

RESPONSE OF THE BRONZE BIRCH BORER TO PRUNING WOUNDS ON PAPER BIRCH

by John Ball

Abstract. Healthy appearing paper birch trees were pruned at the beginning of the bronze birch borer's emergence period. Some wounds were left exposed while others were treated with a commercial wound dressing. Bronze birch borer adults, particularly females, were attracted to fresh pruning wounds on paper birch. Treating the pruning wounds with a wound dressing did not reduce the wound's attractiveness to the borers.

The bronze birch borer (*Agrilus anxius*) is an insect common throughout Canada and the northern United States. It is a contributing factor in birch dieback, the progressive decline of birch (*Betula* spp.) (20). The borer contributes to birch mortality through the phloem-feeding activity of the larva. Population densities in the phloem are often so high that the network of galleries completely girdles the tree, hastening its death (3).

Previous researchers have noted that bronze birch borer adults have a tendency to be found on the sunny side of the tree (1,6). The majority of ovipositing also occurs on the sunny side of the tree (6), primarily along branch bark ridges (19). This is not universal, however. High temperatures may discourage borers from seeking sunny locations (9,19). Olfactory stimuli may also possibly override this tendency. When the shady side of the tree is wounded, females oviposit there (6). Apparently volatiles are released by dying or wounded tissue that can be detected by the borer (23,24). This was demonstrated for a closely related species, the two-lined chestnut borer (*Agrilus bilineatus*), which was attracted by volatiles released from dying oak tissue (10).

Many dieback control strategies center around managing the borer population. In addition to pesticide applications, a common recommendation over the last seventy years has been to remove dying and infested branches from the tree (2,4,7,8,21,22). Birch is prone to bleeding if pruned during late winter and early spring (17). To prevent bleeding some recommend that birch pruning be

delayed until late spring or early summer (14,16,27,28). This would coincide with the borer's flight period in the Upper Midwest of the United States (29). In this region the bronze birch borer typically begins emerging in early to mid-June with emergence continuing for approximately 5 weeks (9,29).

There are no published reports on the attraction of bronze birch borers to fresh pruning wound. Several studies have demonstrated that the borer is attracted to dying trees, whether naturally or mechanically induced (1,6). One study observed that borers were attracted to a birch that was recently climbed using spurs (6). While lacking supporting data, some publications caution against pruning during the summer months since recent wounds may attract the borer (4,12). Information published in Minnesota indicates August is the month to prune (2), presumably since this is after the flight period of the adult borer in the southern and central part of the state. An Illinois publication suggests that if pruning is done during the summer the wounds be treated with a wound dressing (12).

Applying a dressing to pruning wounds is no longer a common arboricultural practice. Studies have indicated that the treatment has no value in reducing decay, the most common reason for its application (26). Wound dressings are only recommended when pruning during the flight period of boring insects. The dressing may prevent the borers from locating the fresh pruning wounds (13). Several studies have demonstrated that pruning wounds will attract the native elm bark beetle (*Hylurgopinus rufipes*) and the smaller European elm bark beetles (*Scolytus multistriatus*) (5,18). Wound dressing will significantly reduce only the native elm bark beetles chances of locating the trees (5,18). Oak trees pruned during May and June attract sap-feeding nitidulid beetles

(Coleoptera: Nitidulidae) that transmit oak wilt disease (*Ceratocystis fagacearum*). If wound dressing is applied immediately after pruning, infection can be prevented (15).

The objectives of this study were to determine if pruning wounds were attractive to bronze birch borers and, if so, would treating with a commercial dressing have any affect on this attraction.

Materials and Methods

A native population of paper birch (*B. papyrifera*) was located in a park-like stand on the western end of Duluth, Minnesota. During 1989 and 1991, co-dominant birch trees were randomly selected from the stand. These trees were 6 to 8 m tall with a dbh of 12 to 18 cm. They appeared in good health and were rated as class one trees according to the birch dieback classification system (4). Selected trees were between 10 to 20 m from their nearest neighbor.

Thirty trees from this group were pruned each year. Only one branch was removed from each tree. The pruned branches were 5.0 to 7.5 cm. in diameter at the base and were located in the north to northeast part of the lower canopy, within 2 to 3 meters of the ground. Branches were pruned from the tree approximately one week after borer emergence began. The branches were pruned following the natural target pruning procedure (25) and were removed from the site. On fifteen trees the pruning wounds were left exposed, on the others the pruning wounds were covered with a commercial wound dressing (Asplundh tree paint). The wounds were covered with hardware screen (12.5 cm. by 12.5 cm., 0.64 mesh) traps coated with a sticky material (Tanglefoot). One meter above these pruning wounds another trap was placed over the branch bark ridges of unpruned branches. There was only one pair of traps per tree.

In addition to these trees, each year fifteen trees served as controls. These trees were not pruned, but had one trap per tree placed over a branch bark ridge. Based on the results obtained in 1989 an additional fifteen trees were added to the experiment in 1991. These trees also were not pruned, but a branch bark ridge on each tree was treated with wound dressing. All traps were

checked weekly and all captured borers sexed, tallied and removed. The collection continued for 5 weeks.

Trap catches were pooled from both years for analysis. The pruning treatments and their respective controls were analyzed with the Wilcoxon signed rank test and the pruning data, dressing versus no dressing, was analyzed by the Mann-Whitney test.

Results and Discussion

In this study the pruning wounds were found to be attractive to borers. The results should be treated with caution since the capture numbers were low though similar to densities obtained in other trapping studies involving other *Agrilus* beetles (10,11). Presumably the volatile plume from a single pruning wound is fairly small and not easily detected by many borers. The borers can apparently detect wounds and are attracted to them. The wound dressing, however, does not prevent bronze birch borers from locating the wounds. The results from the paired traps show significantly more borers ($P < 0.01$) captured at pruning wounds, regardless of treatment, than were captured on the control traps above the wounds (Table 1). The traps on the control trees captured even fewer borers. This difference may be due to the volatiles released by the pruning wounds drawing borers into the immediate area.

While not statistically significant, the wounds treated with a dressing attracted more borers than the untreated pruning wounds. This differs from research with the native elm bark beetles in that the application of a wound dressing was an effective deterrent to the beetles locating the wound (18). It is consistent, however, with the smaller European elm bark beetle study in that pruning wounds, regardless of treatment, were attractive to the beetles and that the number of beetles captured at pruning sites treated with dressing was higher than on those that were not treated (5). In all three studies, different wound dressings were used so perhaps the dressing formulation itself has an influence on the attraction. It does not appear, at least in this study, that the wound dressing itself is an attractant. The treated branch bark ridges on unpruned branches did not attract more borers

Table 1. Adult bronze birch borers captured on traps placed over pruning wounds or branch bark ridges on unpruned branches.

| Mean (SE) number of beetles per trap* with indicated treatment | | | | | | | |
|--|-----|-------------|-----------|-------------------|-----------|---------------|-----------|
| Year | Sex | Pruned only | | Pruned + dressing | | Dressing only | Control |
| | | wound | control | wound | control | | |
| 1989 | F | 1.5(0.59) | 0.1(0.09) | 1.7(0.82) | 0.3(0.19) | | 0.2(0.15) |
| | M | 0.5(0.17) | 0.3(0.33) | 0.9(0.28) | 0.2(0.11) | | 0.1(0.09) |
| 1991 | F | 1.1(0.44) | 0.1(0.09) | 1.4(0.47) | 0.3(0.12) | 0.1(0.09) | 0.1(0.09) |
| | M | 0.4(0.17) | 0.3(0.12) | 0.5(0.17) | 0.3(0.12) | 0.1(0.09) | 0.2(0.11) |

*trap area=156 sq. cm.

than the control trees (Table 1).

The wounds did not become less attractive over the 5 week period of the experiment. Each year approximately 20 percent of the total trap catches on the pruning wounds occurred during weeks 4 and 5, along with a similar percentage for the controls. Apparently, the volatiles released from the wounds are still strong enough to attract borers throughout their flight period. A future study should examine if pruning wounds made during late winter or early spring are still attractive to the borer when it later emerges.

The ratio of males to females emerging from naturally-infested logs has been reported to be approximately 1:1 (6). The sexes were not attracted to the wounds in this same ratio. The traps over pruning wounds, either treated or untreated, captured over twice as many females as males than the traps covering branch bark ridges on unpruned branches. It was not determined if the females contained eggs.

It has been suggested that *Agrilus* spp. depend upon host-selection for mate-finding (9). However, this may not be true. A study of the two-lined chestnut borer has found that the female is initially attracted to the susceptible tree and then attracts the males to the location (11). While not examined in this study, perhaps a similar phenomenon occurs for the bronze birch borer with the female initially selecting the hosts.

Based on these findings, the recommendation is to avoid pruning birch during the bronze birch

borer's flight period and perhaps even several weeks before emergence begins. Pruning wounds made at the beginning of adult emergence are attractive to adults during the entire flight period. If pruning during the borer's flight period is necessary, treating with wound dressing will not serve as a deterrent. The pruned tree should be treated with a chemical pesticide to reduce the risk of successful attack.

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Résumé. Des bouleaux à papier d'apparence saine étaient élagués au début de la période d'émergence de l'agryle du bouleau. Certaines blessures étaient laissées exposées alors que d'autres étaient traitées avec un enduit commercial de recouvrement. Les agryles adultes, particulièrement les femelles, étaient attirés par les blessures de coupes fraîches. Le traitement avec un enduit de recouvrement ne réduisait pas l'attraction des perceurs vers les blessures.

Zusammenfassung. Gesund erscheinende Papierbirken (*Betula papyrifera*) wurden zu Beginn der Flugperiode des "bronze birch borer's" geastet. Einige Wunden wurden ungeschützt gelassen, während andere mit einem kommerziellen Wundverschlussmittel behandelt wurden. Die erwachsenen Tiere, insbesondere die Weibchen, wurden von den frischen Austungswunden angezogen, wobei die Behandlung mit einem Wundverschlussmittel keine Wirkung auf das Verhalten der Tiere zeigte.