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BIOLOGY AND MANAGEMENT OF CLEARWING BORERS IN WOODY PLANTS^{1,2}

by D.A. Potter and G.M. Timmons

Abstract. Clearwing borers are injurious and difficult to control pests of woody ornamental plants. Diagnosis and general control practices for borers are discussed. Emergence and flight periods, based on trapping studies with synthetic sex attractants, are reported for six common clearwing borers, and optimal treatment dates are projected. Research indicates that trees with certain characteristics, such as bark injuries or exposure to full sun, are especially prone to infestation. Proper site selection and tree management can help to prevent borer problems.

Clearwing borers (Lepidoptera: Sesiidae) are common and destructive pests of woody plants. Borer larvae tunnel and feed in living wood, destroying vascular tissues and causing loss of vigor, structural weakness, branch dieback, or complete girdling and death of trees. Infestation sites may provide entry points for disease pathogens. Trees in the urban landscape, which may already be under stress, are especially prone to borer attack. Because borer-infested plants may not legally be sold, economic thresholds for borers in nurseries are very low.

Adult clearwings are colorful, day-flying moths which bear close resemblance to wasps. Although they can not sting, this mimicry no doubt protects them from birds and other predators. Eggs are laid near trunk wounds or in crevices in the bark. The young borers hatch in 1-2 weeks and quickly tunnel into the tree. Once beneath the bark, the borers are protected from insecticidal sprays and

are seldom detected until serious damage has been done.

This article describes the diagnosis and general biology of those clearwing borers which are particularly damaging to woody ornamental plants. Flight periods and optimal treatment dates for central Kentucky, based on 3 years of trapping studies with synthetic sex attractants, are reported for the lilac borer, dogwood borer, peach tree and lesser peach tree borers, oak borer and *Podosesia aureocincta*, an ash borer. We also discuss management practices which help to minimize borer problems in landscape trees.

Diagnosis

Off-color foliage, wilting of terminal shoots, and dieback of the crown are early symptoms of borer attack (Fig. 1). Infestation sites are often marked by scars or callus formation, adventitious growth or large areas of cracked or loose bark, particularly near the ground or where the main branches join the trunk (Fig. 2). Larger branches may die or become weakened and prone to wind breakage. Older trees may persist in an unthrifty condition and be reinfested year after year.

Feeding holes left by woodpeckers or other birds are a good sign that borers are working under the bark. In spring, wet spots caused by oozing sap may stain the bark around infestation

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sites. Active borers expell coarse brown frass (fecal material and wood particles) which accumulates around holes or cracks in the bark or at the base of infested plants. In some hosts, especially *Prunus* spp., the frass may be mixed with profuse exudates of gum. Empty, tan-colored pupal skins, left partially protruding from the bark by emerging adults, are another sure sign that borers are present.

Spray Timing is Important

Insecticidal sprays for borer control are effective only if a lethal residue is on the bark during the brief period between egg hatch and initial entry into the tree. In the past, arborists relied on persistent chemicals such as DDT and dieldrin. These were applied in spring before adult emergence and left residues that remained throughout the larval hatching period. Shorter-lived insecticides

must now be used because of federal restrictions on these persistent compounds. Sprays should be applied just prior to larval hatch so that borers will be poisoned before or as they tunnel into the tree. However, timing of sprays is complicated by phenological variation among borer species in different geographic areas. Until recently, there was no way to accurately determine when the borers were vulnerable to insecticidal treatments.

In 1973, USDA researchers identified the main components of 2 clearwing moth sex pheromones, the volatile, air-borne chemicals emitted by females to attract males for mating. Since then, synthetic sex attractants have been developed for many important species (3). In Kentucky and other states, pheromone-baited sticky traps (Fig. 3) are being used to obtain accurate records of species distribution and flight periods. Pheromone trap data provide a basis for more effective spray

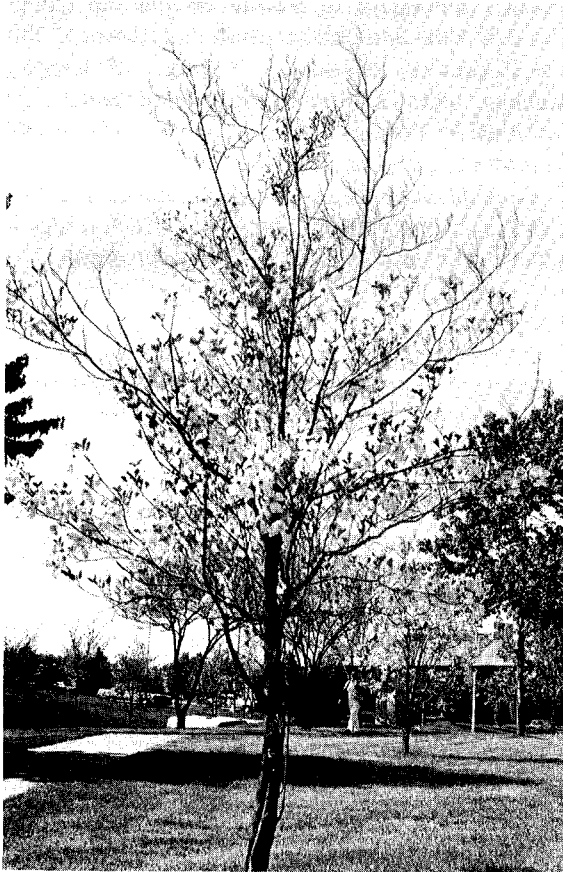


Figure 1



Figure 2

schedules. Capture of males indicates that mating and egg-laying by that species has begun. The first spray is applied 10-14 days after first sustained male catch, to coincide with the beginning of the larval hatching period. A second spray is required if flight continues for more than 6 weeks.

Lindane and Dursban (chlorpyrifos) are registered for control of clearwing borers on lilac, dogwood, rhododendron, oak and peach. Dursban 2E, applied at label rate (1 lb a.i./100 gal = 4 tsp/gal) has given excellent control of lilac, peach tree, and lesser peach tree borers (4) and rhododendron borer (2). In our tests (7) both Dursban and Lindane provided good control of dogwood borer. When applying sprays, it is important to soak the main branches and trunk thoroughly. Dursban may be used only by certified professional applicators.

Biology and Flight Periods

From 1979-82, sticky traps baited with synthetic sex attractants were placed in woodlots, nurseries, cemeteries and orchards in Louisville and Lexington, Kentucky. Traps were hung in early spring and monitored weekly throughout the growing season. Average dates to first, peak, and 90 % total catch, together with suggested treatment dates are listed in Table 1. Note that these dates pertain to central Kentucky and appropriate time shifts should be made for more northern or southern localities.

The **lilac borer**, *Podosesia syringae* is a severe pest of lilac, privet and ash. The borer is

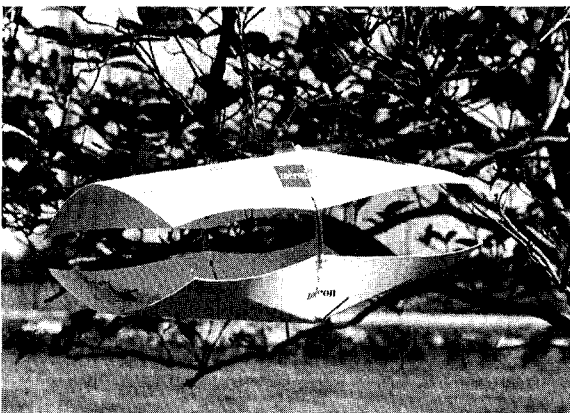


Figure 3

distributed throughout the U.S. east of the Rockies (8). Flight activity in Kentucky generally begins in late April, peaks in early June and declines by early July. Eggs are laid on rough bark or near trunk wounds. After hatching, the young larvae tunnel first just under the bark and later in the sapwood. Most infestations occur from the root crown up to a height of 1 meter. In Ohio, damage to nursery-grown lilacs was estimated at more than \$5000 per acre per cropping cycle (6).

A single, well-timed spray will provide adequate control of lilac borers. In Kentucky, the recommended treatment date for average years is May 6-10, about the time that Winter King hawthorn and Double File viburnum are coming into bloom.

Flowering dogwood is the preferred host of the **dogwood borer**, *Synanthedon scitula*, although the borer also attacks pecan, hickory, apple, cherry and other trees. Dogwood borers feed just under the bark in the phloem and cambium. One or 2 larvae may be enough to completely girdle and kill a small tree. Young trees are usually infested near the ground, often near lawnmower injuries, while infestations in older trees are more likely to be up in the limb crotches or main branches, associated with pruning scars, cankers, or areas of cracked and raised bark (6). The dogwood borer is widely distributed wherever dogwoods are grown.

Earlier references to the dogwood borer (9, 11) state that emergence and egg-laying begin in spring and continue throughout the growing season. However, our research has shown that there are 2 distinct flight peaks in Kentucky (Table 1). Larvae of all sizes overwinter under the bark. The first pulse of dogwood borer flight begins in late May, peaks around June 7 and declines in late June. Only a few males are captured in July. A second, larger flight pulse begins in late July, peaks around August 22 and declines in mid-September. We know that the first pulse represents emergence mainly from dogwood, and the second pulse consists mainly of adults emerging from apple and possible other alternative hosts. Consequently, flowering dogwoods can be protected with a single insecticidal spray applied just after Memorial Day.

The **peach tree borer** and lesser peach tree borer are important as orchard pests and as pests

Table 1. Seasonal flight periods and suggested treatment dates for clearwing borers, based on pheromone trapping in Lexington, Kentucky, 1979-82.

Borer species	Principal hosts	Average date to			No. of treatments (n) and recommended trt date (s)
		First catch	Peak catch(es)	90% catch	
Lilac borer	lilac, privet ash	April 26	June 9	June 25	(1) May 6-10
Dogwood borer	flowering dogwood	May 21	June 7 and Aug. 22	Sept. 4	(1) May 31-June 4
Peachtree borer	<i>Prunus</i> spp.	June 1	Aug. 9	Aug. 29	(2) June 18-24 July 30-Aug. 4
Lesser peachtree borer	peach, plum flowering cherry	May 1	Sustained heavy flight	Sept. 1	(3) May 11-15 June 22-26 Aug. 3-7
Oak borer <i>Podosesia aureocincta</i>	oak ash	May 18 Aug. 10	May 24 Sept. 1	June 11 Sept. 16	(1) May 28-June 1 (1) Aug. 20-24

of peach, flowering cherry, and other *Prunus* species in the landscape. Both are widely distributed in North America. Larvae of the peach tree borer (PTB), *Synanthedon exitiosa*, feed just under the bark from the root crown to just above ground level. Younger trees are preferred. Larvae of all sizes overwinter in galleries near the base of the tree, completing their development and pupating from mid-May to August. Unlike the dogwood borer, this species has a single, prolonged flight period in Kentucky. The first PTB adults emerge in early June, but generally only small numbers are trapped until July. Flight activity peaks in early August and declines by mid-September. Because of the lengthy flight period, 2 treatments are needed to control the PTB. At Kentucky latitudes, the first spray should be applied in late June and the second in early August.

The **lesser peach tree borer** (LPTB), *Synanthedon pictipes* shows a preference for older trees, and is less likely than the PTB to be a primary pest. It generally bores in the upper trunk and scaffold branches, often around cankers or areas damaged by sunscald, winter injury or pruning.

Others have reported 2 flight peaks for LPTB in orchards (1). However, trap catches from landscape plantings in Kentucky indicate that sustained heavy flight occurs from May to September. Because of the limited residual toxicity of sprays, 3 applications are needed to protect trees from LPTB. In Kentucky, the first spray should be applied in mid-May, about the time that *Weigela* and *Philadelphus* (mock-orange) are com-

ing into full bloom. Additional sprays should be applied in late June and early August.

The **oak borer**, *Paranthrene simulans* is a pest of oaks throughout the eastern U.S. and Canada. In the south, the borer attacks mainly mature red oaks (10), while in Kentucky and Ohio it is most damaging to young trees, especially pin oaks. Coarse, brown frass and areas of dark, sap-stained bark may be evident on infested trunks and limbs. The mature larva pupates in the tree and the adult, which resembles a yellowjacket wasp, emerges in the spring. The flight period is relatively short, from mid-May to mid-June in Kentucky. Hence, the oak borer can be controlled with a single, well-timed spray, applied (in average years) on or shortly after Memorial Day.

Another **clearwing borer**, *Podosesia aureocincta*, is found only in ash (8), causing damage to landscape and nursery trees. *P. aureocincta* is closely related to the lilac borer, and there has been considerable confusion between the two species. Larvae of *P. aureocincta* tunnel in the trunk and limbs from ground level up to several meters. The borer overwinters as a partially grown larva, and feeds actively during spring and early summer before pupating in the gallery. Adults emerge in August and September, well after flight of the lilac borer has ended. A single spray, applied in late August, should provide adequate control of *P. aureocincta* in ash.

Factors Predisposing Trees to Borer Attack

Clearwing borers rarely injure healthy trees in their native environment. However, when trees such as dogwoods, oaks or rhododendrons are

transplanted into the landscape or grown in nurseries, environmental stress factors such as moisture deficiency or sunscald can weaken them and make them more susceptible to attack. Moreover, injuries inflicted by lawnmowers or other equipment can provide ideal oviposition sites or provide entry points for young borers. It is important to maintain vigorous trees and to recognize and avoid practices which predispose trees to borer attack.

In a large cemetery in Louisville, Kentucky, a study was conducted to determine if certain tree and site characteristics were associated with higher than average rates of infestation by the dogwood borer (6). On May 15, shortly before first emergence of dogwood borers, 160 dogwood trees of varying sizes were tagged and numbered. Trunk diameter was measured and each tree was characterized with regard to sun exposure, severity of trunk wounding, degree of crown dieback, and color of bloom. The trees were left undisturbed until November, when all new borers had hatched and were feeding under the bark. Each tree was then inspected for evidence of frass, and all galleries were excavated enough to confirm the presence of a live borer.

The results of this study (Table 2) indicate that dogwood trees with certain characteristics were especially susceptible to borers. Trees planted in full sun were more than 3 times as likely to be infested as those in full shade; and the infestation

rate for trees with severe trunk wounds was nearly twice that for non-wounded trees. Both of these increases were statistically significant. Trees with crown dieback or pink bloom were also somewhat more likely to be infested. We found no relationship between a tree's size and its likelihood of being infested, but feeding sites tended to be higher up in the older trees.

These results support the premise that problems with borers may be reduced by proper site selection and tree management. The following guidelines can help to prevent borer infestations in trees and shrubs:

I. Minimize tree stress

- a. Avoid planting native understory species such as dogwood and rhododendrons in the full sun.
- b. Select hardy, well-adapted cultivars for a particular region.
- c. Maintain tree vigor by regular watering and fertilizing, and by controlling other pests such as scales, aphids, leafminers, and caterpillars.

II. Prevent bark injuries

- a. Use lawnmower guards, mulch around trees, or remove grass by hand rather than risking bark injuries from a mower or string trimmer.
- b. Avoid pruning trees prior to and during borer flight periods.
- c. Wrap the trunks of newly planted trees, and brace them to prevent movement by strong winds, which can break the young roots so badly needed by a stressed tree.

III. Early detection and timely treatment

- a. Remove badly infested trees, which serve as reservoirs from which borers emerge to reinfest nearby trees.
- b. Inspect susceptible trees regularly for evidence of borers and apply insecticidal controls only during period(s) when borers are vulnerable.

Table 2. Relationship of selected tree characteristics of dogwood trees (*Cornus florida* L.) to probability of infestation by the dogwood borer, *Synanthedon scitula* Harris.

Tree category	No. trees	No. trees with borers	% Infested
Trunk Wounding			
Light	81	33	40.7
Moderate	37	25	67.6
Severe	42	33	78.6
Exposure to Sun			
Full Shade	23	5	21.7
Partial Shade	34	17	50.0
Full Sun	103	70	68.0
Crown dieback			
Light	96	53	55.2
Moderate	32	17	53.1
Severe	32	23	71.9
Color of Bloom			
White	104	53	51.0
Pink	56	39	69.6

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Assistant Professor
and
County Extension Agent for Horticulture,
respectively
Dept. of Entomology
Agr. Science Bldg. N.
University of Kentucky
Lexington, KY 40546

ABSTRACTS

MERRILL, GORY. 1982. **Reflections of an urban forester**. Am. Forests 88(10): 30-34.

Throughout my growing up with trees, I always looked toward the wildlands for forests. I never perceived the urban forest within which the trees of my life were growing. In the early years, "forestry" in the city was equated with mere street-tree maintenance, oriented to the present. Experience has since taught us that maintenance alone will be forever ineffectual without coordination and planning for future plantings.

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"What's wrong with this plant?" More than 50% of the problems are attributable to factors other than insects or mites. Poor cultural practices, various physiological disorders, and improper planting sites are often responsible. The mere presence of insects or mites on the sample does not mean that they are the cause of the problem. Applying pesticides is not the solution to every pest problem. By the time many people notice a problem and bring in a sample, it is often too late to do anything about it. Plants exhibit various types of symptoms when insects and mites feed. Often these symptoms persist on the plant long after the pest is gone. Knowing which pest causes which symptoms helps to determine what the problem is, even if the pest is not present on the sample used for diagnosis. Symptoms of pest damage can be grouped into five broad categories. They are (1) missing plant parts, (2) discoloration, (3) distortion, (4) dead plant parts or dieback, and (5) accumulations of substances that pests leave behind, such as spittle, excrement, honeydew, or cottony material.