull.

PEST MANAGEMENT SCHEDULE

In order to be successful, an IPM program should follow a schedule of monitoring and cultural controls that begin before the plants are put into the ground and are repeated each year. Read about the specific pest to determine how to monitor for the pest, and to decide what level of pest infestation can be tolerated.

Table 1: Pest management schedule when establishing a blueberry patch

Time	Action
Summer or fall before planting	Locate site where the blueberries will be planted. Take a soil test to determine nutrients levels and soil pH. Amend soil to provide the appropriate pH for blueberry plants. Kill all perennial weeds, especially quack grass and thistle.
Winter-Spring	Order or buy plants from an established nursery that sells plants that have been certified virus free.
Spring	Plant blueberries.
Summer	Control annual weeds by mulching, hand pulling and/or shallow hoeing.

Table 2: Pest management schedule in established blueberry patches

Time	Action
Early to mid-March	If plants were covered for winter protection, remove covers.
April and May	Examine stems and branches for <u>cankers</u> . Prune out and destroy any infected branches.
May	When buds open, prune out any sections of the branch that have been killed by <u>winter injury</u> .
June-July	Look for <u>iron chlorosis</u> in newly formed leaves. If new leaves are chlorotic, spray with chelated iron. Add sulfur to the soil to lower soil pH.
June-August	Watch for branches that have wilted brown leaves. Examine stem for <u>cankers</u> or other damage. Prune out and destroy any infected branches.
Mid-May to early June	Place traps for <u>spotted wing Drosophila</u> and check them regularly throughout the growing season.
Mid-June through August	Check leaves regularly for <u>Japanese beetles</u> . Remove beetles as they land on blueberry leaves when practical.
Late June through harvest	If <u>spotted wing Drosophila</u> is present, harvest ripe berries, dispose of infested fruit and apply insecticides.
Mid November to early December	If <u>winter injury</u> is a concern, cover plants in late fall.

DISEASES

Canker diseases

Cankers can be caused by several different fungal pathogens that girdle the stem at the base of the plant so the entire branch dies. This is often called twig blight or flagging. Usually only one or two shoots die per plant, while the other shoots remain healthy. Cankers only kill the entire plant if the plant is stressed by other factors or are very young. Twig blight is most common in plants that have been in the ground less than five years.

The sudden death of a blueberry branch during the growing season.
Thaddeus McCamant, Central Lakes College.



Identification

Canker diseases are most noticeable during the summer, when one or more stems within an otherwise healthy blueberry bush suddenly dies. The leaves remain attached to the stem and turn a reddish brown color. The sudden branch death is sometimes called flagging or twig blight. Look for cankers at the base of the dying stem. The cankers are usually reddish brown circular or elliptical spots, and primarily occur in young bark on shoots that are less than two years old. Similar branch death can occur if the stem is girdled by physical damage like a weed whip or mice feeding.

One fungus that causes branch death is *Phomopsis vaccinii*, which can also infect leaves, causing small, reddish brown spots on the leaves towards the end of the growing season.



Branch cankers appear as round to oval areas, with gray peeling bark. Michelle Grabowski, UMN Extension.

Important biology

The two most common fungal diseases that cause stems to die during the growing season are *Fusicoccum putrefasciens* and *Phomopsis vaccinii*. Both fungi infect the bark, causing dead areas in the bark called cankers. The cankers usually cover a small area of the cane, but when the canker girdles the shoot, every part of the branch above the canker dies.

The fungi that cause canker diseases overwinter in infected and dead stems. In early spring, the fungus produces spores that can then be spread by rain or overhead irrigation. Spores are released at every rain event throughout the growing season. Spores infect through natural openings in flower buds, leaf buds and young bark or through injured bark. Wounds created by pruning, branches rubbing against each other and winter injury will cause openings that allow canker causing fungi to infect branches.



Leaf spot caused by *Phomopsis*. T. McCamant, Central Lakes College.

Fusicoccum putrefasciens is most likely to spread during cooler weather, with an optimum temperature between 50 and 72°F. *Phomopsis vaccinii* produces spores at temperatures between 50 and 80°F but appears to produce the most spores between 70 and 80°F.

Management

Reducing winter injury will also reduce twig blight and cankers. Plant cultivars that are hardy for Minnesota and provide [winter protection](#) when possible. Examine the lower portions of stems each spring before bud break and prune out any infected or dead branches. Avoid mechanical injury from branches rubbing, mowing or string trimmers. Prune out and remove dead branches as soon as they appear during the growing season. Cut the branches out 2-4 inches below the infected area. Completely remove and destroy any infected branches by burning or burying them. Fungicides are not recommended to control canker disease in home blueberry plants.

When possible, use drip irrigation because overhead sprinkling can spread the fungal spores of both canker causing fungi.

Armillaria root rot

Armillaria root rot is an uncommon disease that usually occurs in blueberries that were planted in sites where one or more oak trees were removed. Although uncommon, the disease can weaken and kill a blueberry plant.

White mycellia of *Armillaria* can be seen under the bark of this root. M. Grabowski, UMN Extension.



Identification

In the early stages, *Armillaria* root rot resembles a nutrient deficiency or drought stress. Leaves are pale yellow to white with green veins or have brown edges. Plant vigor will be low. Leaves may be small and little shoot growth will be observed. As disease becomes severe, leaves wilt and the entire plant dies.

If the bark is peeled away from the base of the stem or some of the major roots, flat white sheets of fungal growth will be seen between the bark and the wood. Nearby stumps or dead trees may provide further signs of *Armillaria*. Thick black, shoestring-like fungal strands called rhizomorphs sometimes grow in a net on infected trees and in the soil around the base of the tree. In fall, honey colored mushrooms, with a round cap, white gills and a ring around the upper stem grow on or near infected trees. Although *Armillaria* mushrooms are uncommon on infected blueberry plants, their presence on nearby trees is a sign that the pathogen is in the area.



Thick black rhizomorphs of *Armillaria* growing on an old tree trunk. M. Grabowski, UMN Extension.

Important biology

Armillaria root rot can be caused by several species of the fungus *Armillaria*. *Armillaria mellea* is the most common species found infecting deciduous trees and shrubs. *Armillaria* spp. can infect over 500 species of trees and shrubs and is commonly associated with oak roots.

Armillaria can survive as a root rotting pathogen on living plants and as a saprophyte on dead wood. Blueberries become infected when their roots come in contact with the infected roots of another tree or shrub, infected plant debris or fungal rhizomorphs. It is not uncommon for infected plants to be right next to healthy plants.



Pale yellow 'honey' colored mushrooms of *Armillaria*. M. Grabowski, UMN Extension.

Management

Avoid using wood chips from oak trees for mulch, especially if the oak trees were diseased or rotting. Blueberry plants killed by *Armillaria* should be removed and burned. If an oak tree is killed, remove as many roots as possible along with the stump before planting blueberries in the area.

Witches' broom

Witches' broom is an uncommon fungal disease that causes clusters of small branches known as witches' brooms to form at the base of the plant. Branches with witches' broom have small leaves and spongy, reddish bark, instead of the green bark normally found on new blueberry shoots. Witches' broom is most common on blueberries in northern Minnesota planted near fir trees.



Blueberry witches' broom. Angela Orshinsky, UMN Extension.

Witches' broom is caused by the rust fungus *Pucciniastrum goeppertianum*, which infects both fir trees and blueberries. In firs, *Pucciniastrum* primarily grows in the needles, causing yellowing and needle drop. Spores produced on fir needles are carried by wind and can infect nearby blueberry plants. The fungus grows into the bark of the blueberry plants and becomes systemic. The fungus lives in the blueberry plant for many years. Each spring, spores are produced on the witches' broom that can infect balsam fir trees.

Because the fungus that causes witches' broom is both perennial and systemic, infected blueberry plants cannot be cured with fungicides nor can the pathogen be removed by pruning. Infected blueberry plants should be removed or killed with an herbicide.



Swollen orange brown stems of a blueberry witches' broom. M. Grabowski, UMN Extension.

Ringspot viruses

Two ringspot viruses infect blueberries: the tomato ringspot virus and the tobacco ringspot virus. The disease caused by tobacco ringspot virus is often called necrotic ringspot. The symptoms, biology and management of the two viruses are very similar.

Both viruses cause blueberry leaves to become small and distorted, cupped leaves, often with a mottle of light green and dark green. Small brown spots (< 1/4 inch) can also form on leaves and stem. Virus infection causes blueberry plants to lose vigor and decline. Plants with either ringspot virus have low yields, are often stunted and are more susceptible to winter injury. The severity of the disease varies among blueberry cultivars, with some cultivars can be severely injured by the viruses while others show few or no symptoms. The relative susceptibility of Minnesota cultivars has not been determined.

Both ringspot viruses are primarily spread by the dagger nematode, which is common in many parts of Minnesota. Dagger nematodes are microscopic worms that live in the soil, and feed on the roots of blueberries and other plants. Nematodes acquire the virus by feeding on infected plants, including susceptible weeds like dandelion, chickweed or common plantain. Once a nematode acquires a virus, it can spread the virus to other plants, including other blueberries.



Northblue blueberry leaves with ringspot virus. T. McCamant, Central Lakes College.

Virus diseases can be minimized by planting certified plants from an established nursery. Maintaining good weed control will help the virus from spreading to other plants. Diseased blueberry plants can be removed, but the disease can continue to spread in the soil even after infected plants have been pulled.

Powdery mildew

Powdery mildew is caused by the fungus *Microsphaera vaccinii*, which only infects blueberries. This disease rarely causes serious harm to blueberry plants. Powdery white fungal growth can be seen on infected leaves in late summer. In some cases, fungal growth is limited to the lower surface of the leaf and yellow or red discoloration can be seen on the upper surface of the leaf. It is important to closely examine discolored leaves for fungal growth on the lower leaf surface so as not to confuse powdery mildew infection with viral disease. No control is necessary. Choosing a site in full sun with good air movement will help to reduce problems with powdery mildew. Space plants to provide good air movement between plants.



Lower leaves of a blueberry plant with powdery mildew. M. Grabowski, UMN Extension.

ABIOTIC PROBLEMS

The two most common problems that Minnesotans who grow blueberries are likely to encounter are iron chlorosis and winter injury. Both disorders can kill plants and limit the range where blueberries can be grown in Minnesota.

Iron chlorosis

Iron chlorosis occurs when the leaves cannot produce chlorophyll due to a lack of iron in the leaves. Without chlorophyll, the leaves do not turn green. Blueberries suffering from iron deficiency are usually pale yellow to white, while the leaf veins remain green. In some cultivars of blueberries, the leaves will develop a reddish color. With iron chlorosis the youngest leaves are yellow, while older leaves will retain a normal green color. With most other nutrient deficiencies, the older leaves turn light green before the youngest leaves. Leaves with severe iron chlorosis die, and the entire plant will die if all the leaves are chlorotic.

Iron chlorosis is caused by a lack of available iron in the soil. Although iron is abundant in most soils, it becomes unavailable to plants when the pH is higher than the optimum for that plant or

when soils are saturated with water. Blueberries can develop iron chlorosis when the soil pH rises above 5.5. The exact pH where blueberries will display symptoms of iron chlorosis varies between cultivars. The cultivar 'Northland' often shows iron chlorosis symptoms before other common cultivars grown in Minnesota. Plants growing in sandy soils can tolerate a higher pH than plants growing in soils that are high in clay.



Iron chlorosis in Superior blueberries. T. McCamant, Central Lakes College.

Iron chlorosis can be minimized by choosing the correct site to grow blueberries and by properly amending the soil. To learn more about how to choose and amend a blueberry planting site, see "Blueberries for Home Landscapes". In many soils, the pH will slowly rise over time, especially if the plants are irrigated with hard water from wells. Soil pH can be maintained low enough for blueberries with a combination of fertilizing with ammonium sulfate and with elemental sulfur. Elemental sulfur gives the most acidity per pound of any product, but acts too slowly to cure the symptoms of iron chlorosis during one growing season. Adding elemental sulfur every two or three years will keep the soil acidic. Oak leaves and pine needles that are used as mulch also help maintain an acidic pH.

For a temporary solution, plants can be sprayed with a foliar iron fertilizer, which are sold at many garden centers. Always make sure that the fertilizer has "chelated" iron in the ingredients. Chelated iron sprays only reduce iron chlorosis on leaves that have already formed. Leaves that form after the spray must be sprayed again.

Winter injury

Winter injury is one of the limiting factors for blueberry growing in Minnesota. Although blueberry cultivars released by the University of Minnesota are all rated for Zone 3, there can be significant winter injury following relatively mild winters, especially winters with little or no snowfall. Young plants usually have significantly more damage than plants that have been in the ground for ten or more years.

Branch tips are the part of the blueberry plant most susceptible to winter injury. Mild winter injury results in only a few scattered dead branch tips. Since blueberries form flower buds at the tips of the branch, mild or moderate winter injury can reduce the amount of fruit produced the following summer. With severe winter injury, the plants will die down to within an inch of the soil. Vigorous stems that grew one or two feet during the summer show more injury than slow growing stems. Sometimes one or two blueberry branches grow late into the fall, and still produce new

leaves into October. Branches that are still producing new leaves in October do not harden off properly and will be damaged during the winter.

Branches showing winter injury should be removed or cut back to living tissue. Wait until the leaves have emerged in late spring before pruning the plants to avoid cutting off living parts of the branch. In blueberries, branches that have brown bark are often still alive.

Avoid fertilizing blueberry plants with nitrogen after the middle of June. Branches are more likely to keep growing into the fall if the plants receive nitrogen in late summer. Make sure that blueberry plants have sufficient water when they go dormant in November either with irrigation or rainfall. Winter injury can also be minimized by planting blueberries in areas that are protected from winds during the winter. Blueberries grow particularly well next to conifer windbreaks. Always plant cultivars that are suitable for Minnesota winters.



Nelson blueberries with severe winter injury. T. McCamant, Central Lakes College.

Young plants can be protected from winter injury with mulch, snow or a breathable row cover. Row covers should be put over the berries in November and removed shortly after the snow melts in early spring. Be careful when using straw mulch because straw mulch attracts mice, which then can feed on the blueberry bark.

INSECTS

Spotted wing *Drosophila*

The spotted wing *Drosophila* (*Drosophila suzukii*) (SWD) is closely related to the common fruit flies that feed on decaying fruit. Whereas most fruit flies feed on decaying fruit, SWD lay their eggs in ripening berries that are still on plants. SWD larvae have been found in many different types of fruit, including raspberries, cherries and blueberries. SWD are a new pest in Minnesota, and were first detected in August, 2012. In 2013, SWD were detected in blueberries across southern and central Minnesota.

Identification

SWD adults look very similar to the fruit flies that accumulate near overripe fruit during late summer. They are about 1/8th inch long, have a tannish body, red eyes, and brown bands on their abdomens. Male SWD can be recognized by a distinct black spot near the tip of each wing. The female SWD can only be distinguished from other species by looking at the tip of their abdomen under a dissecting microscope; you need to examine their distinctly serrated ovipositor to properly identify them.



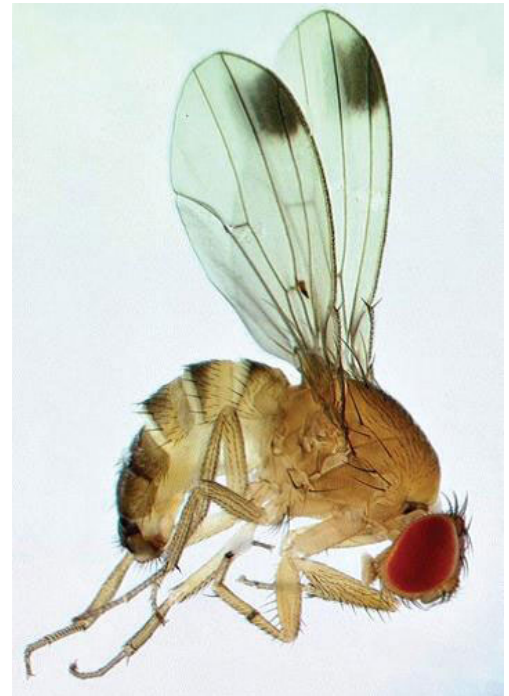
The ovipositor of a female spotted wing *Drosophila*. Martin Hauser, CA dept. of Food and Ag.

The larvae (maggots) are white, with a body that tapers to one end. They only grow as large as 1/8 of an inch long. The larvae blend in easily with the light colored flesh of a blueberry. Small larvae are especially difficult to see. The first indication that fruit have SWD is if they are soft to the touch when picked. The best way to see if SWD larvae are in a batch of blueberries is to place four or five berries in a water and salt solution (one Tablespoon of salt per one cup of water) in a small container or plastic bag. Gently crush the blueberries to break the skin. After 30 minutes, any larvae that are present will float to the surface. Infested berries typically have multiple larvae.

Damage

SWD larvae burrow through the berries, making the fruit soft and unappealing. During egg laying, the female may introduce fungi that cause the fruit to rot, and infested fruit often develop a fermented or a sour smell. If berries are stored at room temperature, larvae can hatch after the fruit has been picked, Fruit that was normal then may be soft and maggot infested a day or two later. Mature larvae often crawl out of berries stored on the counter.

During minor infestations, infested fruit can be processed into wine or jelly. During severe infestations, the berries are too rotten to be processed.



Male spotted wing *Drosophila*. M. Hauser, CA dept. of Food and Ag.

Important biology

SWD overwinter as adults in brush near the fields. SWD have a wide host range, and are known to attack other soft-skinned fruit, including raspberries, blackberries, cherries, plums, strawberries and grapes. They infest a number of wild fruit, including buckthorn. SWD first appear during late June or early July, and the numbers increase rapidly during the middle of summer, with the

populations peaking in August. SWD mature extremely rapidly. During warm weather, SWD can go from egg to mature adult in seven days. The females can lay several eggs on each berry.

Management

Management of SWD can be challenging but is best achieved through a combination of detection, sanitation, and insecticides.

Detection

Gardeners who are concerned about SWD should monitor for the presence of adults. Take a large clear plastic cup with a cover. Make several holes, 3/16 in diameter, near the top on one side of the cup to allow for easy liquid disposal. Larger holes will allow larger flies and other insects, such as sap beetles to enter the trap, making detection of the SWD more difficult. The easiest way to make the holes is to heat a small (8 or 10 penny) nail, which can melt the right size hole in the cup.



A trap for monitoring spotted wing Drosophila. Steve Van Timmeren, Michigan State University.

Pour 1 to 2 inches of apple cider vinegar in the bottom of the cup. You can then either add a yellow sticky card slightly above the vinegar or a little bit of liquid soap, such as dish soap. Hang traps on branches in a shaded location near fruit. Replace the sticky card and apple cider vinegar bait at least once a week when checking for SWD, disposing of the old apple cider vinegar away from the trap location. Checking traps more often can be beneficial for early detection of adult SWD, especially early in the growing season.

Sanitation

Keep the patch picked clean to keep SWD numbers low. When picking, put good fruit in one container and the soft, infested fruit in another container. Be careful to keep fruit from falling on the ground. Infested fruit should be disposed of in a manner that kills the larvae. The larvae can be killed by microwaving the fruit, cooking the fruit or placing the fruit in a sealed plastic bag that will be put in the trash. Do not bury infested berries or place fruit in a compost pile.

Insecticides

Insecticide applications should be considered once adult SWD are detected, as infestation can progress very quickly. These chemicals can kill adult SWD, but are ineffective on larvae in the fruit. If started at first detection and maintained on a regular schedule, insecticide sprays can help prevent larval infestation of fruit before harvest. Insecticides should be applied in the evening to avoid killing honeybees and other valuable pollinators. Readily available insecticides that kill adult SWD include permethrin, carbaryl, malathion, spinosad and pyrethrin. Spinosad and pyrethrin are compatible for organic gardens. Always read and follow labels when spraying pesticides, and follow the pre-harvest interval for all products.

Japanese beetles

In Minnesota, Japanese beetles (*Popillia japonica*) are primarily found in the Minneapolis-St. Paul Metropolitan area, and in some areas in southeast Minnesota. Japanese beetles have an exceptionally large host range, feeding on the leaves of over 300 species of plants, including apples, grapes, blueberries, raspberries, roses and plums.

Identification

Japanese beetles are 3/8 long and oval. Their head and prothorax (the area behind the head) are a green metallic color, while the wing covers are a shiny bronze. Look for five white patches of hair along each side of their body and two white patches on the tip of their abdomen to verify that they are Japanese beetles.



Mature Japanese beetle. T. McCamant, Central Lakes College.

Damage

Adult Japanese beetles feed on the leaves of many different plants including birch, basswood, apple as well as blueberry. They feed on the leaves between the veins, so when they are finished, there is a skeleton of brown fibers where the leaves used to be. Crop losses can occur where the beetles eat fruit along with the leaves or if the beetles damage so many leaves that the plant is weakened. Blueberry plants that have been severely chewed by Japanese beetles will be susceptible to winter injury.



Blueberry leaves damaged by Japanese beetles. T. McCamant, Central Lakes College.

Important biology

Japanese beetles spend the winter as grubs in the soil of turf grass areas. In spring, they move near the soil surface, where they finish feeding and pupate. They emerge as adults in late June or early July and can fly a long distance to suitable feeding sites. When an adult starts feeding on a shrub, it emits a pheromone that attracts other beetles, so that beetles will aggregate on that shrub. This behavior results in huge numbers of beetles feeding on one plant while neighboring plants are left alone. The female releases pheromones to attract males. After mating, adult females lay up to 60 eggs in turf grass. The eggs hatch in about one to two weeks, and the grubs

feed on the roots of grasses and other plants. As the soil starts to cool in the fall, the grubs dig deeper in the soil, where they overwinter. Adults primarily feed in July and August, although you can find some activity into the fall. Japanese beetles have one generation per year.

Management

For fruit growers, Japanese beetles are best controlled as adults. Physical removal is a viable option for small blueberry patches. Remove the beetles by hand and put them in soapy water. Hand picking is most effective as the beetles first arrive, before they release their aggregation pheromones to attract others. The best time to handpick beetles is in the evening and early morning, when they are less active. Don't use Japanese beetle traps. Research has shown that traps attract more Japanese beetles than they catch, and will typically cause more damage to plants in a garden.

Some growers have been able to minimize damage from Japanese beetles by placing a fabric barrier such as cheesecloth over the plants. Be sure to use a fabric with a mesh less than 1/4 inch. This netting keeps both birds and Japanese beetles off the blueberry plants.

Insecticides can help manage adults. Neem extracts like Azadirachtin have been shown to provide short term protection, especially if only small to moderate numbers of Japanese beetles are present. Gardeners can also use conventional insecticides including permethrin, bifenthrin, malathion or carbaryl. When using insecticides, always read and follow the directions on the label.

Leafrollers

Leafrollers are caterpillars that feed on the young leaves of many different species of shrubs and trees, including apples and blueberries. The young caterpillars use silk to tie two or three leaves together, typically at the tips of the branches. In addition to feeding on leaves, leafrollers will eat green or ripe fruit near leaves with webbing. There are at least three species of leafrollers that feed on blueberry leaves in Minnesota, including the obliquebanded leafroller (*Choristoneura rosaceana*), the red-banded leafroller (*Argyrotaenia vultinana*) and the blueberry leafroller (*Sparganothis sulfureana*).



Blueberry leaves with a leafroller. T. McCamant, Central Lakes College.

Leafroller moths lay egg masses on the leaves. Shortly after hatching, the caterpillars start attaching several leaves together. Older caterpillars often leave their nest to feed on other leaves

or young fruit, but when they are ready to pupate, they form cocoons in the leaves. Most leafrollers have two generations per years in Minnesota.

Leafrollers usually only damage a small percentage of the leaves on a blueberry plant, and management is rarely necessary. Leafroller populations are usually kept fairly low by natural predators and parasites.



Inside of the leafroller nest. The leafroller had already started to pupate and form a cocoon. T. McCamant, Central Lakes College.

Forest tent caterpillars

Forest tent caterpillars (also known as armyworms) are common throughout the northern two thirds of Minnesota. They feed on many different trees and shrubs as well as other plants. In northern Minnesota, forest tent caterpillars particularly feed on birch and aspen while in central Minnesota (including the Twin Cities), they prefer oak and linden. Forest tent caterpillars primarily eat blueberry leaves when they are marching across the ground looking for new trees hosts. They generally move in large groups, and a relatively small number of caterpillars can quickly defoliate a blueberry plant.

Identification

Forest tent caterpillars are blue and black, with a series of white footprint shaped spots on their back. Mature caterpillars are about two inches long.



Forest tent caterpillar on a blueberry leaf. M. Grabowski, UMN Extension.

Important biology

Forest tent caterpillars have one generation per year. The caterpillars first emerge in early to mid-May and mature five to six weeks later. Blueberries are most likely to be attacked in early to mid-June when forest tent caterpillars climb down the trees. Forest tent caterpillar populations are cyclical, with peaks occurring every seven to fourteen years.

Damage

Defoliated trees and shrubs rarely die, because the plant still has time to form new leaves before fall. When they defoliate blueberry plants, they destroy the crop for two years. The current season's crop is lost because there are no leaves to support the fruit, and the following season's crop will be ruined, because the plant will be making leaves in July and August instead of forming flower buds for the following year.

Management

When populations are low, no treatment is necessary. In years with high populations, plants should be protected with an insecticide. Low impact insecticides include *Bacillus thuringensis* which should be applied before the caterpillars reach blueberry plants and spinosad, which will kill the caterpillars on contact. There are many conventional options, including permethrin, bifenthrin and carbaryl. Insecticides should always be applied as soon as the first caterpillars reach the blueberry plants. When using insecticides, always read and follow the label directions.



Blueberry plant damaged by forest tent caterpillars. M. Grabowski, UMN Extension.