



Role of Predators on an Artificially Planted Red Oak Borer Population

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Abstract

Adult survival of first-instar red oak borer larvae, *Enaphalodes rufulus* (Haldeman), implanted into red oak trees, *Quercus rubra* L., was 4 times greater when the larvae were protected from predators. Nitidulids, ants, and woodpeckers accounted for 40 to 60 percent of the mortality in unprotected larvae. Most mortality in protected larvae occurred from unknown causes during the first overwintering period.

The red oak borer (ROB), *Enaphalodes rufulus* (Haldeman), is a primary borer and damaging pest in living oak trees, *Quercus* spp. The life history of the ROB was reported by Hay (1969) and Galford (1983). Adult ROB emergence occurs from mid-June through August in odd-numbered years in the Northeastern United States. The adults are nocturnal and females lay eggs under bark scales and lichen patches on trees. Complete larval development takes almost 2 years. Larvae spend the first year feeding in the phloem-cambium region of the tree and complete development in the xylem during the second year.

In 1978 and 1979, newly emerged ROB larvae from a labora-

tory culture (Galford 1974) were placed in live red oak trees, *Quercus rubra* L., to determine if larvae from the laboratory strain could still develop into adults in nature. Although some of the 1978 group developed into adults, all of the 1979 larvae apparently were killed directly or indirectly by sap beetles of the family Nitidulidae, which were attracted to sap seeping from ROB feeding sites. The fall of 1979 in central Ohio was unusually wet and the late sap flow attracted hundreds of these beetles.

In 1980 and 1981, studies were conducted to determine the role of predators in ROB mortality by measuring their effect on artificially implanted larvae.

Materials and Methods

This study was conducted from July 1980 to September 1983 at the USDA Forest Service's Forestry Sciences Laboratory in Delaware, Ohio. The 19-year-old red oaks were 6 to 28 cm in d.b.h. and were located in a pure red oak plantation of about 2 hectares.

First-instar larvae used in this study were reared from a laboratory culture maintained for six or more generations on an artificial diet (Galford 1974). The larvae were implanted in the trees within 24 hours after emerging from the eggs. The larvae were placed in the trees in late July and early August, which coincides with the time when eggs of indigenous ROB would have been hatching.

A smooth area of bark was selected for placing larvae in the trees so that protective plastic screening could be stapled tightly on the bark without leaving gaps for entry by predators. A draw knife was used to smooth bark areas on some trees. A small hole was punched into the phloem-cambium region of the tree with a dissecting needle and a newly emerged larvae placed head first in the hole with a small artist's brush. Then a small plastic

bandage strip was stretched tightly over the hole. Thumbtacks were placed on each side of the bandage adhesive pads to secure the bandage. Two to ten larvae were placed in each tree. In 1980 and 1981, 114 and 250 larvae, respectively, were implanted in the trees.

In 1980 and 1981, plastic screening, approximately 12 mesh per cm, was stapled over half of the larval infestation sites on each tree.

In 1980, the bandages were not removed during the 2-year larval development period. In 1981, the larvae in the unscreened group were allowed 2 weeks to become established before the bandages were removed.

The trees were checked weekly during the first year of larval development and monthly the second year. No checks were made from December through March. Frass production by larvae, appearance of sap at the infestation points, ROB survival, and the species and activities of all insects observed at attack sites were recorded.

Results and Discussion

Only 10 of the 114 larvae (9 percent) in the 1980 group completed development; 2 were from the unscreened group and 8 from the screened group. In 1981, only 25 of 250 larvae (10 percent) completed development; 5 from the unscreened group, 20 from the screened group.

Nitidulids, or sap beetles (mainly *Glischrochilus* spp.) were the most important "predators." These beetles destroyed 27 to 32 percent, respectively, of the unscreened ROB larvae in 1981 and 1983. The beetles were not observed feeding on ROB larvae but probably killed them indirectly by feeding around the attack sites, enlarging the holes, and causing ROB larvae to fall to the ground. The enlarged

holes were characteristic of nitidulid activity and easily identified even if no beetles were present.

Ants preyed on 13 and 29 percent, respectively, of the unscreened larvae in 1981 and 1983. Ants were observed feeding on ROB larvae. Ants excavated frass from the galleries until they reached the ROB larvae. Small larvae were carried off whole, while larger larvae probably were consumed in their galleries. Past studies (unpublished) had shown that ants would soon carry off every egg or ROB larvae from open petri plates placed in the oak nursery.

Woodpeckers preyed on 1 percent of the 1980 unscreened group and less than 1 percent of the 1981 group. Woodpecker predation on ROB larvae can be quite variable. In a forest situation in southern Ohio, Hay (1972) reported 33 percent predation by various species of woodpeckers on first-year ROB larvae and 3 percent on second-year larvae. In another study in a forest situation in southern Ohio, (Galford, unpublished) woodpeckers preyed on less than 1 percent of several thousand ROB that were located and observed frequently during the 2-year development period. However, several hundred dead trees in the study area may have been a more readily available food source for the birds, reducing their normal impact on ROB populations.

Mortality from unknown causes during the winter months was the most significant factor in the screened groups. In 1980, 50 percent of the screened larvae died during the first overwintering period. In 1981, 59 percent died during winter. Predators obviously killed unscreened ROB larvae that would have died during winter from other causes. But 4 times as many adults emerged from screened sites as emerged from unscreened sites, indicating that predators are a significant factor in limiting ROB populations.

Literature Cited

- Galford, J. R. **Some physiological effects of temperature on artificially reared red oak borers.** *Journal of Economic Entomology*. 67:709-710; 1974.
- Galford, J. R. **Life history of the red oak borer, *Enaphalodes rufulus* (Haldeman) in white oak (Coleoptera: Cerambycidae).** *Entomological News*. 94:7-10, 1983.
- Hay, C. J. **The life history of a red oak borer and its behavior in red, black, and scarlet oak.** *Proceedings, North Central Branch of the Entomological Society of America*. 24(2):125-127; 1969.
- Hay, C. J. **Woodpecker predation on red oak borer in black, scarlet, and northern red oak.** *Annals of the Entomological Society of America*. 65:1421-1423; 1972.
- Hay, C. J. **Survival and mortality of red oak borer larvae on black, scarlet, and northern red oak in eastern Kentucky.** *Annals of the Entomological Society of America*. 67(6):981-986; 1974.

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