Asian Longhorned Beetle

actual size adult ALB

What is it?

The Asian longhorned beetle, also known as ALB, is another invasive bark-boring insect transported by firewood. The ALB is known to infest a wide range of host trees, including maples, elms, willows, birches, poplars, and ashes. This is one of the reasons why it is of such great concern and is so difficult to combat. ALB is an introduced species of beetle that is native to China. ALB first arrived in the United States in New York in 1996. The beetle arrived on solid wood packing material. It has since spread to several surrounding states, mostly by infested firewood, timber and nursery stock.

Adult ALB are large beetles with bodies measuring 1 to 1.5 inches in length with long antennae. Their bodies are black with small white spots and their antennae are banded in black and white. The antennae are about 1.2 to 1.8 times its body length.

Life Cycle and Damage

The ALB undergoes complete metamorphosis. Adults do little damage to trees. They feed on the midrib of leaves, on leaf petioles and on the thin bark of twigs before mating and laying eggs. The primary source of damage is ALB larvae. Females chew pits into the bark of a tree. They lay a single egg—about the size of a rice grain—under the bark. Females will lay eggs at multiple sites. One female is capable of laying up to 90 eggs. The egg hatches within two weeks and the white larva bores into the tree. The larva feeds on the living tissue that carries nutrients as well as the layer responsible for new growth under the bark. After several weeks, the larva tunnels into the heartwood, where it continues to feed and develop over winter. As the larvae feed, they form tunnels, or galleries, in tree trunks and branches. Larval tunnels can be found in broken branches of infested trees. After pupation occurs, adults chew their way out of the tree, leaving round exit holes approximately ¼ to ½ inch in diameter.

round exit holes

adult ALB

adult feeding

larva

larva galleries

Signs and Symptoms

New ALB infestations are difficult to detect and may not be seen for 3-4 years. Symptoms of an infestation include upper crown dieback and discolored leaves. Signs of an infestation can be recognized by identifying adult beetles or round exit holes on the outside of the bark. Infestations can also be detected by seeing oozing sap around pits chewed in the bark by females laying their eggs. Another sign of a potential infestation is an accumulation of frass at the base of an infested tree. Frass is a mixture of the solid feces of larva and wood shavings that result from feeding.

crown dieback

egg pits

oozing sap

frass

Controls/Prevention

- **Leave firewood at home!** Don't bring it with you for camping or traveling.
- Buy firewood near your destination, buy only what you need, and burn it completely before leaving.
- Do not take wood collected in the forest home.
  If you have already brought wood with you, burn it all before leaving. Do not take it home and do not leave it for the next person.

Birch Leafminer

What is it?

The birch leafminer is an invasive insect pest that affects a variety of birch trees including paper birch. Adult birch leafminers are small, black sawflies about 3 mm long. Larvae are small, white, and slightly flattened. The leafminer is native to Europe and was accidentally introduced into the United States during the 1920s.

birch leafminer damage

Life Cycle and Damage

adult sawfly

leafminer larva

Birch leafminers undergo complete metamorphosis. The larval stage is the primary source of damage to the tree. In the spring, adult birch leafminers emerge from the ground where they over-wintered as mature larvae. Females then lay hundreds of eggs in developing birch leaves (1 – 20 eggs per leaf). After the eggs hatch, the larvae feed in the leaves. Birch leafminers are a type of skeletonizer. The birch leafminer larvae eat the cells between the upper and lower leaf surfaces but they do not eat the veins of the leaves. Leaves begin to turn brown as a result. Repeated leaf loss over the entire tree weakens the tree and makes it less resistant to other insects and diseases. When the larvae mature, they drop to the ground where they turn into adults. The second generation adults also lay eggs. The larvae from these eggs over-winter beneath the ground.

Signs and Symptoms

Larvae feeding eventually causes large brown blotches on the leaves and gradual leaf death. Some birch trees are almost completely defoliated as a result of feeding activity by the larval stage of this insect.

severe leaf loss

Controls/Prevention

Pesticides can be sprayed on the leaves when the adult black sawflies are active. Pesticides can also be injected into the soil where they are taken up through the tree roots to control the larvae. Release of parasitic wasp species, natural enemies of this pest, has proven to be helpful and has decreased the frequency of outbreaks.

Chestnut Blight

What is it?

orange canker

The chestnut blight is a canker disease that affects American chestnut trees and is caused by an invasive fungus. Chestnut blight fungus was introduced to the United States in the late 1800's on Chinese chestnut trees imported from China. The trees were planted in New York botanical gardens and the Bronx Zoo. The Chinese chestnut is resistant to the fungus, so they are not affected by the disease. The blight is easily spread to American chestnut trees by wind, rain and the feet of birds. The American chestnut has no natural resistance to the fungus. By 1904, many American chestnuts in New York were starting to die from the blight. Before the introduction of the blight in the United States, one out of every four trees in the eastern United States were an American chestnut. By 1950, mature American chestnuts were mostly extinct as a result of the blight.

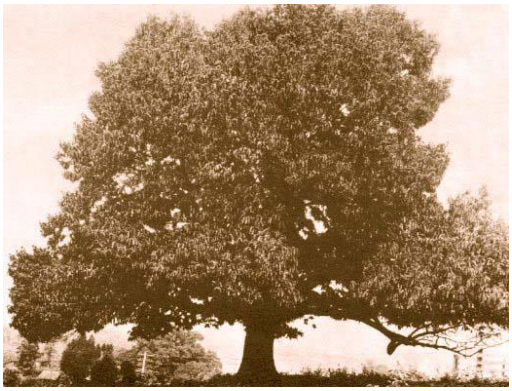
Life Cycle and Damage

The chestnut blight enters the tree through small wounds which are mostly caused by insects feeding. The blight then grows on the inner bark of the tree and eats away the bark. The blight eventually eats a ring all the way around the tree, girdling the tree and the tree eventually dies. Spores (the fruit of the fungus) can live in the soil for years before landing on a chestnut tree and infecting it.

American chestnut sprout

Signs and Symptoms

The chestnut blight lives only in the trunk and branches of American chestnut trees. The fungus makes an orange canker on the trunk of diseased trees. Root systems are resistant to the blight and can survive. From the roots new American chestnut trees sprout, even 100 years later. The new trees, however, rarely grow enough to produce seeds before the blight attacks and kills them.



historical photograph of an American chestnut

Controls/Prevention

The American Chestnut Foundation has been working hard to preserve American chestnuts that are still standing. They are also working to develop trees that show increased blight resistance while preserving the main qualities of the original American chestnut tree. Their goal is to plant these disease tolerant American chestnut trees across the Eastern hardwood forests.

"Chestnuts were once so numerous along the eastern forests of the U.S. that it is said a squirrel could jump from chestnut tree to chestnut tree all the way from Georgia to New York without ever touching the ground." – US Fish and Wildlife Service

Dutch Elm Disease

What is it?

Dutch elm disease is a vascular wilt disease in elm trees caused by an invasive fungus. American elms are more susceptible to the disease than other elm species. Dutch elm disease was first discovered in the United States during the 1930's. The fungus' native country is unknown but thought to be somewhere in Asia. The disease got its name from the Dutch scientists who first studied the disease. The fungus was introduced to the U.S. accidentally on diseased logs imported from Europe.

flagging in an elm tree

Life Cycle and Damage

The fungus can be transmitted through touching root systems or by insects carrying the fungus.
The native elm bark beetle and the smaller European elm bark beetle lay eggs in the inner bark of the tree. After the eggs hatch and the beetles mature, they bore their way out of the tree. When they do this, the beetles can pick up the fungus spores. The beetles carry the fungus spores to other trees. When the fungus enters an elm tree, it clogs the tree's xylem. Xylem are the cells that carry water and nutrients through the tree. When the xylem is clogged, the tree starves to death. The disease spreads rapidly throughout the tree resulting in death in 2-3 years.

Signs and Symptoms

One of the early symptoms of Dutch elm disease include "flagging". Flagging is when the leaves on upper branches curl, turn yellow and wilt. Soon after one branch shows signs of flagging, adjacent branches also show signs, followed by major canopy dieback. If a tree is suspected to have Dutch elm disease, bark can be peeled off of affected branches to look for additional signs. The presence of brown bands or streaks in the wood beneath the bark is further evidence of the disease. This sign is referred to as vascular staining and is the most distinctive sign of Dutch elm disease that can be observed in the field.

Controls/Prevention

There are several methods of control depending on the situation. In trees that have been recently infected, dead and dying branches should be pruned and destroyed. Insecticides can be used to kill the beetles that spread the fungus. Fungicides can be injected into the tree to kill the fungus. Researchers have developed several disease resistant elm varieties. Some are now sold in nurseries and are slowly being reintroduced to natural areas.

vascular staining

Emerald Ash Borer

What is it?

EAB adult

Some campers think that it is easier to bring their own firewood to a campsite rather than collect local wood. It may be easier but it can have major effects on the local forest. One particular insect transported by firewood is a small insect called the emerald ash borer, also known as EAB. EAB is responsible for the death of millions of ash trees in North America. EAB is an introduced species of beetle that is native to Asia. It is thought that EAB arrived in the United States on solid wood packing material carried on cargo ships or planes. It was first found in the United States in 2002 in Michigan and has since been found in several states including Pennsylvania where it was first detected in 2007. EAB is known to infest all species of ash trees in North America

actual size

Life Cycle and Damage

"S" galleries

Adult EAB feed on the trees' leaves but do very little damage to the trees. The primary source of damage is EAB larvae. The adults lay their eggs between layers of bark or in crevices in the bark. The larvae hatch in about one week and bore into the tree where they feed on the inner bark, disrupting the trees ability to transport water and nutrients. As the larvae feed they create "S" shaped galleries. The larvae dig a pupal chamber in the fall where they over winter. Pupation occurs in late spring and the adults emerge through "D" shaped exit holes in May and early June. Adults remain active through the end of summer.

"D" exit holes

Signs and Symptoms

New EAB infestations are difficult to detect and may not be seen for up to three years. Symptoms of an infestation include upper crown dieback, yellow leaves or sprouts that come directly out of the trunk, and vertical bark slits. EAB infestations can cause girdling and death of branches and entire trees. Girdling is damage to the tissues that carry food and water the entire way around the tree. Signs of an infestation can be recognized by identifying adult beetles or "D" shaped holes on the outside of the bark. Adult EAB are bright metallic green in color, approximately ½ inch long, and have flattened backs and purple abdominal segments beneath their wing covers. Infestations can also be detected by identifying larvae or "S" shaped galleries beneath the bark. EAB larvae are creamy white and legless. Another sign of a potential infestation is excessive woodpecker activity. Several species of woodpeckers feed on EAB larvae and pupa, so finding an ash tree with large size or large quantities of woodpecker holes could mean that it is infested with EAB.

crown dieback

trunk sprouts

bark slits

woodpecker damage

Prevention

- **Leave firewood at home!** Don't bring it with you when camping or traveling.
- Buy firewood near your destination, buy only what you need, and burn it completely before leaving.
- Do not take wood collected in the forest home with you.
- If you have already brought wood with you, burn it all before leaving. Do not take it home and do not leave it for the next person.

Spongy Moth (formally known as Gypsy Moth)

female spongy moth with egg mass

What is it?

The spongy moth is an invasive forest pest that defoliates hundreds of acres of forests. It is one of the most damaging tree defoliators in the United States. Oak species top the list of over 500 tree species preferred by the spongy moth. The spongy moth is native to Europe and Asia. It was introduced to the United States in 1869 when a French entomologist imported moth eggs to Massachusetts with the idea of breeding a silk-spinning caterpillar that was more resistant to disease than the domesticated silkworm. Unfortunately, the caterpillars escaped into his backyard. About 10 years later, they began to appear in large swarms and, by the late 1880s, they were causing severe defoliation in the area. The invasive pest spreads when caterpillars move to new locations. They crawl to the tops of trees where they spin a silken thread and are caught on wind currents. Spongy moths can also be spread by humans by hitchhiking to motorized vehicles and transporting firewood.

gypsy moth larva

Life Cycle and Damage

Spongy moths undergo complete metamorphosis. The larval stage is the primary source of damage to trees. Adult moths emerge from the pupae in July and females begin to lay eggs in July and August. The eggs are enclosed together in a hairy brown mass, called an egg mass. Each female lays between 500-1000 eggs in sheltered areas such as underneath the bark of trees. When the spongy moth larvae (caterpillars) emerge, they begin feeding on the leaves of their host tree. The caterpillars usually feed at night and rest during the day. However, when populations are very high, caterpillars will feed nonstop until the tree is completely bare and then look for a new food source. Caterpillars mature in mid-June or early July and go into the pupae stage. A tree can leaf out a second time in the summer but this decreases the energy stored in the tree. These weakened trees are more susceptible to other diseases. Trees that are defoliated two or more times in successive years will be killed by the constant stress and loss of energy reserves.

Signs and Symptoms

Spongy moth infestations can be identified by the presence of caterpillars. Caterpillars have five pairs of blue spots and six pairs of red spots on their back. They are about 2 inches long, dark colored and covered with hairs. Adult female moths can also be seen in the area. Female moths have whiteish wings and a tan body and do not fly. Egg masses can be found on trees, fence posts, outdoor furniture, cars and firewood in late summer.

Controls/Prevention

There are a variety of actions recommended to control spongy moth populations on a single tree. Egg masses can be destroyed by soaking them in soapy water. Burlap placed around tree trunks will encourage larvae to hide there during the day. The larvae can then be killed. Barrier bands prevent larvae from climbing up the trunk. On a forest wide scale, pesticides can be effective in killing feeding larvae. Natural predators, including native birds and small mammals, prey on gypsy moth larvae and pupae. Several non-native biological controls, including insects, parasites, and disease organisms have been introduced to target spongy moths. Unfortunately, these biological controls also attack native species of caterpillars. To prevent the spread of spongy moths, it is important to check vehicles before leaving infested areas and not transporting firewood.

Hemlock Woolly Adelgid

What is it?

The hemlock woolly adelgid is a serious threat to our state tree, the Eastern hemlock. The hemlock woolly adelgid is an invasive, aphid-like insect that attacks North American hemlocks. The hemlock woolly adelgid was accidentally introduced to Virginia from Japan in the 1950s. By the late 1960s, it was reported in southeastern Pennsylvania. The insects can be carried by birds and can be moved on hemlock nursery trees, logs or firewood.

white, waxy egg masses

Life Cycle and Damage

The hemlock woolly adelgid undergoes incomplete metamorphosis. The nymph stage is the primary source of damage to the tree. Adult adelgids are black, oval, soft-bodied, and about 2 mm long. They are very small and hard to see, but they can be easily identified by the white waxy masses they form on the underside of branches at the base of the needles. These masses can contain up to 200 eggs and remain present throughout the year. Once hatched, adelgid nymphs, known as crawlers, crawl onto branches to feed, usually at the base of the needles. The hemlock woolly adelgid is a type of sapsucking insect pest. The nymphs insert their piercing-sucking mouthparts into the base of the needles and remove plant fluids. They remain in the same spot, continually feeding until they develop into adults. Their feeding severely damages the canopy of the host tree by disrupting the flow of nutrients to its twigs and needles. Trees typically die within 4 to 10 years.

Signs and Symptoms

A hemlock woolly adelgid infestation can be identified by the presence of the white waxy egg masses on the underside of branches at the base of needles. Because the nymph feeding interferes with the tree's use of nutrients, the tree can experience needle loss and branch dieback.

magnified adult, eggs, and crawler

Controls/Prevention

The adult hemlock woolly adelgid can be controlled by applying insecticides in the fall. Insecticides applied in the spring target feeding nymphs. Insecticides injected into the soil are taken up by the tree roots and also kill feeding nymphs. The Bureau of Forestry has been introducing several different predatory beetles that feed solely on hemlock woolly adelgid which has reduced the impact of the insect. The U.S. Forest Service, along with other agencies and several universities, are working to find, cultivate, and selectively breed hemlock trees that have inherent characteristics that defend against these invasive insects. To prevent the spread, do not transport firewood.

needle loss

dead eastern hemlocks

Spotted Lanternfly

What is it?

The spotted lanternfly (SLF) is an introduced, invasive pest that feeds on over 70 plants, including important forest species, community trees, and agricultural crops. The name lanternfly is misleading; SLF have little in common with any type of fly. Also, adults with their wings spread are often misidentified as moths. SLF are planthoppers (true bugs), and are closely related to cicadas, brown marmorated stink bugs, aphids and leafhoppers. SLF is native to Asia. It was first found in North America in 2014, in Pennsylvania. It is believed to have arrived on shipments of stone from China. Since then, SLF infestations have been detected in several states surrounding Pennsylvania.

adult with wings closed

SLF are invasive and can spread rapidly when introduced to new areas. While the insect can walk, jump using their powerful hind legs, or fly short distances, its long-distance spread is facilitated by people who unknowingly move items that contain egg masses, such as firewood. SLF also spreads through nymphs and adults hitchhiking on clothes, gear, or vehicles. If allowed to continue to spread in the United States, this pest could damage the country's grape, orchard, and logging industries. Some of the trees that are feed on by SLF are tree of heaven, black walnut, maples, willows, birches, black cherry, and tulip tree.

Life Cycle and Damage

Adult female SLF lay their eggs on smooth surfaces such as bricks, stones, plants, and outdoor furniture. Egg masses are yellowish-brown in color and covered with a gray, waxy coating. Each egg mass can contain up to 60 eggs. Nymphs hatch in Spring and early Summer. Nymphs are black with white spots in their early stages of development and then turn red just before becoming adults. Adult SLF have a wingspan of about 2 inches. The forewings are pinkish tan with black spots and the hindwings are red with black spots. When at rest, adults are approximately 1 inch long and ½ inch wide.

egg mass

early nymph

late nymph

adult

SLF adults and nymphs all have piercing-sucking mouthparts which allow them to drill into the phloem (living tissue) of a plant to feed directly on the sugary sap. This can reduce photosynthesis, weaken the plant, and eventually contribute to the plant's death. As the adults feed, they excrete sticky, sugar-rich fluid (honeydew) which has a fermented odor. This fluid can build up on plants and on the ground underneath infested plants, causing sooty mold to form. SLF can weaken trees and make them susceptible to other pests and diseases.

Signs and Symptoms

SLF adults and nymphs can be seen gathering in clusters on plants and trees. Other signs of SLF infestation include oozing sap, mold growth from honeydew, wilting, leaf curling and plant dieback.

cluster of adults

mold growth

leaf wilting & curling

Prevention

- Do not transport firewood.
- Spotted lanternfly is a hitchhiker. Be sure to inspect for the pest on clothing, backpacks, outdoor furniture and vehicles for hitchhiking nymphs and adults.
- Regularly inspect your trees, plants, and smooth surfaces in your yard for signs of this pest. Kill any nymphs and adults and scrape and dispose of egg masses.
- Eliminate tree of heaven.

oozing sap

plant dieback