



Chestnut Growers Guide to Pests and Diseases

By Elsa Youngsteadt and Kendra Gurney

Growing American chestnuts is an adventure with many rewards: stately trees, delicious nuts, and conservation of an important species. But today's chestnuts have to fend off much more than the notorious blight fungus. Other exotic pathogens and pests have arrived on the scene, and a whole host of hungry insects and mammals—both native and introduced—probably want a bite of your trees. This guide, intended for backyard and small orchard growers, will help you recognize some of the common problems and offer suggestions for how to deal with them.

Give your trees a good start

Although many pests and pathogens bother American chestnuts, often the biggest problems are caused by poor site selection. A good tenet of gardening is “right plant, right place,” and this certainly applies to American chestnuts. Planting your trees on well-drained, slightly acidic soil in a sunny location will give you the best chance of growing success. Other common problems with chestnut result from poor or non-existent vegetation management around the base of young trees, over-watering, and under-watering.



Asian Chestnut Gall Wasp

Dryocosmus kuriphilus

Asian chestnut gall wasp, *Dryocosmus kuriphilus*, is known to attack all species of chestnut throughout its natural range. Photo courtesy of Gyorgy Csoka/Hungary Forest Research Institute/ForestryImages.org

This tiny insect, about the size of two poppy seeds, was accidentally introduced into North America from China nearly 40 years ago. It now attacks all chestnut species in 13 states and Ontario, Canada, including almost the entire historical range of American chestnut. Its damage can be severe, but the good news is that its natural enemies are spreading along with it.

Gall wasps lay their eggs in leaf and flower buds in early summer. The eggs hatch quickly, but cause no sign of trouble until the next spring. At budburst, the larvae cause distorted growth and globular galls on leaves, stems and petioles. These green swellings often have a reddish blush and reach about one-quarter to one inch in diameter. Inside the galls, the larvae feed for a few weeks, then pupate and emerge as female wasps in early summer. (All chestnut gall wasps are females that reproduce without mating!) Once the wasps emerge, the galls shrivel up. Dry leaves stay attached to the old galls, making infestations especially easy to spot in the winter.



Galls on an American chestnut caused by Asian chestnut gall wasp. Photo by Paul Franklin

Although the wasps rarely kill established trees, galled twigs die back, nut production declines, and small trees may die. No pesticide is labeled for this species; instead, a grower's best allies are other wasps. Parasitic species, both native and introduced, infiltrate the galls and devour the gall wasp larvae. It may take time for these species to catch up to a new infestation,

Asian Chestnut Gall Wasp *continued*

but they have a good track record of eventually reducing damage to acceptable levels. These beneficial species spend the winter in shriveled galls, so it's important to leave the previous season's galls on the tree rather than prune them out. Cutting out galls is only helpful if you're dealing with one or two fresh galls on an isolated tree.



Japanese Beetle

Popillia japonica

Japanese beetles will gladly feed on more than 300 plant species, including chestnuts. Adults are bulky insects about three-eighths of an inch long, with metallic green bodies, coppery wing covers, and a row of five white tufts just below each wing cover. They first appear in late spring or summer and continue to feed and mate—and feed some more—for the rest of the season. They eat leaves but not the veins, producing a characteristic, lacy-looking damage. Established trees can generally withstand the defoliation, but young trees may need special treatment. On cool mornings (below about 73°F), beetles can be easily knocked off the plant into a bucket of soapy water, and several pesticides are labeled for Japanese beetles. Although traps are available, they're usually counterproductive because they attract more beetles than they catch.

Japanese beetle, *Popillia japonica*. Photo courtesy of Steven Valley, Oregon Dept. of Agriculture/ForestryImages.org



Lacy leaves are typical damage caused by Japanese beetles. Photo by Sara Fitzsimmons



Periodical Cicadas

Magicicada species

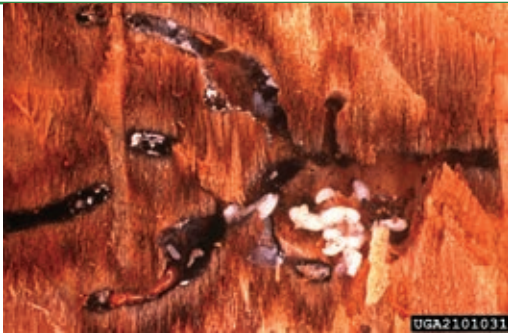
Periodical cicadas kill branch tips and reduce or eliminate nut production for three years; at least they don't do it very often. These insects spend most of their lives underground, emerging as noisy, red-eyed adults only once every 13 or 17 years. Adult females do the most serious damage by carving slits in the undersides of small branches and laying eggs there. The tips of these branches turn brown and droop, called "flagging." To find out whether and when to expect periodical cicadas in your area, consult with your extension agent or use maps, such as those at magicicada.org.

Minimize damage by waiting until after an emergence year to plant saplings, which cicadas can kill. Protect other trees by draping them with bird netting (one-quarter to one-half-inch mesh). If you install netting before cicadas emerge, gather and fasten it around the trunk. Otherwise, wait until cicadas have been active for a few days and drape it loosely over the tree.



Typical of cicada damage, many branch tips on this tree have turned brown and died. Photo by Sara Fitzsimmons

Red-eyed and noisy, periodical cicadas emerge just once every 13 or 17 years. Photo courtesy of Jon Yuschock/ForestryImages.org



Ambrosia Beetles

Ambrosia beetles damage trees by carrying pathogens deep into the wood. Photo courtesy of Daniel Adam/Office National des Forêts/ForestryImages.org

(See page 28 for special report on ambrosia beetles.) Small trees less than three inches in diameter are the most likely to be attacked, and damage from the beetles and fungi often kills them; at best, it stunts their growth or sets you back to a resprout.

Once beetles make it inside the trunk, there's no remedy, so the key is to catch them early. Start monitoring in early spring, before budbreak, using purchased or homemade traps baited with ethanol. (See page 29 for instructions on building ethanol traps.) As soon as ambrosia beetles show up in the traps, you know it's time to spray. Coat trunks of small trees with an approved pyrethroid insecticide and repeat the spray every two to three weeks. Once chestnuts are fully leafed-out, they seem to be safe for the season.

Although dozens of ambrosia beetle species live in the eastern United States, just a handful of introduced species are really pestiferous. Among the most severe are granulate ambrosia beetle (*Xylosandrus crassiusculus*), black stem borer (*X. germanus*), and fruit-tree pinhole borer (*Xyleborinus saxeseni*). Like most ambrosia beetles, they are a few sixteenths of an inch long, bullet shaped, and black or brown. Get familiar with online identification resources or consult your extension agent. If in doubt, any ambrosia beetle in your trap probably means it's time to treat.

Weevils



Small chestnut weevil *Curculio sayi*. The weevil uses its long snout to drill holes in chestnuts into which it lays its eggs. Photo courtesy of Jennifer C. Giron Duque/University of Puerto Rico/ForestryImages.com

Little beige “worms” inside your chestnuts are likely the larvae of long-snouted beetles called weevils. The lesser chestnut weevil (*Curculio sayi*) is a common problem, but a handful of fairly similar species can also infest your crop, damaging the nuts but not the tree. (See special weevil report on page 24.) Adults range in color from gray to brown and are about one-sixth to one-half an inch long. Females use their long proboscis to drill holes in developing chestnuts, where they lay their eggs. The larvae tunnel through the nuts as they feed.

By the time chestnuts fall to the ground in the autumn, the larvae are nearly developed and ready to chew their way out, leaving a visible pinhole. They burrow a few inches into the ground and spend the winter (or sometimes a year or more) inactive under ground. Finally, adult weevils make their way back into your trees in search of nuts.

If left unmanaged, these beetles can ruin an entire nut crop. Even the tiniest amount of weevil damage drastically reduces germination, and nobody wants to eat a wormy chestnut. Commercial nut producers with heavy infestations may need to spray in late summer or early fall when adult weevils are active.

Weevils *continued*

In other cases, good sanitation alone should do the trick. That means harvesting directly off the tree and collecting fallen nuts daily, before larvae escape into the ground. Depending on your goals, simply burn the nuts, or store them in a thick, plastic bucket to capture emerging larvae. Destroy the larvae and use the good nuts that don't have holes in them. If you plan to eat the nuts, dunk freshly harvested chestnuts in 120°F water for 20 minutes. The heat kills eggs and larvae inside the nuts—usually when they're still too small to notice. Bon appétit!



Chestnut saplings show leaf curl caused by aphids. Photo by Sara Fitzsimmons

Sucking Insects

Many small, soft-bodied insects drink plant sap using flexible, straw-like mouth parts. They can deplete a tree's resources and inject toxic saliva that causes leaves and shoots to become distorted and yellow. Aphids, whiteflies, phylloxerans, and leafhoppers can all damage chestnuts, although they're rarely bad enough to warrant treatment. Aphids are small, soft, grenade-shaped insects with or without wings; whiteflies are minute, white bugs that often flutter off leaves when disturbed. Both groups make sweet, sticky excrement that can be messy and promote mold growth, but their natural enemies usually keep them in check. Phylloxerans can cause more severe yellowing and crinkling of leaves; look for yellow or orange slow-moving, soft-bodied insects clustered along leaf veins. Similar damage can also result from potato leafhoppers—bright green, wedge-shaped insects that scamper quickly across the leaves. If any of these groups reach damaging levels, check with your extension agent for a positive ID and treatment recommendations.



Gypsy moth caterpillars are voracious and can defoliate entire orchards. Photo courtesy Haruta Ovidiu/University of Oradea/ForestryImages.org

Gypsy Moth

Lymantria dispar

Gypsy moths have defoliated millions of acres of forest and may be the most notorious caterpillars on the continent. When they hatch in the spring, they cause shot-hole damage in foliage. As they grow, older caterpillars develop two recognizable rows of blue and red spots on their backs; they can devour entire leaves. After feeding for several weeks, they spin cocoons and remain inactive until adults emerge in midsummer, mate, and lay clusters of several hundred eggs. Gypsy moth abundance varies wildly from year to year, so keep in touch with your extension agent to find out when to expect an outbreak. Chestnuts can usually

withstand up to 50% defoliation before they require treatment. For small-scale control, wrap an apron of burlap around the tree trunk. Large caterpillars will rest there and can be easily found and destroyed. On a larger scale, spraying a pesticide such as Bt protects trees during outbreak years. Spraying also a good choice for smaller saplings, where wrapping is not a viable solution.



Other Caterpillars

Although gypsy moths are the most severe, many moth caterpillars find their way to chestnut leaves, and some may cause obvious damage. Orangestriped oakworm (*Anisota senatoria*) and yellownecked caterpillar (*Datana ministra*) are two conspicuous species that appear in late summer. Both are boldly striped with black and orange or yellow, and often feed in clusters when small. Leaf rollers, leaf skeletonizers, bagworms, and armyworms are all groups of caterpillars that you may find on chestnut. They can make a tree look bad, but birds, diseases, and parasites usually do a good job of controlling them. If you reach 50% defoliation, or if you have two bad caterpillar years in a row, you may need to treat. Several pesticides are effective, and your extension agent can recommend one for your particular caterpillar.

Orangestriped oakworm is one of several types of caterpillar that can do damage to foliage, but seldom pose a serious threat to the tree.

Photo courtesy of Clemson University/ForestryImages.org



Chestnut Blight

With all the work that TACF has done to produce blight-resistant chestnuts, it is hard sometimes to remember that they are only blight *resistant* – not blight proof. Even with Restoration Chestnut 1.0 trees, a certain percentage will succumb to the blight, and many chestnuts planted today in backyards or small orchards are from earlier stages in the breeding process and are less resistant. This means that chestnut blight will still claim a significant number of trees.

Chestnut blight starts when the pathogen, *Cryphonectria parasitica*, enters the chestnut through a crack or wound in the bark. Once established it sends out threads of fungus that eventually encircle the stem, creating raised or sunken cankers. On young trees with smooth bark the canker often appears orange in color. As it expands, the infection cuts off the flow of water and nutrients beyond the canker. When the fungus encircles the trunk, every part of the tree beyond the canker dies. When the fungus is reproducing, the surface of the blister can be covered in orange pimple-like structures called stromata. The fungus is very good at spreading, as it can travel both in water and through the air, and it is very effective at hitching a ride on insects, birds, or mammals.

This blight canker shows both raised and sunken attributes. The canker has completely encircled the stem and the reproductive orange stromata are clearly visible.

Photo by Paul Franklin

Although in the wild there is little one can do to stop the blight, in the home orchard there is one simple treatment that can be applied to individual trees that may slow the progression of the disease. The soil around the tree contains

Chestnut Blight *continued*

millions of microorganisms, some of which may attack or slow the spread of *Cryphonectria parasitica*. Gather soil from around the tree, add water until it makes a thick paste and pack it around the canker, holding it in place with 4-inch-wide shrink wrap purchased from a building supply store. Extend the mudpack about a foot above and below the canker so the canker cannot expand beyond the treatment area. You must treat all the cankers on a tree and inspect the tree monthly, treating new cankers and replacing the mudpacks on old cankers annually. As the tree grows larger it becomes more difficult to reach and treat all the cankers, but this method can extend the life of the tree.



Phytophthora attacks the root system, denying the tree nutrients and water. Photo by Joe James

is resistant to both blight and *Phytophthora*. In the meantime, there is no cure for *Phytophthora*, but it is possible to minimize the effects of the pathogen by treating soils and plants with anti-fungal agents like Ridomil®, as well as urea or potassium phosphite. All of these are potent treatments, so it's a good idea to consult your regional extension agent before using them. Follow all label instructions carefully.

Phytophthora (Ink Disease or Root Rot)

Chances are if you live south of Pennsylvania and your chestnut seedlings or trees suddenly wilt and die, the culprit is *Phytophthora*, a deadly pathogen that lives in soil and kills plants by destroying the roots. Also known as ink disease and root rot, *Phytophthora* was accidentally imported to North America from Asia in the late 1700s through human commerce. The pathogen moves slowly, transported in soil or by water mostly through agricultural activity. There are many species of *Phytophthora*, and one of the most lethal to American chestnut is *Phytophthora cinnamomi*. This pathogen tends to exist in the soil in patches, and the roots of a tree must make contact with it in the soil to be infected. One tree in a location can die of *Phytophthora* while others nearby remain healthy. Once a tree is infected, the roots quickly turn black and shrivel. Above ground, the leaves wilt and turn brown and within a remarkably short time the tree is dead.

The good news is that some of TACF's blight-resistant chestnut trees also show resistance to *Phytophthora*. A TACF breeding program underway in Seneca, SC, is working to develop a tree that



Deer Browse

Deer love American chestnut trees, and in areas with a large deer population, they can be devastating to a chestnut planting. Even in places where deer pressure is low, deer often discover that chestnuts are one of the tastiest trees to munch on.

The best way to keep deer from eating your chestnut trees is to keep them physically protected. For a small number of trees, many growers use individual cages made of garden wire. Tall

The effects of deer browse on a chestnut seedling. Photo by Sara Fitzsimmons

tree shelters are another option that could be considered, however we don't recommend them for chestnut because the trees often end up weak and spindly, creating a new set of problems. For a larger planting, an 8' deer fence is often the best option. TACF growers have used a variety of materials to fence orchards; galvanized steel woven wire seems to hold up the best over time, though it is not always the most cost effective. Plastic mesh or multi-strand electric fencing are also options and can be a good fit, depending on the situation.

If deer pressure is relatively low, repellents might be all that are needed to keep the deer from snacking on your chestnut trees the next time they stroll by. Several commercial repellents are available, some of which work with scent and some with taste. In either case, they work best when instructions are followed and applications are made on a regular basis.



Rodent Damage

There are many small mammals that will chew on chestnut stems, but often the most devastating to a chestnut planting are voles. Voles are particularly fond of eating plants, especially tender roots, and will often burrow under chestnut trees and eat the roots. (See the February/March 2013 Journal wildlife issue for more on voles.)

Rodents seek areas that can give them cover, so keeping the vegetation in the orchard short and well maintained is a good first step in controlling rodent damage. Both mulch and landscape fabrics can offer shelter to rodents as they burrow, so keeping the area around each tree vegetation-free with herbicide is often your best bet.

Typical of vole damage, this chestnut has been completely girdled at ground level. Photo by Sara Fitzsimmons

Another good preventative measure is to protect the base of each tree with a short shelter that is 18-24" tall. This can do double duty to protect the base of your tree – it provides a physical barrier above ground and can also be sunk 2-4" into the ground to halt most tunneling voles in their tracks. A variety of commercially available or homemade shelter types could be used; just remember that you will want to be able to remove the shelter before the tree outgrows it. Other rodent solutions include using vole and mole repellents, poisons, or traps. Any commercial products should be used according to the manufacturer's instructions.

