

Insect Borers of Shade Trees and Woody Ornamentals

James A. Kalisch, Extension Associate-Entomology
Frederick P. Baxendale, Extension Specialist-Entomology

Several species of wood boring insects can damage trees and shrubs in Nebraska (*Figure 1*). Many of these require carefully timed annual management programs to minimize infestation and damage. This publication covers the biology, life history, and management of the key wood borer species in Nebraska.

Nearly all shade trees and most shrubs are subject to borer attack, especially if they are injured or weakened by disease or environmental stresses. Younger trees are likely to decline or die if borer damage is left unchecked.

Borers are the cream-colored, worm-like larval stages of beetles or moths. There are four important families of wood borer insects. The life cycles and habits of these vary, depending on the type of borer. Among the beetles are two families — roundheaded borers (Cerambycidae) and flatheaded borers (Buprestidae). Among the moths are two families of wood-boring caterpillars — clearwing borers (Sesiidae) and carpenterworms (Cossidae).

Borer infestations are best prevented because once larvae have penetrated deep beneath the bark, little can be done to control them. In addition, injury by borers can permit fungal and bacterial disease organisms to enter the tree, contributing to further decline.



Figure 1. Damage from a wood-boring insect. Borer infestations are best prevented — once they bore beneath the bark, there are few treatment options.

Roundheaded Borers



Figure 2. (Clockwise from left) Roundheaded borer adult beetle, larva, and oval tunnel opening

Adults of roundheaded borers (Figure 2) are called longhorned beetles because most have long, jointed antennae. These beetles are cylindrical in form and often have colorful patterns on their bodies.

Larvae are creamy white and legless (Figure 2). Their bodies are widest immediately behind the head and taper gradually to the end of the abdomen. After hatching from eggs deposited on the bark, larvae bore into the sapwood and heartwood of the tree. Their tunnels are oval and often packed with coarse, sawdust-like excrement (“frass”) or shavings. Before pupation, a mature borer creates a chamber just beneath the bark and plugs it with wood shavings. Upon emergence, the new adult chews an oval exit hole through the bark. Most roundheaded borers have a one-year life cycle, but some species may take several years to complete a generation.

Redheaded Ash Borer, *Neoclytus acuminatus*



Figure 3. Redheaded ash borer adult

This roundheaded borer attacks several species of shade trees, but has a strong preference for ash, oak, and hackberry. Adults vary in length from $\frac{1}{2}$ to $\frac{3}{4}$ inch and

are reddish-brown to black with transverse yellow stripes on the wing covers (Figure 3).

Beetles emerge in the spring and deposit eggs from May until August. Like most borers, they are attracted to weakened trees and freshly fallen logs. Females deposit their eggs in cracks in the bark. The newly hatched larvae initially feed under the bark and later tunnel into the sapwood. The redheaded ash borer generally has a one-year life cycle. Larvae feed during the summer and pupate in the fall. Because of the borer's extended activity, ash trees must be protected from early spring until autumn.

Banded Ash Borer, *Neoclytus caprea*



Figure 4. Banded ash borer adult

Banded ash borer adults (Figure 4) emerge in the spring and are attracted only to dead, dying, diseased, or stressed ash, elm, or hickory trees. They deposit their eggs in bark crevices of newly felled trees and cut logs, and are rarely a major concern for healthy trees in the landscape.

Ash logs cut for firewood in the fall are especially subject to attack the following spring. In late winter, banded ash borer adults emerge from infested firewood stored indoors. Storing firewood outdoors or in an unheated garage will prevent this.

Cottonwood Borer, *Plectrodera scalator*



Figure 5. Cottonwood borer adult

This large borer infests the bases and exposed roots of cottonwood, poplar, and to a lesser extent, willow trees. Adults are large, about 1½ inches in length. The top of the body has a pattern of longitudinal rows of black, angular patches bordered by white stripes (Figure 5). Beetles emerge in late spring and early summer and feed on tender new shoots of young trees. They deposit eggs in openings chewed into the bark at the bases of trees below the soil line. The larvae burrow into the bases and roots of trees, pushing out frass at the entry points. Severely infested young trees may be badly damaged or even killed. Larger trees tolerate light to moderate infestations without apparent serious results. Cottonwood borers have a two-year life cycle.

Poplar Borer, *Saperda calcarata*



Figure 6. Poplar borer adult

This roundheaded borer attacks cottonwood, poplar, aspen, and willow trees. Adults are approximately 1 inch long and are a gray-tan with small orange spots on the wing covers (Figure 6). They emerge in summer and feed on foliage and young shoots of host trees before laying eggs in slits cut in the bark. Larvae bore into the heartwood and take three years to mature.

Damage appears as swollen areas on trunks and larger branches. Holes where larval excrement is pushed out and where adults have emerged are also signs of an infestation. The junctions where branches meet the trunk are often riddled with exit holes. Fibrous frass may accumulate around the base of trees. Woodpeckers feed on this borer and their pecking and probing may increase the severity of injury. Older trees gradually decline and die with continued reinfestation. Young trees can die quickly from the girdling caused by larval tunneling.

Pine Sawyers, *Monochamus spp*

Several species of pine sawyers occur in Nebraska, all of which breed in conifers. Beetles are usually mottled brown to black and have long, jointed antennae. They are over 1 inch in length. Adults attack stressed, dying, or recently killed trees and rarely injure healthy trees.



Figure 7. Pine sawyer adult

Pine sawyers are vectors of the pinewood nematode, which causes pine wilt disease. Older Scotch pine and Austrian pine trees are especially susceptible. Many pine trees in shelterbelts and home landscapes have been killed over the last several years. Trees killed by pine wilt disease must be immediately removed and chipped to reduce further spread of the disease.

Pine sawyer adults (Figure 7) emerge in the spring (although beetles may continue to appear through the summer) through circular holes cut through the bark. After emergence, beetles chew on tender shoots and needles. During feeding activity, they may transfer the pinewood nematodes to healthy trees as well. After feeding, females deposit eggs in notches chewed into the bark of the trunk and branches. Young larvae feed initially just below the bark and later bore deeply into the heartwood. As they reach maturity, they tunnel back toward the surface and create a pupal chamber below the bark. Adults emerge the following spring. The life cycle requires one to two years.

Flatheaded Borers

Adults of flatheaded borers are called metallic wood borers or jewel beetles because many species in this family are brilliantly colored with a beautiful metallic luster. These beetles are usually narrow, somewhat flattened, and bullet-shaped. The most important species are from ½ to ¾ inch long.

Flatheaded borer larvae are creamy white and legless, having a flat, worm-like appearance with a large swelling behind the head (Figure 8). Larvae hatch from eggs deposited in bark crevices. They bore into and throughout the cambium layer and superficially into the sapwood. Tunnels are flattened, and wind back and forth in sinuous or S-shaped fashion. They are tightly packed with fine frass. In smaller branches, larvae create spiral tunnels as they feed.

Mature larvae create a chamber just beneath the bark to pupate. When adults emerge, they chew a D-shaped

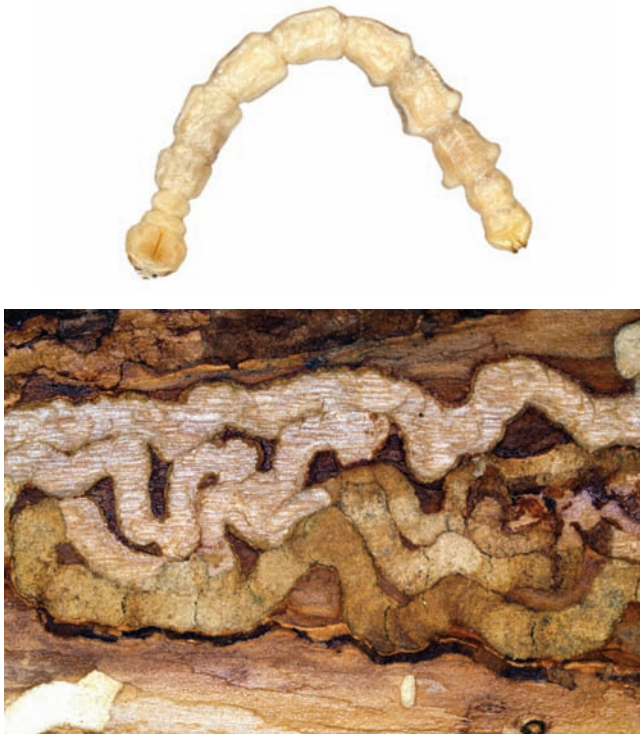


Figure 8. (Top) Flatheaded borer larva; (bottom) flattened, S-shaped tunnels, generally found in the cambium layer and superficially in the sapwood layer of a damaged tree

exit hole through the bark. Most flatheaded borers have a one-year life cycle, but development may take one to three years to complete, depending on location.

Flatheaded Appletree Borer, *Chrysobothris femorata*

The flatheaded appletree borer feeds on an extremely wide host range of trees and shrubs, but prefers maple, apple, and poplar. These borers are found throughout the continental United States from Mexico into Canada. They generally attack younger trees that have been recently transplanted into the landscape, or those that are injured, drought-stressed, or weakened by disease. Larvae tunnel beneath the bark and into the cambium, girdling and killing the trees (Figure 9). Older trees can tolerate some injury, but damage may be less visible as injury beneath the bark may be sunken, cracked, or overgrown with scar tissue. Oval, adult exit holes will be present at infestation sites.

Adults are black and over ½ inch long (Figure 9). The head and thorax are generally brassy, while the wing covers have strong, long ridges that are interrupted by sunken brassy or coppery patches. Adults primarily emerge in May, but may be present throughout the summer. There is one generation per year.

Bronze Birch Borer, *Agrilus anxius*

This flatheaded borer occurs in most species of birch grown in Nebraska. Adult beetles are about 3/8 inch long,



Figure 9. (Top) Tunneling damage from the flatheaded appletree borer; (bottom) adult flatheaded appletree borer



Figure 10. (Top) Bronze birch borer; (bottom) tunnel damage

slender, and have a metallic bronze sheen (Figure 10). They emerge from infested trees in late May and are present until July. They feed on birch leaves for several days before laying eggs. Eggs are deposited in cracks in the bark. Larvae burrow directly through the bark into the cambium layer (Figure 10). Heavy infestations produce raised ridges that can be observed on the bark surface.

Adults prefer weakened trees for egg laying. Healthy, vigorous trees are less likely to be infested. Cultural practices are very important in the prevention of bronze birch borer infestation and injury.

Birches should be planted where they are shaded in the afternoon — avoid southern or western exposures. They are best suited for shaded, damp situations and should be watered regularly. Add a 4- to 6-inch mulch layer or plant a ground cover over the root area to keep roots cool and moist. Do not mow grass over the root area during summer. Many birch species are not well adapted to Nebraska and are susceptible to bronze birch borer attack.

Emerald Ash Borer, *Agrilus planipennis*



Figure 11. Emerald ash borer adult

The emerald ash borer is an exotic, highly destructive pest that was introduced into the Detroit, Michigan, area about 2002 and since has spread to many states. As of July 2010, it had not been detected in Nebraska. It is important, however, to be able to recognize this metallic-green, ½-inch-long beetle (Figure 11) so it can be reported to the Nebraska Department of Agriculture when first detected.

All ash species of all ages are susceptible to emerald ash borer attack; however, beetles seem to have a preference for green, white, and black ash. Infested trees show an array of symptoms, including a thinning canopy, sucker growth at the tree base and cracking, loose bark. Without early intervention, most trees die after two to three years. Adults are present from May into early summer and feed on the foliage just after emergence. Females deposit eggs in bark crevices, and young larvae bore flat, sinuous tunnels in the cambium layer just beneath the bark. Emerging adults chew D-shaped exit holes through the bark. There is usually only one generation per year. Beetles often reinfest trees in the same area, but they also can colonize new hosts within a few miles.

One of the most common ways that emerald ash borers are spread is through the illegal transport of infested firewood from quarantined areas. It is critical that firewood be burned in the same area where it was obtained.

Much research is underway to develop methods for managing the emerald ash borer. Unfortunately, it appears this pest is destined to spread into most areas where ash trees are grown.

Caterpillar Borers

There are two important families of wood-boring caterpillars in Nebraska — clearwing borers and carpenterworms. Caterpillar borers are the immature stages of moths. These larvae are often creamy white, but also may be dark tan or purplish, depending on the species. Hairs and/or spots are often present. Unlike the roundheaded and flatheaded borers, these caterpillars have a much darker head capsule. Behind the head are three pairs of jointed legs followed by additional fleshy legs along the underside of the body with a final pair at the tip of the abdomen.

Caterpillar borers chew and digest wood. Webbing and moist fecal pellets may be evident in their tunnels. Since adults do not have chewing mouthparts, the caterpillars maintain an opening through the bark from which they discharge their feces and through which the moth emerges. These holes often weep sap or may be gummy.

Examples of clearwing moths include the ash/lilac borer, dogwood borer, peachtree borer, red oak borer, viburnum borer, and the willow clearwing. Carpenterworms consist of a family of large, pink to purple larvae. Several other moth families include some species that are important wood-boring pests as well.

Ash/Lilac Borer, *Podosesia syringae*

This pest has a preference for green ash, white ash, lilac, and privet. Moths are active during the day. They resemble paper wasps, having red-brown wings and a body that is crossed by yellow and black bands (Figure 12). Peak adult emergence occurs in May and June. Adult emergence holes in the host plant are circular and often have protruding pupal skins.

After mating, the adult females deposit eggs on the lower portions of ash trees or on the main stems of lilac or privet. Young caterpillars bore through the bark and feed deeply within the heartwood. Feeding in lilac and privet may cause foliage of infested branches to wilt. Frass produced by the borers is pushed out from their burrows. Infested canes become perforated with tunnels, scar, and eventually die (Figure 12).



Figure 12. (Top) Ash/lilac borer adult; (bottom) a cane infested with the ash/lilac borer is perforated with tunnels

While ash trees are able to sustain considerable injury, they also may be weakened to a point where they are attractive to other borers and bark beetles. Severely infested or dead stems of lilac and privet should be cut at the soil level and destroyed in late spring. Regular pruning will help reduce borer numbers and restore a pleasing appearance to lilac. Ash/lilac borers overwinter in the pupal stage and have only one generation each year.

Banded Ash Clearwing, *Podosesia aureocincta*



Figure 13. Banded ash clearwing adult

The banded ash clearwing has a similar biology to the ash/lilac borer, but in Nebraska, adults emerge toward the end of the summer rather than in the spring.

The adult is also a day-flying moth that resembles a wasp, but its body is mostly brownish-black with a single bright orange-yellow band at the middle segment of the abdomen (Figure 13). Adults emerge in late August into September and deposit eggs only on the bark on the lower trunks of green and white ash trees. After hatching, the caterpillars bore through the bark and feed within the branches and trunks of the tree. They overwinter as partly grown larvae and continue feeding and tunneling until midsummer. There is one generation each year.

Carpenterworm, *Prionoxystus robiniae*



Figure 14. (Top) Carpenterworm adult; (bottom) larva

In the Great Plains, this common pest prefers cottonwood, ash, and elm as hosts, but it also will attack many other shade and fruit trees, and shrubs. The female carpenterworm moth is large and stout with a 3-inch wingspan (Figure 14). Its wings are intricately mottled with gray, tan, and brown. Males are much smaller and have yellow-orange coloration at the posterior half of each wing. Moths are nocturnal and active from June through July. Females deposit their eggs on the bark of trees, usually on the lower trunk, and often in old wounds. After hatching from eggs, young carpenterworms tunnel directly into the inner bark and later bore into the heartwood. Larvae maintain openings in the bark through which they eject their frass. Infested areas become scarred and stained with seepage. Heavily infested trees are structurally weakened, and major branches may break during windy weather. These caterpillars require more than one year to complete development and may be up to 3 inches long at maturity (Figure 14).

Pine Moth, *Dioryctria* spp



Figure 15. (Top) Pine moth adult; (bottom) tunneling damage to a pine branch

There are at least three species of pine moths in Nebraska. Adults are similar in appearance. The two most common species associated with injury to pines are *Dioryctria zimmermani* (Zimmerman pine moth) (Figure 15) and *Dioryctria tumicolella*. A third species, *Dioryctria ponderosae* (locally called the ponderosa twig moth), has a preference for ponderosa pine and is also a pest of pinon pine in the western U.S. The ponderosa twig moth only occurs in central and northern Nebraska.

Ponderosa, Austrian, and Scotch pines are highly susceptible to attack by pine moths. Other pine hosts, including jack and white pines, may sustain some damage. Younger trees are the most frequently infested and damaged.

Pine moths typically deposit their eggs at branch junctions, in fresh wounds, or in previously infested sites. Ponderosa twig moths emerge in early summer and begin laying eggs. Upon hatching, larvae immediately begin boring into the tree. These larvae may take two years to complete development. Moths of the other two species emerge in late July to early August. Initially, newly hatched larvae feed on bark, then construct cocoon-like structures (“hibernacula”) in crevices where they overwinter. Larvae become active again the following April and then bore into the trees and complete development by midsummer.

Typical signs of injury by young pine moths are extrusions of pinkish pitch masses composed of frass and sap. Later in the season as the older larvae tunnel more deeply into the trunk, these masses enlarge to golf-ball size and become yellow-white and hardened. Heavily damaged branches of infested trees often break off where they join the trunk. On occasion, branch tips also may become infested.

Management

Cultural

Several cultural practices that promote plant health and vigor also will help reduce borer infestations. Trees maintained under vigorous growing conditions are generally less susceptible to borer attack. Trees should be properly watered, fertilized, and protected from other pests and physical injury, particularly during the first two or three years after planting and during periods of drought.

Consider planting oaks, lindens, crabapples, and conifers that are well-adapted to local environmental conditions. Ash, birch, lilac, cottonwood, locust, and flowering stone fruits are typically more susceptible to borer injury. Select species and cultivars that are resistant to borer attack.

Mechanical

Wrapping younger or thin-barked trees to prevent borer attack is not recommended as it typically does more harm than good.

Reduce borer numbers in the landscape by disposing of dead or dying trees or shrubs, or by pruning off infested branches.

Removing related wild host plants in the immediate vicinity also may help reduce potential infestation of prized trees and shrubs.

Insecticidal

Table 1 provides general guidelines for noncommercial insecticides applied as topical sprays or systemic applications.

Table 2 provides information on the emergence periods of many common wood-boring insect pests in Nebraska. It can be used to time insecticidal treatments targeting the borer pests covered in this publication as well as others that on occasion may be problematic in woody ornamentals. Monitoring with sticky traps is also helpful in finely tuning treatment times.

Table 1. Guidelines for noncommercial insecticides applied as topical sprays or systemic applications.

<i>Application</i>	<i>Active Ingredient</i>	<i>Directions</i>
Topical	Permethrin Bifenthrin	Spray trunk and lower branches or canes with a coarse spray to the point of runoff. Concentrate efforts on exit holes and wounds. Timing of the application is extremely important (see below), and multiple treatments may be necessary to cover the entire period of adult emergence, egg laying, and early larval activity. In some cases, foliar treatments may help provide borer control if adults feed on the foliage after emergence. Carefully read and follow label directions.
Systemic	Imidacloprid Chlorantraniliprole (Available soon for homeowner market)	Imidacloprid has been shown to be effective against larval flatheaded borers as well as adults of flatheaded borers and roundheaded borers that feed on foliage of treated trees and shrubs. Apply as a liquid or granule to the soil around the base or drip-line of a tree or shrub according to label instructions. Since it takes time for uptake of the insecticide by the host plant, applications are usually made several weeks before pest activity is anticipated. Systemic control with imidacloprid will usually provide season-long control. Carefully read and follow label directions.

Table 2. Common hosts and emergence periods of many common wood-boring insects in Nebraska.

<i>Pest Name</i>	<i>Common Hosts</i>	<i>Adult Emergence Period</i>
Roundheaded Borers		
Banded Ash Borer	Ash, elm, hickory	May - June
Elm Borer	Elms	Late May - July
Cottonwood Borer	Cottonwood, poplar, aspen, willow	June - August
Locust Borer	Black locust	August - September
Oak Twig Pruner	Oak, walnut, elm, apple	Late May - early June
Poplar Borer	Poplar, cottonwood, aspen	June - August
Pine Sawyers	Pines	May - July
Redheaded Ash Borer	Ash, oak, walnut, hackberry, maple	May - July
Red Oak Borer	Oaks	June - July
Roundheaded Appletree Borer	Apple, pear, crabapple, serviceberry, hawthorn	June - late July
Twig Girdler	Oak, elm, linden, hackberry, pecan, maple	Late August - early October
Flatheaded Borers		
Bronze Birch Borer	Birch	Late May - July
Emerald Ash Borer	Ash	Late May - July
Flatheaded Appletree Borer	Apple, maple, walnut, poplar, oak, many others	Late May - August
Honeylocust Agrilus	Honeylocust	May - August
Oak Twig Girdler	Oaks	May - July (alternating years)
Twolined Chestnut Borer	Chestnut, oak, beech	May - August
Caterpillar Borers		
Ash/Lilac Borer	Ash, lilac, privet, mountain-ash	Late April - June
Banded Ash Clearwing	Green ash, white ash	August - September
Carpenterworm	Oak, elm, poplar, ash, boxelder, and others	May - early July
Dogwood Borer	Dogwood, pecan, oak, birch, and others	June - August
Lesser Peachtree Borer	Peach, plum, cherry, flowering Prunus species	June - July
Peachtree Borer	Peach, plum, cherry, flowering Prunus species	July - August
Pine Moths (Dioryctria spp.)	Pines	June - August
Red Oak Clearwing	Red oak, pin oak, black oak	June - July
Viburnum Clearwing Borer	Viburnum, arrowwood	June - early August
Willow Clearwing	Willow	July - August

Natural Controls

A number of natural factors are often quite effective in reducing borer infestations. Sudden temperature extremes during adult emergence through egg hatch can induce high mortality. Heavy rainfall and cold temperatures can interfere with adult mating and egg-laying activities. Birds and other arthropods, as well, can make a

severe impact on borer populations. Among the beneficial arthropods are predaceous mites, spiders, ground beetles, assassin bugs, parasitic wasps, ants, and tachinid flies.

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