



Cornell Cooperative Extension

# TREE FRUIT

## Black Stem Borer *Xylosandrus germanus* (Blandford) (Coleoptera: Curculionidae)

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### Introduction

The black stem borer is an introduced species from eastern Asia that first was detected in NY in greenhouse-grown grape stems in 1932, but has since been documented in most parts of the US. A member of the group known as ambrosia beetles, this generalist wood boring insect can infest a number of ornamental and forest species, including American beech, maple, dogwood, black walnut, oak, and magnolia; infestations in apple were first reported in Ohio in 1982. Damage associated with black stem borers was first reported in 2013 in western NY apples, and infestations have been found as far east as Long Island. This species probably was present in New York apple growing regions for some years before first being detected. Nearly every orchard showing characteristic types of tree decline symptoms has black stem borer infestations.

### Adults

The adult female, approximately 1/12-inch (2 mm) in length, is a compact and somewhat hump-shaped shiny black beetle with a hooded head and its mouthparts directed downwards (Fig. 1A). The male (Fig. 1B), which is marginally smaller and light brown in color, has rudimentary hind wings and, unlike the female, does not fly. This species completes two generations per year in New York and overwinters as adults, primarily females, in galleries of host plants, frequently located at the base of the trunk. Such galleries may contain dozens of beetles.



The first beetles emerge after 2–3 days with temperatures above 68°F (20°C). Typically, they become active to infest new hosts beginning in late April to mid-May, or when between 105–190 DD base 50°F have accumulated from January 1. The first flight continues until early to mid-June, with a typically smaller second flight occurring from mid-late June into September. Late in the summer, the beetles migrate to a previously made entry hole in the lower trunk, enter the gallery, undergo diapause and overwinter until they become active again the next spring.

### Eggs

A female can lay anywhere from 2–54 eggs, depending on the host, but clutch size averages about 18; eggs are tiny (~1 mm), white, translucent, shiny, and football-shaped (Fig. 2).

### Larvae

The grub-like larvae (Fig. 3) are white, robust and slightly curved, having visible mandibles but without a distinct head. They move slowly in an undulating manner; it is common to find all stages of the insect living together within a single chamber (Fig. 4). Larvae pass through three instars.

### Pupae

Pupation occurs after a prepupal period of 2–3 days; newly pupated individuals are white, but within 2 days the eyes, mandibles and wings darken and become distinguishable (Fig.



Figure 1. Black stem borer adult female (A); photo: S. Valley; used with permission; and male (B); photo: A. Agnello.

5). Development from egg to the adult stage takes approximately 30 days.

### Damage

The adult female attacks by boring 1-mm-diameter holes (Fig. 6) into the trunk to form galleries in the heartwood of trunks or limbs of stressed, dying or recently dead trees. Galleries excavated by the female that initiates the infestation (known as the foundress) contain entrance tunnels, brood chambers with eggs, adults and immatures (Fig. 4), and branch tunnels where the young develop; this arrangement accommodates all life stages and development in the insect's life history.

Ambrosia beetles derive nourishment during the larval and adult stages from a symbiotic fungus carried by the adult female in a mycangium, a specialized, internal pouch located on the insect's back, behind the head, and introduced into host plants during gallery excavation. The ambrosia fungus associated with *X. germanus* is *Ambrosiella grosmanniae*, visible in the galleries as an abundant grayish-white fungal growth lining the chambers and tunnels (Figs. 2 and 4).

Studies suggest that this species invades from nearby wooded areas to attack stressed apple trees. A variety of stressors,

including flooding, drought, and temperature extremes have been identified as potential causes of physiological stress that preferentially attract ambrosia beetles. Trees under this type of stress produce several types of volatiles, among them ethanol, which has been found to be a strong attractant to the adults.

The beetles feed directly on the fungal growth, rather than the host plant tissue. However, their presence signals to the tree that it is under attack, and as the tree walls off its vascular system in response, symptoms develop during the summer that include wilting, dieback, tree decline and death (Fig. 7). Infested trees often have discolored and blistered bark around the attack site. A "toothpick" of compressed sawdust, pushed out as the beetle bores into the trunk, may be seen sticking out of the entrance hole (Fig. 8), although this is often dislodged by wind or rain. Some trees drip sap that resembles fire blight ooze from the entry holes (Fig. 9). Attack sites tend to be confined to the bottom 1–2 feet of trunk (Fig. 10), but can sometimes extend along the central leader up to head height (Fig. 11).

### Monitoring and Management

Most orchards where black stem borer infestations are detected tend to be dwarf, high-density (e.g., tall spindle or super spindle) plantings, in areas of wet soil conditions (Fig. 12), or



**Figure 2.** Brood chamber (with egg circled) showing mycelial growth of *Ambrosiella grosmanniae* fungus. Photo: E. Tee.



**Figure 4.** Adults and mixed brood in chamber. Photo: A. Agnello.



**Figure 3.** Black stem borer larvae. Photo: A. Agnello.



**Figure 5.** Black stem borer pupa. Photo: A. Agnello.

alternatively, where no irrigation is available. Damage tends to occur on orchard margins near wooded areas, and where air drainage promotes exposure to extreme cold temperatures. Although these borers typically attack stressed trees that give off ethanol volatiles, they also have been reported to attack “apparently healthy” trees. If the weather is calm and dry, it may be possible to see the sawdust “toothpicks” pushed out of the holes, which may be surrounded by flaky bark. Upon close inspection, small pinpricks (1 mm diameter) may be found (Fig. 13), sometimes with the tiny black beetle visible in the hole.

Because ethanol strongly attracts adults, growers can start a trapping program in the spring using ethanol-baited plastic bottle traps (Fig. 14A, B), checking them weekly. Traps are made from plastic juice or soda bottles with 2 x 4-inch windows cut in the four sides, baited with a commercially available ethanol lure and a drowning solution of dish soap and water (Fig. 14 A). Peak flight corresponds with the major infestation activity and occurs from mid- to late May. Very wet spring or fall weather and poor soil drainage can result in more damage the following season.

In commercial ornamental tree nurseries, where this species is a serious pest, growers routinely rely on insecticide trunk sprays to prevent new infestation and colonization of trees by ambrosia beetles, but successful control is difficult. Although several chemical and biological control methods have been tested, researchers have not yet identified a strategy that will prevent beetle infestations in the absence of frequent trunk sprays. Insecticide trunk sprays, while not completely effective, may offer some level of control; applications should be closely timed with beetle attacks, and multiple applications may be necessary. For the most current management recommendations, consult the Cornell Pest Management Guidelines for Commercial Tree Fruit Production.

It appears that maintaining tree health – avoiding stress to the trees – is an important factor in black stem borer management. If an infestation of black stem borers is found, it is recommended to remove the infested trees (along with the rootstock), and take them to a location where they can be burned immediately to prevent re-infestation by emerging adults.



**Figure 6.** Entry holes in apple trunk. Photo: J. Carroll.



**Figure 7.** NY2 tree showing midsummer decline from black stem borer infestation. Photo: A. Agnello.



**Figure 8.** Compressed sawdust “toothpicks” pushed out by beetles boring into apple trunk. Photo: E. Tee.



**Figure 9.** Sap oozing from multiple infestation sites. Photo: E. Tee.



**Figure 10.** Entry holes at base of infested tree. Photo: A. Agnello.



**Figure 11.** Attack sites along central leader. Photo: A. Agnello.



**Figure 12.** Wet orchard site exhibiting tree loss from black stem borers. Photo: E. Tee.



**Figure 13.** Close-up of entry sites with adult. Photo: E. Tee.



**Figure 14.** (A) Black stem borer trap using juice bottle and commercial ethanol lure. Photo: A. Agnello; (B) Black stem borer adults captured in bottle trap. Photo: E. Tee.



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