ATTRACTION OF ELM BARK BEETLES TO CUT LIMBS ON ELM[1]

by John A. Byers, Pavel Svihra, and Carlton S. Koehler

Abstract. The smaller European elm bark beetle, *Scolytus multistriatus*, vector of the Dutch elm disease fungus, is attracted to pruned limbs of European and Siberian elm compared to healthy, non-pruned limbs. To minimize the spread of Dutch elm disease it is suggested that pruning of elm limbs be undertaken during the fall and winter when bark beetle activity is reduced or absent.

The smaller European elm bark beetle, *Scolytus multistriatus* (Marsh.), the vector of the Dutch elm disease fungus, *Ceratocystis ulmi,* releases chemical attractants (pheromones) when feeding on elm subcortical tissue resulting in the aggregation of beetles and subsequent colonization of the host (4, 9). Before pheromones are released, the first beetles to arrive at a potential host appear to use, at least in part, elm odors in locating breeding sites (7, 8, 10). Evidence presented by Meyer and Norris (1967a) suggests that *S. multistriatus* flies upwind in response to host volatiles released by American elm logs, *Ulmus americana.* Their experimental method must be questioned since the placements of treatment and control traps were not randomly assigned or even alternated to correct for possible positional effects. In the laboratory, Meyer and Norris (1967a) reported that *S. multistriatus* was attracted to air containing volatiles from either elm logs or elm bark extractives. We performed a chi-square analysis of their data and found no significant differences in attraction between host volatiles and control air (in all comparisons $p > 0.15$). In another study, Meyer and Norris (1967b) showed that beetles were attracted in the laboratory to certain oxidative products of lignin indicating that *S. multistriatus* may utilize compounds in orienting to dying or decaying hardwood trees. Evidence that *S. multistriatus* may orient to freshly cut logs was shown by Svihra and Koehler (1980). They found that Siberian elm, *U. pumila,* and English elm, *U. procera,* logs were more attractive than Chinese elm, *U. parvifolia,* logs or a blank. This attraction to cut elm logs may be caused by the release of larger quantities of alpha-cubebene, a component of the beetle's pheromone (4).

Hart *et al.* (1967) found that the incidence of Dutch elm disease increased dramatically in areas where trees were pruned during the growing season of the previous year. They found in areas with high populations of *S. multistriatus* a few of the recently pruned trees had sustained bark beetle attack in the lower trunk. The Dutch elm disease fungus was isolated from the beetle galleries and the following summer most of the trees wilted from the disease.

We wanted to determine if the observed association of Dutch elm disease with the pruning of apparently healthy elms could be due to the attraction of *S. multistriatus* to pruning wounds. A non-parametric statistical analysis of beetle catch on pairs of sticky traps on pruned and non-pruned branches of English and Siberian elms was used to test if *S. multistriatus* is attracted to recently pruned branches.

Methods and Materials

Thirty-four pairs of 25 × 25 cm hardware screen traps (¼ inch mesh) coated with Stickem Special® were placed on 34 elm trees, 17 were English elm (Pleasanton, CA) and 17 were Siberian elm (Livermore, CA). The traps were attached vertically to limbs (5±2 cm dia.) about 2±0.5 m above the ground. One trap of each pair was fixed to the end of a limb that had been sawn off while the other trap was fixed in a similar way to an apparently normal branch about 3±0.5 m away from the pruned branch. The paired traps were placed on the pruned trees on May 21, 1979 and adults of *S. multistriatus* and *S. rugulosus* were collected from the traps after 6 and 20 days and placed in vials containing hexane. The beetles were counted and identified in the laboratory. Beetle catches were compared

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using the Wilcoxon test (6). Only paired traps were included in which at least one of the traps caught beetles.

Results and Discussion

The catch of *S. multistriatus* on 2 of 11 trap pairs appeared to have been influenced by pheromonal attraction since attacks of the beetle were observed in two pruned branches. On the remaining 9 trap pairs, a total of 19 *S. multistriatus* was caught on traps on the pruned branch while a total of 5 beetles was caught on traps on the non-pruned branch. Statistical analysis showed that the traps associated with pruned branches caught significantly more beetles ($p=0.025$). Only 2 beetles were caught on traps during the first 6 days (on two prune-branch traps) and these data were not used in the analysis. It is not known how much pheromonal attraction influenced the trap catch on pruned branches except in the two cases where hundreds of beetles were caught. However, the non-parametric statistical analysis that was used minimized the effect of these large numbers since the paired comparisons were ranked. Only 9 pairs out of 34 paired traps caught 26 beetles, indicating that the attraction elicited by pruning wounds is rather weak compared to pheromonal attraction (where the 2 prune traps caught several hundred beetles).

The number of shothole borers, *S. rugulosus,* caught on prune-branch associated traps was also higher than on the non-prune-branch traps (25 vs 3) ($p=0.017$).

The wounding (pruning) of English and Siberian elm appears to enhance the release of volatile attractants from the host which increases the response of both *S. multistriatus* and *S. rugulosus*. However, the possibility of the beetle's pheromones enhancing or causing the attraction cannot be conclusively ruled out. *S. multistriatus* that have been attracted and remain to feed on the elm branch because of feeding stimulants (1, 2) would release pheromone and attract additional beetles.

Pruning increases the visitation rate of *S. multistriatus* and probably increases the chances of attack and introduction of the Dutch elm disease fungus. Our results may explain, at least in part, why Hart *et al.* (1967) found a higher incidence of Dutch elm disease associated with elm trees that had been pruned. Thus, pruning should be undertaken during the late fall and winter when beetle flight is known to be minimal or absent (3).

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Department of Entomological Sciences, and
Cooperative Extension
University of California,
Berkeley, California