Forest Insect
& Disease
Leaflet 163

U.S. Department
of Agriculture
Forest Service

Red Oak Borer

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The red oak borer, *Enaphalodes rufulus* (Haldeman)[3], is an important member of the oak borer complex that permanently damages the wood of living oak trees and causes a decrease in lumber grade. The loss in grade can amount to 40 percent of the current tree value, which, at today's prices, is about $80 per thousand board feet for factory grade lumber in terms of reduced quality caused by larval tunnels. About 38 percent of the oak wood used for lumber, cooperage, and veneer in the Eastern United States is affected.

The red oak borer is native to North America, where it occurs naturally from southeastern Canada and Maine to Florida, and west to Minnesota, Iowa, Oklahoma, and Texas. The distribution map (fig. 1) presents all known county collection records, with the exception of Brewster and Jeff Davis Counties in Texas. This borer also has been found in ornamental nursery stock and shade trees outside its natural range.

The red oak borer has been found in many oak species. Economic loss occurs when borer tunnels and subsequent wood overgrowths in attacked trees are distributed on the grading surfaces of boards and veneer. Wood-inhabiting insects such as carpenterworms, timberworms, and carpenter ants use red oak borer tunnels to gain entry into oaks. These other pests extend and increase the damage begun by the red oak borer. Decay organisms also gain entry into oak heartwood through borer tunnels.

Hosts

Most oaks (*Quercus* spp.) in Eastern North America are attacked by the borer. The most common hosts are northern red oak. (*Q. rubra* L.), black oak (*Q. velutina* Lam.), and scarlet oak (*Q. coccinea* Muenchh.). Less commonly damaged are white oak (*Q. alba* L.), post oak (*Q.*

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[3] Coleoptera: Cerambycidae

stellata Wangenh.), pin oak (*Q. palustris* Muenchh.), bur oak (*Q. macrocarpa* Michx.), overcup oak (*Q. lyrata* Walt.), and laurel oak (*Q. laurifolia* Michx.).

Damage

Certain specific external signs indicate internal red oak borer damage in host trees: extruded frass (fig. 2), discolored bark patches (fig. 3), wet spots (fig. 4), wood slivers (fig. 5), and exit holes (fig. 6). These surface indicators have been associated with different stages of larval development during the insects' 2-year life cycle, and therefore can be associated with defects in lumber and other wood products.

The fine larval frass (fig. 2) is found during the first fall and winter after eggs hatch. Wet spots (fig. 3) and medium-sized larval frass can be found during the first spring and early summer. Discolored bark

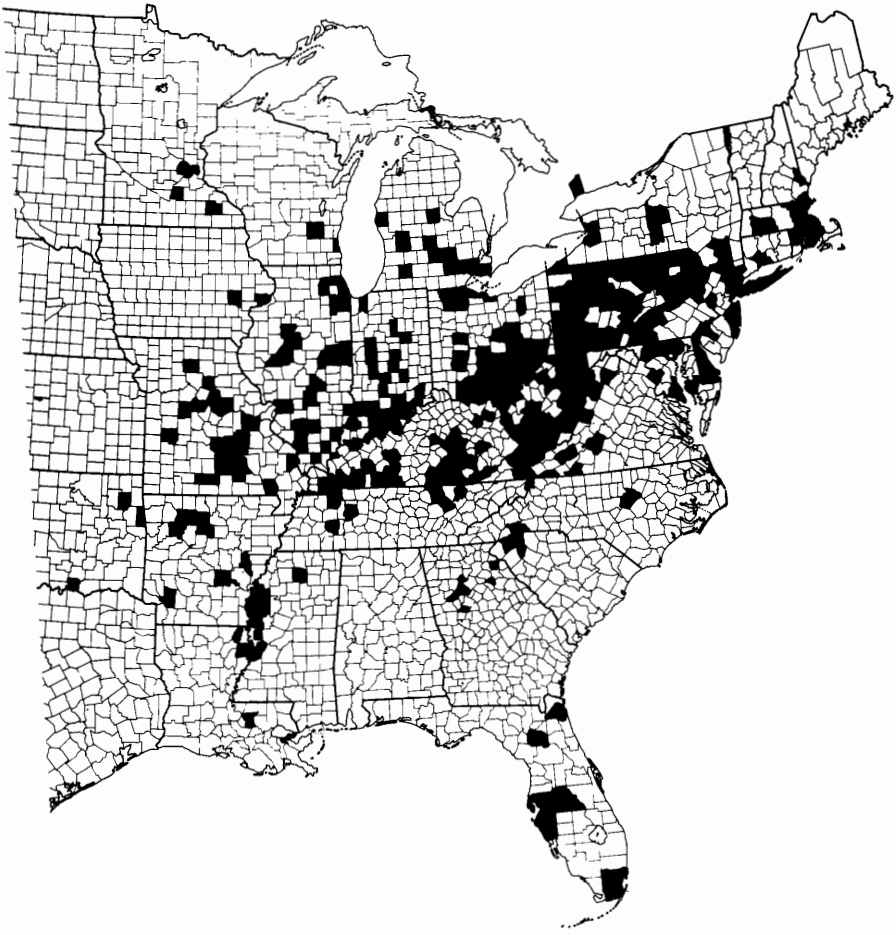

Figure 1.—Range of the red oak borer in the United States.

patches (fig. 4) and large quantities of larval frass occur in the second fall and winter (fig. 7). Wood slivers are extruded in the spring and early summer just before the adult emerges (fig. 5). The adult exits through an oval hole which it chews in the bark (fig. 6).

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Figure 2.—Frass accumulates below a red oak borer attack site.

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Figure 3.—Discoloration around a red oak borer attack site.

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Figure 4.—Sap flow at an early red oak borer wound causes "wet spots" (pins delineate egg-laying site).

Life Stages

The red oak borer has a 2-year synchronous life cycle. The pest has been studied in Pennsylvania, West Virginia, Ohio, Kentucky, Indiana, Illinois, and Missouri (fig. 8). In nearly all cases, adults emerged in odd-numbered years.

The adults (fig. 9) are nocturnal and can be found from mid-June to mid-August. The sex ratio in natural populations is nearly 1 to 1. Mating takes place on the host tree and the female lays an average of 110 eggs. The eggs are attached with an adhesive in cracks, and under lichen patches and vines on host trees. Often, as many as 95 percent of the eggs hatch.

The young larvae begin boring directly through the bark

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Figure 5.—Slivers are the remains of a "plug" constructed by the overwintering larva and pushed out of the tunnel during the second spring activity period.

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Figure 6.—An oval exit hole is made through the bark near the initial attack site.

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Figure 7.—Frass accumulates at the base of an attacked tree.

and spend their first year in the phloem and sapwood making small (2 by 3 by ½ in.) (5 by 7.5 by 1.2 cm.) tunnels (fig. 10). The 2-year-old larvae make larger mines (7 by 3 by ½ in.) (15.5 by 7.5 by 1.2 cm.), and tunnel into the heartwood to construct a pupal cell (fig. 11). The adult emerges near the original oviposition site by gnawing an oval hole through the bark.

Natural Control

Woodpeckers are the most important recognized natural control agents of the red oak borer, often reducing larval numbers by 40 percent. Winter feeding activity by the hairy woodpecker, *Dendrocopus villosus,* and the downy woodpecker, *D. pubescens,* is most successful against first year larvae because these larvae overwinter in shallow furrows in the inner bark. The success of woodpecker predation on second year larvae (fig. 12) within the wood depends on the placement of the woodpecker work relative to the site where the borer entered the wood. Excavation by woodpeckers at the entrance site can reduce adult red oak borer emergence by only 16 percent, but excavation away from the entrance site can result in 40- to 86-percent reduction.

Predation by the formicid ants, *Aphaenogaster flemingi*

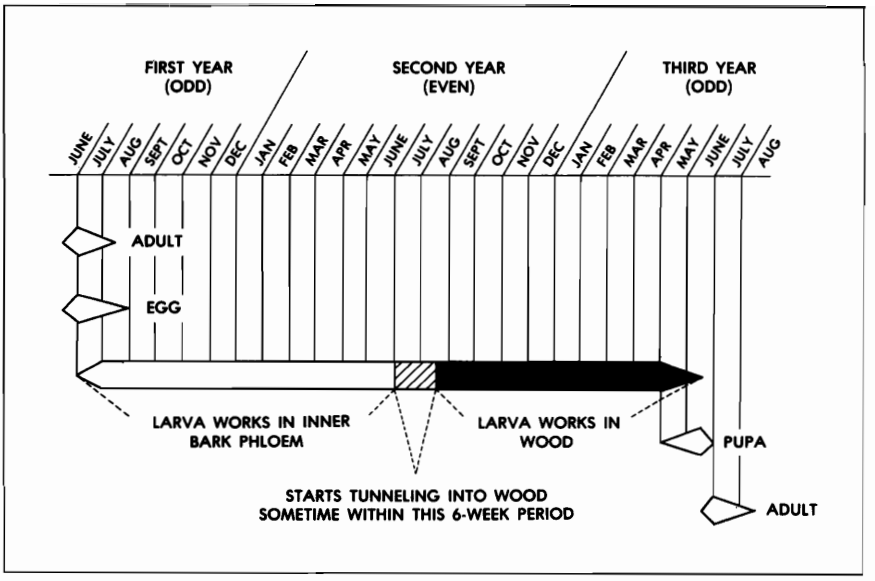

Figure 8.—Life history of the red oak borer in the North Central United States.

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Figure 9.—Red oak borer adult.

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Figure 10.—Longitudinal view of overgrown 1-year-old larval feeding tunnels.

M.R. Smith and A. *treatae* Forel, also provides some degree of natural control.

Applied Control

Borer impact studies showed that only about half of the borer-caused defects produce lumber or veneer degrade. The remaining defects produce no degrade because of their size, location, or association with other degrade-producing factors such as rot, knots, and wane. When the grader disregarded half the red oak borer-caused defects, lumber grade improved and borer impact was almost eliminated. Therefore, any control practice which reduces borer damage by 50 percent will eliminate most borer-caused degrade.

Silvicultural control of the red oak borer has been achieved by removing infested trees from timber stands. Population reductions of 95 percent have been achieved over a 5-year period by this approach. Cultural controls are aimed at decreasing borer numbers in pole-size stands of red, black, scarlet, and white oaks, which reduces the chances of subsequent borer attack in the residual stand throughout its rotation.

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Figure 11.—Two-year-old larval feeding mines and pupal chamber.

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Figure 12.—Woodpecker excavations for red oak borers.

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November 1980

* U.S. GOVERNMENT PRINTING OFFICE: 1980 O—325-427

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