



Forest Research Laboratory Victoria, B.C.

PREVENTING AMBROSIA BEETLE DAMAGE

In Brief

- (1) The problem is mostly created by one kind of ambrosia beetle which attacks all B.C. softwood species.
 - (a) Beetles cause damage by boring holes in the sapwood thus degrading lumber cut therefrom.
 - (b) Beetles start flying and attacking in spring when the maximum daily temperatures are higher than 60°F. This occurs most commonly from mid-April onwards; fresh attacks can continue until July, but most damage is done during May and June.
- (2) The best method of preventing damage is through logging management.
 - (a) Remove and utilize logs from the forest as soon as possible after felling.
 - (b) Winter-cut logs left in the woods through the following April-June period are most likely to be damaged; avoid this felling-logging sequence as much as possible.
 - (c) Logs cut after January are relatively unsusceptible, and may be left in the woods with reasonable safety throughout the spring attack period.
 - (d) If susceptible logs must be left in the forest during the attack period, leave low grade logs for the beetles to infest rather than logs that will yield a high percentage of clear lumber.
- (3) Winter-cut logs that cannot be removed by mid-April should be sprayed just prior to this time with 0.4% gamma BHC or 0.4% thiodan emulsion.
 - (a) Spray logs thoroughly, particularly the undersides. Rate of application should be 1 gal. per 80-100 sq. ft. of log surface. Don't spray during rain, but damp bark can be treated effectively.
 - (b) Logs decked or scattered along roads can be treated at reasonable

cost, but labour costs of treating inaccessible logs is usually prohibitive.

- (c) Don't expect much prevention of damage if spray is applied after beetles have started to attack in spring.
- (d) Provide full protective clothing for workers handling the concentrated insecticide, and gloves, clean rags and water for workers applying the dilute spray.
- (e) Do not spray logs on, over, or near fish bearing waters without first obtaining clearance of the appropriate government Fisheries representative.

In Detail

The Problem

Various species of ambrosia beetles cause appreciable loss through lumber degrade to logs of most tree species in British Columbia. With few exceptions, most of the damage is caused by attacks in logs of B.C. conifers by one beetle species, Trypodendron lineatum.

Adult beetles commence flying in early spring when the air temperature exceeds 60°F. This may occur any time from early April to as late as the end of May in cool seasons. The period extending from the last week of April to the third week of May is the more usual time of first appearance. Beetles fly to the attractive logs, and commence boring holes into the sapwood without delay. Although the boring dust pushed to the surface of the log may be reddish brown as the beetles tunnel through the bark, the dust piles soon become white as the beetles enter the sapwood. Eggs are laid and larvae are reared in these tunnels in the sapwood. Most holes are confined to the outer $1\frac{1}{2}$ inches of the wood. New attacks and rapid penetration of the wood continues throughout May and June. Although some fresh attacks may appear in July and even August, most of the damage is done earlier.

Both parents and progeny leave the brood logs in July, August, and early September. They fly to the shelter of surrounding uncut forest where they overwinter in the surface soil and outer bark of standing trees. In spring they fly and disperse in search of attractive logs in which to rear another brood.

Logs, slash and stumps of trees felled throughout the period from August through January are the most attractive materials. In the majority of cases, (note that exceptions do occur) logs of trees cut in February, March, April and later are either not attacked, or are attacked only lightly. Old logs - those cut a year earlier - are rarely subject to further ambrosia damage.

Although beetles do not penetrate the wood deeply, much damage through lumber degrade results from even light attacks in logs that would otherwise yield a high proportion of clear lumber. Heavy attacks in low grade logs have little effect on selling price of lumber cut from them, although marketability may be adversely affected. Actual dollar loss depends on degree of attack, log grade, and current market restrictions, but ranges from one to five dollars per thousand board feet. An equally serious effect of beetle damage arises when lumber is being sold in a market that will accept little or no lumber showing this type of defect.

High beetle populations are perennially common throughout coastal forests. Damaging populations also occur in the Interior wet belt and in the spruce types of central British Columbia. There have been few reports of damage from the drier sites of the Interior. In any one locality the expected severity of damage will depend on general logging practice and recent logging history. Recent widespread catastrophies such as blowdown and fires can also provide material for population build-up, but logs, stumps, and logging debris remain the principal breeding sources for high populations.

Preventing Damage

Logging Management

Logging practice varies considerably throughout the region of known ambrosia beetle hazard. Weather conditions and logging equipment in current use dictate the felling and logging schedule in any one place. Obviously, logs from trees felled after February, if utilized within the year, will yield lumber free from ambrosia damage. Logs cut after July and before February of the following year and left exposed to the beetles from April through June are those most subject to damage.

Usually logs cut in late summer and early autumn can be removed from the forest and utilized well before spring attacks occur. By contrast, logs felled in late autumn or early winter often become "snowbound" and cannot be removed and utilized before the spring beetle invasions begin; whenever conditions permit, this logging sequence should be avoided.

If winter felling with little chance of logging before spring is unavoidable for a particular operation, losses can be reduced by restricting winter cutting to relatively low-grade trees or stands. Other factors being equal, schedule pulp stands for winter felling-spring logging operations.

The importance of rapid utilization to prevent damage by beetles cannot be overstressed. If the hazard situations are recognized by logging managers, much damage need never occur. "Hot" logging can reduce to a minimum the need for chemical treatment, but it also carries the additional bonus of reducing idle capital. All trees felled and left in the forest represent dollars spent without matching returns from products sold. Every logging operation should be carefully examined to determine if logs are being left unnecessarily in the woods where their value may be further reduced by beetles.

Slash burning has little effect in reducing beetle populations unless

it is done in a felling-logging-burning sequence specifically designed for this purpose. Beetles leave the logs and slash a month or two before slash fires can be lit safely. Therefore, at the time of burning, the insects are protected in surrounding uncut forests. If a forest were being harvested on a more or less continuous clear-cut plan, the standing forest adjacent to a breeding source of a given year could be felled, logged, and burned during September and October of the same year; most beetles would be destroyed if the burn were efficient. This method of population reduction has neither been proven nor disproven, but there can be little doubt that if it were practiced consistently over several years, beetle populations in a given locality would be greatly reduced.

The present method of "patch" logging practiced in coastal forests tends to favour ambrosia beetle abundance. Attractive logs, and hence active beetle infestations are so scattered over such an operation that population reduction by a logging management method is extremely difficult.

Chemical Preventives

Although rapid utilization following cuttings is the best method of reducing beetle losses, it is readily conceded that many situations occur where it is economically impractical to remove and mill susceptible logs before beetles start to attack. If damage is to be averted, chemical preventives must be used. As yet, a satisfactory method has not been devised for treating large areas of scattered felled and bucked. Decked logs, logs along road rights-of-way, and logs in water storage can be treated economically.

Two chemicals have proven effective when applied to logs before beetles start to attack. Benzene hexachloride (BHC) and thiodan emulsions containing 0.4% of the active ingredient are about equally effective, but BHC is somewhat less costly. A list of some of the suppliers of these materials is available from the Department on request.

Formulation

1/ BHC emulsifiable concentrate (containing
one lb. gamma isomer per Imp. gal.) 4 gal. per 100 gal.
water

Or Thiodan emulsifiable concentrate (con-
taining 2 lb. of active ingredient
per gal. 2 gal. per 100 gal.
water

The emulsifiable concentrate is poured into the spray tank first, then water is added, slowly at first and with moderate stirring.

1/ For commercial products containing more or less gamma isomer per gallon, adjust the amount of concentrate used proportionately. e.g. If the E.C. contains only $\frac{1}{2}$ lb. gamma per gal., 8 gal. of concentrate would be needed to prepare 100 gallons of finished 0.4% emulsion.

Workers should wear a face shield, rubber gloves and coveralls when handling the concentrate. Rubber gloves offer sufficient protection for workers spraying the dilute mixture, but they should avoid inhaling the spray mist over prolonged periods. Clean water and rags should always be available in case of accident such as when a hose bursts, dousing the face of a worker. With common-sense care, the dilute spray can be used quite safely; only in the event of gross negligence may injury occur. BHC is somewhat safer to handle than thiodan.

Equipment

Fire fighting equipment already on hand can usually be adapted for this purpose with little additional expense. Pressures in the range of 50 to 100 psi are adequate for most situations, but pressures of around 200 psi are desirable when decked logs have to be treated. The system should be fitted with a pressure relief valve and a by-pass line back to the tank for agitating the mixture. Y-valves can be fitted at the pump outlet to supply spray lines to two or more workers. Except at the high pressures needed for treating decked logs, ordinary plastic garden hose is adequate. Six-foot spray wands fitted with trigger shut-off valves and flat fan nozzles are effective; design is not critical, being governed by personal preference and materials at hand.

Application

It is essential that spray be applied before, or just as attack commences. The spray acts as a toxic barrier to the beetles. Once they have entered the wood the beetles are little affected by the treatment. As a general rule, the first half of April is the optimal period for treatment. Spraying can be continued with some benefit one or two days after the first attacks are noted.

To be effective, all bark surfaces must be sprayed to the point of drip-off. Rate of application required is one gallon of dilute emulsion to about 80 to 100 square feet of bark surface.

Undersurfaces of logs exposed to full sun are particularly susceptible to attack and must be sprayed thoroughly.

If log decks are being treated, spray should also be forced between the logs from the ends of the decks. High pressure - 200 psi or greater - and jet nozzles help to achieve the penetration necessary.

Spray should not be applied when rain is falling, but damp bark can be treated quite effectively.

Remember that time and materials are wasted by treating logs cut later than the end of January. Concentrate on protecting the high value logs cut earlier.

Water-stored logs can be treated with this dilute material with the spray equipment mounted on a raft. This treatment, or spraying of logs over or near fish-bearing streams is not recommended, unless the applicator

has first notified, and received clearance by the Department of Fisheries or the B.C. Fish and Game Branch.^{1/}

Water-stored logs can also be treated successfully by spraying BHC by helicopter at the rate of 10 lbs. of gamma isomer (the active ingredient) in 10 Imp. gals. of oil solvent per acre of log booms. This method can be an effective preventive when applied at the correct time, but it can also be hazardous to fish if applied in certain places at certain times. No such spraying should be attempted without first consulting the Department of Fisheries and this office or the B.C. Forest Service, or the B.C. Loggers' Association. On the coast, an annual programme of aerial log-boom spraying has been in effect since 1960. The success and safety of this programme has been ensured by the several participating companies working through the Pest Control Committee of the B.C. Logger's Association. It is strongly recommended that any logging company should work through this committee if the aerial application method is being seriously considered.

The helicopter-applied method is not recommended for treating logs in the forest. Insufficient spray reaches the susceptible undersides of the logs to afford adequate protection.

JMK/EW

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^{1/} Canada Department of Fisheries is responsible for protection of ocean, and ocean-going fishes. Salmon-bearing streams come under the jurisdiction of this Department. Correspondence regarding spray projects affecting such water should be addressed to: The Director, Pacific Area, Department of Fisheries, 1155 Robson Street, Vancouver, B.C.

The British Columbia Fish and Game Branch is responsible for protection of fresh-water fishes throughout the Province. Address appropriate correspondence to: The Chief Fisheries Biologist, Fish and Game Branch, Department of Recreation and Conservation, 525 Fort Street, Victoria, B.C.