WOOD BORER CONTROL IN SPRUCE LOGS WITH P-DICHLORO-BENZENE AND PLASTIC SHEETING (COLEOPTERA: CERAMBYCIDAE)

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ABSTRACT

Fumigation under plastic sheating of white spruce (**Picea glauca** (Moench) Voss) logs with crystalline p-dichlorobenzene (PDB) for 26 days killed more than 95% of cerambycid and other wood borer larvae under the bark and in the wood, at the lowest dosage of 8g of chemical per cubic meter of log plus air space volume. The long treatment-duration promoted the discoloration of logs by stain fungi. When treatments were shortened to 2, 4 and 7 days, and the PDB was dissolved in trichloroethylene, the lowest dosage at the shortest duration killed more than 80% of the wood borer larvae.

INTRODUCTION

The lumber industry has expressed growing concern over the degrading of lumber caused by wood borers in decked logs. Some methods of chemical preventative control have been published (Becker and Abbot, 1961, Ross and Downton, 1966, Gardiner 1970), and one study (Buffam and Lucht 1968) reported that excess heat in slash piles covered with clear polyethylene sheeting killed bark beetles under the bark. This paper reports the results of a pilot study testing the effects of fumigation with p-dichlorobenzene (moth balls), under plastic sheeting, on mortality of wood borer larvae under the bark.

METHODS

Two trials were made with borer-infested logs of white spruce *(Picea glauca* (Moench) Voss*)*, in a clearing at the Kananaskis Forest Experiment Station, Alberta. The logs were covered with 6-mil clear plastic sheeting and chemical placed under the covering. All logs were collected about 80 km W of Olds. They were less than one year old, and were severely infested with mature wood borer larvae.

In the first test crystalline p-dichlorobenzene (PDB) was used on fifteen log "decks", three for each of the following: a control, plastic covering only, plastic covering plus 8, 32, and 128 g of PDB per cubic meter of wood plus air space volume. The decks were about 0.6 m^3 in volume and consisted of three to seven logs each 67 cm long. Treatments began on 23 September 1968, and the decks remained covered till 19 October 1968, when all the fumigant of the largest dosage had evaoporated. Then all live and dead larvae under the bark and in the wood were removed, identified and counted. About one-tenth of the larvae classified as dead were kept at room temperatures for 24-48 hours to verify this.

In the second test dissolved PDB was used on one replicate each according to the experimental design of Table 2. Treatment decks were about 0.4[3] in volume and consisted of two 130 cm long white spruce logs, about 36 cm in diameter. Treatment began on 22 May 1969 and lasted 2, 4 or 7 days. The fumigant was dissolved in trichlorethylene[3] at the rate of 1 gm of PDB per 1 ml of solvent, distributed over the deck, and the deck then covered with plastic sheeting. The cover was removed after the prescribed duration and all dead and live larvae under the bark and in the wood were removed, counted and identified about 10 days after treatment.

RESULTS AND DISCUSSION

More than ninety percent of the wood boring insects present in all logs were *Tetropium parvulum* Casey (Cerambycidae). The larvae of other species present in decreasing numerical order were: Buprestidae— mainly *Melanophila* supp.; Cerambycidae-*Monochamus* spp., *Anoplodera* spp., *Acmeops* sp., *Tetropium cinnamopterum* (Kirby); and Melandridae-*Serropalpus* sp. Differential mortality among species apparently did not occur, and the data were therefore combined.

Crystalline PDB The fumigant in crystalline form gave effective control of wood borer larvae under the bark at all dosages (Table 1). The total mortality given in Table 1 includes a percentage of natural mortality, which is assumed to approximate the percentage mortality (20%) in the controls. Natural mortality was recognized by a brown discoloration of the

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[3] Supplied by Dow Chemical of Canada Ltd. of Calgary under the trade name of "Neu-tri".

TABLE 1—Mortality of wood borer larvae in three replications of white spruce log "decks" fumigated with granular crystalline p-dichlorobenzene for 26 days, under plastic sheeting.

Treatment	No. live wood borer larvae	No. dead wood borer larvae	Percent mortality
	Totals of three replications		
Control	265	66	19.9
Plastic sheeting only	378	138	26.8
8 g/m³ of PDB	16	379	96.0
32 g/m³ of PDB	7	305	97.8
128 g/m³ of PDB	2	398	99.5

larvae, or by fungal growth on the dead larvae. Heat built up under the plastic apparently did not contribute appreciably to larval mortality in this experiment since mortality was also low (26%) in the plastic-only treatment. Crystalline PDB also penetrated into the logs or into the plugged larval tunnels, killing larvae in the pupal cells 10 cm in the log.

In all PDB treatments, live larvae were very sluggish compared to those in control and plastic-only logs. Bark beetle larval mortality was estimated at 60%, 90%, and 98% at dosages of 8, 32, and 128 g per m³ of log deck, respectively.

Of special interest is that parasitic larvae, mainly Braconidae, exhibited a much greater tolerance to PDB than did the wood borer larvae. Mortality of parasites in cocoons could not be judged, but mortality of free parasitic larvae was negligible, except at the heaviest dosage, when it reached about 75%.

The high humidity and temperatures maintained under the plastic sheeting promoted severe discoloration of logs by blue-stain fungi, which would degrade lumber from logs treated in this way as much as would the "wormholes". It is therefore important that decks be covered with plastic for a short fumigation period only.

Dissolved PDB The dissolved fumigant treatments increased mortality of wood borer larvae compared to the control, at all durations (Table 2), but the total mortality was less than it was with crystalline PDB. Many live larvae were found where logs contacted the soil, indicating that the fumigant apparently did not penetrate these areas within seven days. Treated logs showed no perceptible increase in wood stain from fungi during treatment.

A treatment with only the solvent, which is slightly toxic, was not done. The addition of the solvent did not increase mortality appreciably, because the total mortality of chemical plus solvent was lower than that with crystalline PDB.

Since both the plastic and PDB are inexpensive compared to the value and volume of the logs treated, utilizing this chemicaal in liquid form may be feasible if applied in June or July when wood borer larvae are in the early stages of development, and have not yet bored into the wood. Estimated cost for insecticide and 6-mil plastic sheeting, based on a deck 5 m

TABLE 2 — Mortality of wood borer larvae in white spruce log "decks" fumigated with dissolved p-dichlorobenzene under plastic sheeting.

Treatment	2 days			4 days			7 days		
	No. live	No. dead	% dead	No. live	No. dead	% dead	No. live	No. dead	% dead
Control							42	12	22.2
Plastic sheeting only							11	10	47.7
8 g/m³	8	62	88.6	15*	48	76.2	7	47	87.2
32 g/m³	0	22	100	5	35	85.3	11*	24	68.6
128 g/m³	1	28	96.7	0	27	100	9*	25	67.6

*Live larvae in portion of log in contact with soil.

wide, and 60 m long is 10^{c} to 15^{c} per 2.36 m^{3} (=M bd. ft.) (1969 prices). If care is taken to prevent snagging and tearing, the sheeting can be reused, thus greatly reducing the cost of treatment.

A present PDB is one of the safest chemicals in use agains insects. Its ability to penetrate into wood and kill boring insects in a relatively short time may have wide application in the lumber industry.

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Résumé

La fumigation des billes d'Epinette blanche (**Picea glauca** (Moench) Voss) au p-dichlorobenzène (PDB) cristallin pendant 26 jours a tué plus de 95% des larves de perce-bois sous l'écorce des billes et dans le bois ' à la dose minimale de 8 g de produit chimique par mètre cube de bille plus volume spatial d'air. La longue durée du traitement a causé la décoloration des billes par des Champignons de décoloration. Les périodes de traitement ont été réduites à 2, 4 et 7 jours et le PDB a été dissous dans du trichloroéthylène. La dose minimale à la plus courte durée a tué plus de 80% des larves de perce-bois.

References

Becker, W. B., and H. G. Abbott. 1961. Prevention of insect damage to decked pine sawlogs in Massachusetts with BHC emulsion sprays. **J. Forestry 59:** 366-369.

Buffam, P. E., and D. D. Lucht. 1968. Use of polyethylene sheeting for control of **Ips** spp. in logging debris. **J. econ. Ent. 61:** 1465-1466.

Gardiner, L. M. 1970. New northern Ontario spruce beetle compels May start on log spraying. Canadian Forest Industries, July 1970.

Ross, D. A. and J. S. Downton. 1966. Protecting logs from long-horned borers with lindane emulsion. **For. Chron. 42:** 377-379.

BOOK REVIEW

Borden, J. H. and Herrin, B.D. 1972. *Insects in the Classroom.* B.C. Teachers' Federation, Vancouver. 147 pp. $3.50

Years ago this society discussed the idea of producing a school book on insects and even struck committees to investigate the problems. It is ironic that when a member independently authored such a book, the society as a whole appeared to be unaware of it. Another society has taken note, and with approval (see Bull. Ent. Soc. America 20(3) p. 218. 1974).

The book is a three-way collaboration. Professor Borden of Simon Fraser University supplied the basic knowledge; his co-author, a teacher in Vancouver, supplied the presentation; and the artist, Poul Neilson, supplied much of the interest. The Teachers' Federation and some named individuals also contributed. Physically, the book is 8½ x 7 inches, with paper covers, perforated pages and plastic spine, so that it lies perfectly flat when open. Some of the typography is open to criticism. Chapter and sub-heads in lower case letters with no capitals are followed by sub-sub-heads in large, block capitals. Both gimmicks are out of place, but perhaps the authors are not responsible. The line drawings range from adequate to excellent.

There are two parts. The first covers the necessary systematics, including four non-insectan Arthropod Classes and 22 Orders of insects. Each taxon is given one page on which is included: a line drawing of a typical representative; the derivation of its ordinal name and the common names; and characteristics, habits and importance in a paragraph apiece. Within the constraints of available space, these are very well done. Short chapters on metamorphosis, populations, and good and bad insects complete Part 1.

Part II is more ambitious, with longish chapters on collecting, rearing, experimenting and getting information, plus a bonus of three pages on possible and probable disasters. Little is missed that could possibly be included, except a note on avoiding otherwise inevitable damage by dermestids in collections. Experiments with choice chambers, temperature preferences, tasting and feeding in flies, soil insects, flight mills, nutrition, etc. are described with a maximum of ingenuity and a minimum of expense. Good directions are given for rearing *Drosophilia*, flour moths, blowflies, mealworms and locusts.

The last chapter (9) is a useful annotated list of biological supply houses, books, films etc., Provincial Entomologists and State Extension Directors. A detailed 8-page index completes this excellent, and for its avowed purpose, highly recommended book.

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