Environment Canada Environnement Canada
Canadian Forestry Service / Service canadien des forêts

ISSN 0228-9989

# canadian forestry service research notes

Phytoxicity of Dimethoate 4E® to Douglas-fir in Seed Orchards

Effect of Water Sprinkling of Spruce Logs on Bark Beetle Attack

Equipment and Technique for Rapid Determination of Second-Instar Larval Counts from Branch Samples

Frequency of Forest Spraying in New Brunswick

**VOL. 2, NO 2, APRIL–JUNE 1982**

Canada

also have effects, since not all ramets or seedlings from one family were equally sensitive to burning. The degree of needle burn was not correlated with position in the orchard.

It is not known if the trees were sensitive to the active ingredient or to another constituent of the insecticide formulation, such as the emulsifier. The previous studies that indicated little or no phytotoxicity at the concentrations applied used a technical grade of dimethoate or the Cygon® formulations and not the formulation used in this study (Dimethoate 4E®). The differences in the levels of phytotoxicity observed in this study and in previous studies may be caused by differences in the trees that were treated. In the previous studies, a small number of "wild" trees were treated, not specific clones or families as in this study. The proportion of clones or families that were moderately or severely burnt in the orchards was low, 13% or less, and may be even lower in non-orchard stands if orchard practices, such as grafting, make trees more susceptible to damage by dimethoate. Susceptible trees may be missed when selecting trees for small-scale efficacy tests.

Only two severely burnt trees died, both at Tahsis Seed Orchard. The other severely burnt trees survived because the vegetative buds flushed 1–2 wk after dimethoate application. Application of dimethoate after vegetative flush, for control of Cooley spruce gall aphid, *Adelges cooleyi* (Gill.) (Homoptera: Phylloxeridae), could result in considerable mortality within the sensitive tree clones or families. The consequences of treating sensitive trees just before vegetative flush in consecutive years is not known.

The burning of these orchard trees indicates the need for an expanded arsenal of registered insecticides and other control methods, biological or cultural, for use against cone and seed insects in Douglas-fir seed orchards. Otherwise, seed crops of sensitive clones will not be protected without damaging these trees. The results indicate that more attention should be paid to insecticide sensitivity of trees to be included in seed orchards, through a screening process. Sensitive clones could, if necessary, then be avoided.—G.E. Miller, Pacific Forest Research Centre, Victoria. B.C.

**Effect of Water Sprinkling of Spruce Logs on Bark Beetle Attack.**—The spruce beetle (*Dendroctonus rufipennis* [Kby.]) is a highly destructive pest of mature spruce (*Picea* spp.) forests. Large spruce beetle populations, built up in logs and log decks, pose a threat to living trees in mature spruce forests surrounding log storage areas and mill sites. Therefore, in some situations, it is desirable to protect logs and log decks from attack by the spruce beetle. Although a number of synthetic insecticides such as chlorpyrifos and carbary and some natural products such as pine oil (Nijholt et al., Can. Entomol. 113:337–340, 1981) are effective in preventing attack by spruce beetles, none of these materials is registered for bark beetle control in British Columbia, and pesticide use may not be desirable in millsites and log storage areas. Water misting of log decks is effective in preventing attacks by ambrosia beetles (Richmond and Nijholt, Pac. Forest Res. Cent. Rep. B.C.P–4–72, 1972) and wood borers (Roff and Dobie, B.C. Lumberman 52:60–63, 70–71, 1968). This paper reports the effects of water sprinkling on attacks by the spruce beetle and other scolytid bark beetles in decked spruce logs.

The study was done in a mature spruce (*P. glauca* [Moench] Voss – *P. engelmannii* Parry) hybrid population – subalpine fir (*Abies lasiocarpa* [Hook] Nutt.) forest, about 65 km southeast of Prince George, B.C. Two spruce trees, located in a north-facing stand edge about 15 m apart, 30 and 23 cm in diameter at 1.35 m, were felled and limbed, and six logs, each about 2 m long, were cut from each tree on 13 May 1980. The logs from each tree were randomized and placed in a compact pile on two dry log supports (Fig. 1) over clear, 4–mil polyethelene sheeting. The pile made up from the 30–cm diameter tree was randomly assigned to the sprinkling treatment. The other pile served as control. The sheeting was of sufficient dimensions to allow tight wrapping of the piles during periods when sprinkling was not being done. The log piles were located on a north-facing stand edge, about 10 m apart, and their long axes were parallel to the north-south direction. A 5 mL Boston bottle (Bel-Art B7547-5) containing ½ mL of frontalure (33% frontalin + 67% alpha-pinene) was attached near the mid-point of the top log in each log pile during sprinkling to enhance attractiveness to the spruce beetle.

Water was pumped from a nearby stream to two garden sprinklers that delivered a combination of coarse droplets and fine, dense mist at a rate of about 12 L/min each. The sprinklers were placed 1 m off the ground and 2 m to the east and west of the treated pile. Sprinklers were operated on 6 days between 6 June and 19 June, from 10:00 a.m. until spruce beetle flight tapered off in the late afternoon of each day. The pump was stopped for about 10 min/h for fuelling and to prevent overheating. On 20 June, all logs were numbered (Fig.1) and the

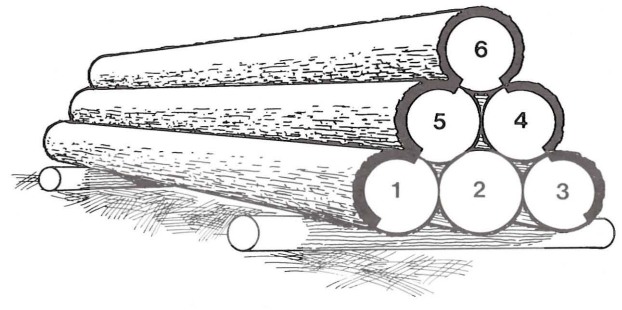


Fig. 1. Decking and numbering of logs in the experimental decks. Exposed bark is indicated by heavy lines.

unexposed bark surface of each log was delineated. In the laboratory, 30-cm bolts were cut from the ends and center of each log; bark areas of the exposed and unexposed portion of each bolt were measured and attacks by spruce beetles and other scolytids were recorded. Attacking species were identified from adult beetles collected from gallery systems. With the exception of the spruce beetle, scolytids were keyed only to genera. The three samples from each log were combined and attacks were converted to numbers/100 $cm^2$ before analysis. Attack density in the sprinkled and unsprinkled pile was compared by t-test for paired observations, the pairs being the logs in the corresponding locations within the piles. Attacks on the exposed and unexposed parts of the logs were compared by analysis of variance in a split-plot design (the totally shaded bottom-center logs were excluded from this analysis).

The logs in both decks were attacked by the spruce beetle, *Ips* spp., *Dryocoetes* spp., and *Scierus* spp. However, a total of only two and seven attacks respectively were made by bark beetles of the last two genera; therefore, these were not analyzed. Attack density by the spruce beetle and *Ips* spp. on logs in the sprinkled and unsprinkled deck is given in Table 1.

TABLE 1

Density of attacks by *D. rufipennis* and *Ips* spp. on spruce logs in sprinkled and unsprinkled decks. (For log positions in deck, *see* Fig. 1)

| | D. rufipennis | | Ips spp. | |
|---|---|---|---|---|
| Log No. | Sprinkled | Unsprinkled | Sprinkled | Unsprinkled |
| | — Attacks/100 $cm^2$ — | | | |
| 1 | 0.46 | 0.45 | 0.00 | 0.01 |
| 2 | 0.39 | 0.78 | 0.00 | 0.06 |
| 3 | 0.75 | 0.42 | 0.01 | 0.19 |
| 4 | 0.58 | 0.18 | 0.00 | 0.37 |
| 5 | 1.23 | 0.39 | 0.04 | 0.01 |
| 6 | 0.79 | 0.30 | 0.00 | 0.42 |
| Means | 0.700±0.124 | 0.420±0.082 | 0.008±0.007 | 0.177±0.074 |

The difference in average attack density by spruce beetle on the sprinkled and unsprinkled logs, 0.70 and 0.42/100 $cm^2$ bark area, was not statistically significant ($p=0.17$). In the unsprinkled deck, the heaviest infestation occurred on the bottom center log, whereas in the treated deck, the log in the same position received the lightest attack. Higher attack densities on the bottom logs of the unsprinkled deck were in accordance with expectation. In the sprinkled deck, the relatively light attack density on the bottom center log appears to indicate that beetles were repelled by the generally cooler, wetter environment of this log. On the five logs in each deck that had both exposed and unexposed bark (Fig.1), the attack density was greater on the unexposed bark than on exposed bark ($p < 0.05$), but there was no significant interaction between treatment and exposure.

Even though there was no significant difference in spruce bettle attack density between the sprinkled and unsprinkled decks, the higher average density for the former was unexpected. During sprinkling, we observed that flying spruce beetles were knocked down by the spray onto the sprinkled deck and the polyethelene underlay sheeting that was spread out on the ground. Thus, sprinkling tended to accumulate beetles that attacked the logs during periods when sprinkling was stopped.

Attacks by *Ips* spp. were significantly greater ($p < 0.01$) on logs in the control deck (0.18/100 $cm^2$) than in the sprinkled deck (0.01/100 $cm^2$) (Table 1). Attack density on exposed bark (0.15/100 $cm^2$) was significantly greater ($p < 0.05$) than on unexposed bark (0.01/100 $cm^2$). These results indicate that *Ips* spp. prefer the exposed, warmer sites and that they do not oviposit on wet bark. There was very low attack density on sprinkled logs in spite of the fact that numerous *Ips* beetles were seen knocked down onto the deck and the polyethelene underlay sheeting.

These results indicate that intermittent sprinkling of spruce logs and log decks during the daily flight period of the spruce beetle is not effective in preventing attacks. Beetles knocked down by the spray onto the logs will attack the logs during periods when the sprinklers are not in operation. Roff and Dobie (B.C. Lumberman, 52:60–61, 1968) reported similar results from daytime sprinkling of spruce to prevent attacks by ambrosia beetles and wood borers. However, sprinkling during the flight period was effective in reducing attacks by *Ips* spp. Further tests are needed for exploring the effectiveness of continuous day-night sprinkling during the flight period to reduce attacks on logs by the spruce beetle.—L. Safranyik and D.A. Linton, Pacific Forest Research Centre, Victoria, B.C.

**Equipment and Technique for Rapid Determination of Second-Instar Larval Counts from Branch Samples.**—The use of various methods for sampling larval populations of the spruce budworm (*Choristoneura fumiferana* [Clem.]) is well-documented. The 45-cm mid-crown branch was introduced as early as 1944 (Atwood, Can. Entomol. 76:64–65) as a working unit for sampling second-instar budworm larvae. Jaynes and Speers (J. Econ. Entomol. 42:221–225, 1949) introduced the concept of using the whole branch as a unit for expressing early population densities. The latter was supported and used widely in research and operational surveys in the province of New Brunswick (Morris, Can. J. Zool. 32:302–313, 1954). The use of the 45-cm branch was re-established in 1950 (Fettes, Ann. Tech. Rep. Forest Insect Lab. 4:163–395; Hurtig et al., D.R.B. SES Rep. No. 176, 1953) for sampling late-instar budworm