

# TREE FRUIT CROPS

CORNELL COOPERATIVE EXTENSION



Insect Identification  
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## Apple-Boring Beetles

Roundheaded Appletree Borer: *Saperda candida* Fabricius (Coleoptera: Cerambycidae)

Flatheaded Appletree Borer: *Chrysobothris femorata* (Olivier) (Coleoptera: Buprestidae)

Broad Necked Root Borer: *Prionus laticollis* (Drury) (Coleoptera: Cerambycidae)

Tilehorned Prionus: *Prionus imbricornis* (Linnaeus) (Coleoptera: Cerambycidae)

**Arthur M. Agnello**

Department of Entomology, New York State Agricultural Experiment Station, Geneva

### Introduction

Although the number of wood-boring beetles attacking fruit trees is relatively small and their infestations are sporadic, four species found in New York are capable of seriously damaging or killing trees. They differ some in biology and life history, but they are addressed here as a group because their general activities as a pest class are similar. Taken in order of importance and frequency as a pest, they are the roundheaded appletree borer, flatheaded appletree borer, broad necked root borer, and tilehorned prionus. With the exception of the flatheaded appletree borer, which is a buprestid (metallic wood-boring beetle), they belong to the cerambycid (long-horned beetle) family, and the last two are closely related species in the group known as prionus root borers. All are native to and widely distributed throughout the United States and southern Canada. They all damage deciduous fruit and shade trees by tunneling as larvae into the conducting tissue of the lower trunk, crown, and roots and compounding the injury by providing an entryway for destructive fungi. Each of these pests attacks a broad range of host plants. All four species attack apple, cherry, peach, and plum, and the roundheaded and flatheaded borers also occur in quince, pear, flowering crabapple, mountain ash, shadbush, cotoneaster, and hawthorn. The flatheaded borer and one or both of the two *Prionus* species are also serious pests of numerous other trees, including pecan, hickory, poplar, willow, chestnut, oak, maple, dogwood, linden, and several shrubs.

### Adults

The adult roundheaded appletree borer is an attractive beetle about 5/8–1 inch (15–20 mm) long, olive brown with two longitudinal white stripes running the length of the body, and gray antennae, which are stout, many-segmented, and approximately body length. Its legs are also gray, the underside of the insect is silvery white, and its entire body is covered with fine hairs that give it a neat appearance (fig. 1). This species requires 2–3 years to complete its development, depending on location; most (perhaps two-thirds) occurring in New York probably require 3 years. Beetles emerge mostly at night through round, pencil-size holes from the bases of infested trees over a period of 2–3 weeks, usually during mid-June in New York, although they may appear in the trees as much as a month earlier. After emerging, the adults feed on the leaves, twigs, and fruit of host plants. Mating occurs about one week after emergence, and the fe-



**Fig. 1. Adult roundheaded appletree borer (actual size)**



**Fig. 2. Adult flatheaded appletree borer (2x actual size)**

male lives approximately 40 days, normally hiding by day and secretively laying eggs, usually in young healthy trees. The female makes a longitudinal cut with her mandibles in the bark near the base of the tree, inserting a single egg between the bark and xylem and cementing it in place with a gummy secretion.

The flatheaded appletree borer adult is a short-horned beetle measuring approximately 5/8 inch (15 mm) in length. It is flattened above and vaguely resembles the elaterid (click) beetles (fig. 2) but has no similar jumping structures. This beetle has short antennae, large conspicuous eyes, and forelegs with a noticeable tooth. The upper surface of the body is dark metallic brown, with slightly patterned wing covers, and underneath (as seen in flight) the body is a bright metallic blue. The undersurface of the adult is coppery bronze. This species is diurnal in habit, at its most active in the heat of the day, and is often seen basking in the sun on fallen trees or logs. The flatheaded appletree borer is a very active insect that runs rapidly and flies readily when disturbed. Beetles appear after mid-May in New York, feeding at the bases of twigs on partially defoliated young trees, and lay eggs in crevices or under bark scales through the summer months. This insect takes about 1 year to develop.

The two species of prionus borers are similar in appearance and biology. The adults are robust, broad, somewhat flattened, and blackish to reddish-brown beetles, with antennae roughly half the length of their body (fig. 3). Adults of the broad necked root borer are as much as 1 3/4 inches (45 mm) long with 12 antennal segments, and those of the tilehorned prionus are nearly 1 1/2 inches (37 mm) long with 16–20 antennal seg-

ments. They emerge from the soil in early to midsummer, probably mostly in July in New York, hiding beneath loose bark or debris at the base of the tree except during dusk and at night. The females live for only 1–2 weeks but are capable of producing hundreds of eggs during that time, mostly in the soil near the base of host trees. Beetles fly at night and may be attracted to lights; female broad necked root borers have not been observed to fly.

## Eggs

Egg-laying by the roundheaded appletree borer occurs mainly in June and July, although it can extend through the summer. The eggs are initially light cream in color, later darkening to a pale rust-brown; they are 1/8 inch (3–4 mm) long and one-third as wide, rounded at both ends. Eggs hatch in 15–20 days.

Although flatheaded appletree borer females lay their eggs singly, one site may be visited several times by one or more females, so small groups of eggs are often found in the same vicinity. The egg, which is a pale yellow, flattened disk with a wrinkled surface, has a diameter of just over 1/20 inch (1.3 mm). It is attached firmly to the bark surface and hatches in 15–20 days.

Prionus eggs are light yellow and elongate oval, with irregular punctures, and measure about 1/8 inch (3.5 mm) in length. Eggs hatch in 2–3 weeks.

## Larvae

The roundheaded appletree borer larva, a fleshy, cream-colored, legless grub, is about 1/8 inch (3–4 mm) long upon hatching and 1 inch (25 mm) when fully grown; it reaches nearly twice this length during its development, but a considerable shortening occurs just before pupation. It has a dark brown head and blackish mandibles. The first thoracic segment is broader than the rest of the body, with a patch of brownish tubercles on the dorsal (top) surface. The body segments are separated by deep constrictions, and most have large oval spiracles on either side (fig. 4). This species passes through six instars during the course of its larval development, moving upward or

downward in the trunk depending on the year and stage of growth, feeding on the inner bark (or cambium) layer, and widening its tunnels as it feeds. Some of the frass produced fills the tunnels (fig. 5), and some is pushed through openings to the outside, where it accumulates in small piles and has the appearance of sawdust at the base of the tree. By the end of its third season of feeding, the larva has bored several inches straight up in the trunk (fig. 6) and constructed a pupal chamber just beneath the bark surface, where it passes its final winter.

The larva of the flatheaded appletree borer shows a characteristic enlargement of the thoracic segments (just behind the head), particularly the second segment, which gives this insect its common name. This grub is light yellow and when full grown is nearly twice the length of the adult (fig. 7). It is commonly found curved like a horseshoe, sluggish and inactive except in very warm weather. Upon hatching, the borer usually enters the bark directly and, if the wood is in favorable condition (that is, weakened, diseased, or dying), burrows at once into the inner bark, where it feeds on the sapwood and develops rapidly. If the tree is vigorous with a heavy sap flow, the borer is often unable to thrive in the growing tissue and either dies or survives poorly for an extended period. The flatheaded appletree borer lives for the most part just beneath the bark, where it excavates broad, flat, and irregular channels filled with powderlike frass, until late in the summer as it approaches maturity, when it abruptly burrows more deeply into the solid heartwood and constructs a pupal chamber.

Larvae of the prionus root borers are among the largest insects that attack apple trees. These large grubs are fleshy, elongate, and creamy white to yellowish, with three pairs of small legs and small heads armed with strong black mandibles (fig. 8). Mature larvae reach lengths of 3 1/2 inches (9 cm) or more and weigh up to 1/2 ounce (15 g). After hatching, the young borers dig down to the roots and begin feeding on the bark. They move through the soil from one root to another, feeding on the surfaces of small roots, and eventually enter the wood of larger roots, which they hollow, girdle, or sever (fig. 9). In the summer, the larvae feed on the roots in the upper 6–18 inches (15–45 cm) of the soil, but in winter they are often located at nearly twice these depths. The feeding and develop-

### Apple-Boring Beetles Fact Sheet Figure Captions



Fig. 3. Adult broad necked root borer (actual size)



Fig. 4. Roundheaded appletree borer larva (4x actual size)



Fig. 5. Galleries of roundheaded appletree borer showing frass



Fig. 6. Roundheaded appletree borer burrow in tree



Fig. 7. Flatheaded appletree borer larva (3x actual size)



Fig. 8. Broad necked root borer larva (one-third actual size)

ment periods last 3–5 years for the tilehorned prionus and 3–4 years for the broad necked root borer. In early spring, mature larvae rise to within 3–6 inches (6–12 cm) of the surface to pupate.

## Pupae

Mature larvae of the roundheaded appletree borer pupate in April to May in New York; the pupal stage can last between 19 and 30 days, depending on when it begins. During this stage the larvae start out yellowish and gradually darken, somewhat resembling the adult in form, with the legs, wings, and antennae visible, although tightly pressed to the body (fig. 10). After transformation to the adult, it generally remains in the chamber for 10–14 days before gnawing a hole through the bark and emerging.

In New York, the flatheaded appletree borer pupates in the spring after changing to a deeper shade of yellow. The pupa averages 1/2 inch (12 mm) long and half as wide, resembling a small pumpkin seed, and eventually turns a metallic brown in color. It transforms into the adult form in 3–5 weeks, and the beetle escapes by cutting an elliptical exit hole in the bark.

Pupation of the prionus root borers takes place in large, oval earthen cells. The pupa is colored similarly to the larva, with smooth, shiny skin and abdominal segments prominently separated like accordion pleats. It can reach up to 2 3/4 inches (7 cm) in length; pupation lasts about 25 days.

## Damage

The roundheaded appletree borer is considered to be the species of boring beetle most destructive to fruit trees in New York. Toward the end of the 1800s it was deemed second in importance only to the codling moth as an apple pest, and there was some speculation that it might cause the demise of New York's apple industry. Because of the adult's susceptibility to pesticides applied against other pests in most commercial orchards, however, it is found today mainly in abandoned, wild, or unsprayed plantings. Trees of all sizes are attacked, but those from 3 to 10 years old suffer the most. Frequently, several larvae may be found in a single tree, which is enough to girdle a

young tree completely. Infested trees have a sickly appearance, producing sparse, pale-colored foliage (fig. 11). Continued yearly attacks can kill the tree or weaken it so that it is broken off by the wind. Young trees that have been girdled will often bloom profusely and set a heavy crop of fruit and then die in the process of bringing it to maturity.

Unlike the roundheaded appletree borer, the flatheaded borer preferentially attacks diseased or dying trees, inhabiting all parts of the tree from the base of the trunk to the limbs; the injuries it causes are practically confined to newly transplanted nursery stock and to trees that have been weakened from causes such as inappropriate pruning, drought, or inadequate soil or nutrient conditions. Trees suffering from sun scald are particularly subject to attack. Points of larval activity are difficult to locate because scarcely any castings are thrown out, although white, frothy sap may be seen oozing from cracks in the bark. Injured spots can usually be detected by the darker color and slight depression of the bark, which may split over time; these sites may be enlarged year after year by succeeding generations that attack the borders of the wound in the dead wood around the injury. Like many borers, the flatheaded appletree borer will often girdle a small tree, and a single larva can kill the tree.

The broad necked root borer and tilehorned prionus are exclusively root feeders; the only aboveground symptoms of infestation are a gradual thinning and yellowing of foliage and limb-by-limb mortality. Young trees are sometimes chewed off just below the surface and their root systems devoured. Established trees may have one or two roots left near the surface that keep them alive until blown over by the wind. Whole-tree excavation is usually the only method of verifying the insects' presence and often reveals root and crown areas with extensive honeycombing (fig. 12). Some of the galleries in large roots are filled with wood chips and frass, which eventually turn dark from the action of decay organisms (fig. 13). It is not unusual to find several to 20 or more borers in one tree.

## Management

All of these borers are among the most difficult to control of the insects that attack fruit trees because they are concealed



Fig. 9. Broad necked root borer in crown of apple tree



Fig. 10. Pupa of roundheaded appletree borer in its pupal chamber



Fig. 11. Tree damage caused by roundheaded appletree borers



Fig. 13. Gallery of *Prionus* borer showing darkened frass



Fig. 12. Portion of an apple crown showing galleries made by *Prionus* borers

## GUIDE TO STAGES

Stage		Timing	Where to Look
Adult	Roundheaded appletree borer	Mid-June through August	Bases of trees, usually concealed
	Flatheaded appletree borer	Mid-May through August	On trunks or fallen logs, in open sun
	Prionus root borers	July	Bases of trees, beneath bark or debris; attracted to lights
Eggs	Roundheaded appletree borer	June and July	In bark of tree near base
	Flatheaded appletree borer	June through August	Under bark scales and in crevices
	Prionus root borers	July	In soil near base of tree
Larvae, Pupae	Roundheaded appletree borer	During bloom and September	Bottom 12–24 inches of trunk, beneath small pinholes showing sawdust castings
	Flatheaded appletree borer	June and July	Just beneath discolored, depressed patches of bark, near exuding sap
	Prionus root borers	Summer months	In roots in upper 6–18 inches of soil

during the majority of their developmental period. No single management method has been proven fully effective, and the most successful efforts involve a combination of preventive and remedial techniques.

- **Cultural Practices.** New trees should not be started in areas in proximity to the borers' wild host plants, especially flowering crabs, thorns, hawthorns, or *Amelanchier* spp; destruction of any such plants within 300 yards of the orchard will greatly improve its chances. Keeping the base of the trees free from rank growth of weeds, grasses, briars, and shrubs not only makes it easier to detect and remove borers but also exposes them to natural enemies such as golden and downy woodpeckers, ants, and a small number of parasitic wasps and flies. Heavily infested trees that are beyond recovery should be removed and burned before the following spring to prevent developing borers inside from completing their life cycle. Keeping trees in a healthy, vigorous condition is one of the best preventive measures against attack by the flatheaded appletree borer, especially for newly transplanted trees. This is also a (somewhat less effective) measure for prionus root borer infestations; disease, drought, mechanical injury, and poor soil conditions increase trees' susceptibility.

- **Foliar Sprays.** The adult population of roundheaded and flatheaded appletree borers can be reduced by application of the pesticides commonly used to control plum curculio and codling moth in New York, particularly those applied at the beginning and end of June. Sprays of broad-spectrum insecticides against prionus borer adults are only partially effective.

- **Oviposition Barriers.** In early May, protective coverings of various materials can be wrapped around the bottom 12–24" of trunks (higher, up to the level of the branches, for flatheaded appletree borer) to exclude the female beetles from their preferred oviposition sites. Mosquito netting, fine mesh hardware cloth, tree wrap, tarpaper, cotton batting, or even layers of newspaper should be wrapped loosely around the trunk, tied at the top with twine, and covered at the bottom with soil. Barriers should be removed in September, after all egg-laying activity is finished. An alternative method is to paint the lower surface of the trunk with white latex paint; this approach tends to work better on the smooth trunk surfaces of younger trees and should be repeated each year because the paint layer tends to crack with normal tree growth.

- **Surface Deterrents.** Additional protection from ovipositing females is gained by applying a deterrent wash on uninfested trunk surfaces using a paintbrush; an alkaline mixture of insecticidal soap plus caustic potash (lye) mixed to the consistency of thick paint is recommended. This should be applied every 2–4 weeks, depending on rainfall, from late May through July to deter egg-laying by the roundheaded appletree borer.

- **Trap Logs.** A large number of flatheaded appletree borer adults can be trapped out by placing posts or felled logs of almost any kind in the orchard, either pounded in upright or simply lying on the ground and exposed to the sun. These posts can be coated with insect trap coating to catch the beetles or left uncoated until the egg-laying period is past and then removed to another site and burned.

- **Worming.** Destruction of the roundheaded appletree borer by hand is more labor-intensive but can be the most effective measure, depending on the magnitude of the infestation. During bloom and again in September, inspect the bark surface for small pinholes with sawdust exuding from them, checking the lower 24 inches of the trunk to just below the soil surface. Using a sturdy knife, cut through the bark at any such points until the burrow is reached; be careful not to damage the tree further. Insert a stiff wire that is slightly hooked at the end to reach and impale the borer if possible. Additionally, a mixture of pyrethrum in ethanol or PDB (para-dichlorobenzene moth flakes) in cottonseed oil can be injected into the gallery using a grease gun to kill the borers that cannot be reached with the wire. Soil insecticides and fumigants have shown some promise against larvae of the prionus borers, but none that are commercially available are fully effective.

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