ISBN 0-662-19297-4 Cat. No. Fo 29-6/72-1992E

FOREST Pest LEAFLET

Pacific Forestry Centre

Ambrosia Beetles

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Introduction

Ambrosia beetles, or "pinworms" as they are often called in the forest industry, are a group of beetles totalling over 1000 species worldwide.

In British Columbia there are at least five ambrosia beetle species affecting commercial timber: *Trypodendron lineatum* (Olivier), *Gnathotrichus sulcatus* (LeConte), *G. retusus* (LeConte), *Platypus wilsoni* Swaine, and *Xyleborus saxeseni* (Ratz.). Of these five species, *T. lineatum* beetles are the most abundant and damaging, followed by *G. sulcatus* (Figure 1)and, to a lesser extent, *G. retusus* . Most commercial conifer species are susceptible to ambrosia beetle attack but most damage occurs to Douglas-fir *(Pseudotsuga menziesii* (Mirb.) Franco), western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), true firs (*Abies* spp.), and spruce (*Picea* spp.). The pinholes from their tunnels or galleries (Figure 2) and the dark staining of the wood caused by a fungus associated with the beetles occurs in the sapwood - the most valuable, clear portion of the log. Attack densities of over 2500 holes per square metre of log surface have been reported. This damage, although more of a technical than a structural defect, results in a reduction in grade (degrade) of the lumber or veneer product, greatly reducing its value. The ability of ambrosia beetles to attack, survive, and develop in green lumber has resulted in export and quarantine problems. For this reason, additional care has to be taken to keep damaged or infested material out of export shipments. This means additional costs due to extra handling, repackaging, and remanufacturing. Annual losses to the British Columbia forest industry as a result of ambrosia beetle damage have been estimated as high as $63 million per year (McLean 1985).

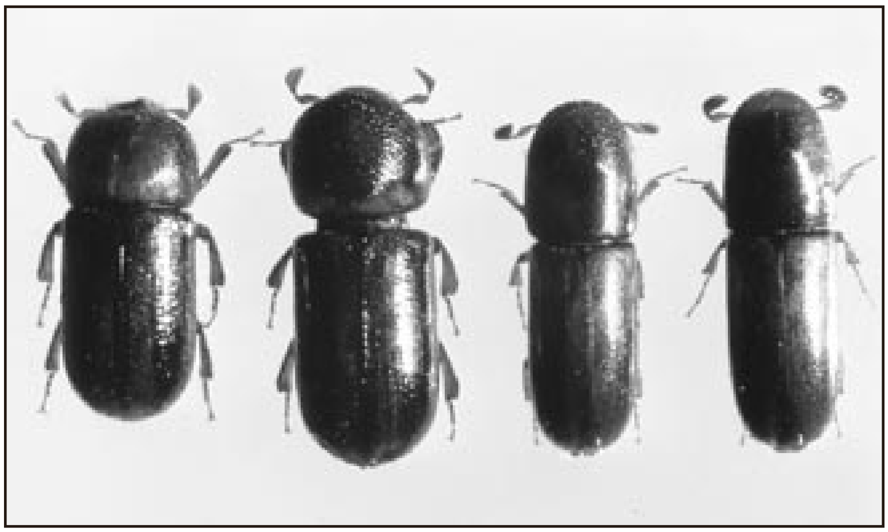

Figure 1. Ambrosia beetles: from left to right, *Trypodendron lineatum* (male, female) and *Gnathotrichus sulcatus* (female, male).

Life history of ambrosia beetles

Trypodendron and *Gnathotrichus* ambrosia beetles have many similarities in their life histories. Both species emerge in the spring and are

Figure 2. Lumber showing ambrosia beetle entrance holes (pinholes) which result in degrade.

attracted to suitable wood material by specific chemical odors. The factors that make a log suitable to these beetles are not well understood, but the wood must be of sufficient moisture content, be in the right temperature range, and be of the required soundness to support both fungal and beetle development. On finding a host, the beetles that attack first (female *Trypodendron* and male *Gnathotrichus*) secrete a chemical that attracts other members of their species. These species-specific chemical attractants are called population aggregation pheromones. Each mated pair of beetles subsequently bores a gallery into the log. Although there is only one entrance/exit hole, the gallery may have several branches inside the log and penetrate to a depth of 10 cm.

Ambrosia beetles do not feed on wood, they feed on fungi. The ambrosia fungi associated with these beetles have been identified as *Monilia ferruginea* Mathiesen-Kaarik (*Trypodendron*), *Ambrosiella sulcati* Funk, *Raphaella sulcati* Funk, and *Graphium* spp. (*Gnathotrichus*). The fungal spores adhere to the beetles and quickly germinate in suitable new host material, creating a dark stain around the tunnels.

Eggs are laid in niches along the gallery. After the eggs hatch, the larvae feed on fungus and enlarge the niche in which they will pupate and become adult beetles (Figure 3).

There are several differences in the biologies of *Trypodendron* and *Gnathotrichus* which are important to recognize for pest management purposes:

Trypodendron beetles overwinter in the forest litter and under the bark of trees in forest margins, while *Gnathotrichus* remain in their galleries over winter.

Trypodendron have a concentrated spring flight beginning when the temperature exceeds 16°C. *Gnathotrichus* appear to have overlapping generations; this results in a first flight slightly later in the spring than *Trypodendron* and a second major flight period in late summer.

Trypodendron beetles prefer host material felled the previous fall or winter. *Gnathotrichus* are less particular about the aging of wood material and will attack trees felled as recently as two weeks before their flight. In addition, *Gnathotrichus* more commonly attack green lumber than *Trypodendron.*

Recognition of ambrosia beetle damage

Unlike several species of bark beetles, ambrosia beetles will not usually attack living trees. Also, ambrosia beetles penetrate into the sapwood, producing a whitish sawdust, while bark beetles remain in the bark and produce a brown boring dust. This white sawdust can be seen in bark crevices and on the ground when logs are on land, and floating on the water around boomed logs. The holes in the wood made by ambrosia beetles are very small and perfectly round. A few days after attack, a dark fungal stain will appear around the holes. *Trypodendron* produces a hole about 1.7 mm in diameter, and *Gnathotrichus* makes a hole approximately 1.3 mm in diameter. While this difference is relatively small, a 1.5 mm drill bit will fit into the former but not the latter. Dark-stained ambrosia beetle galleries with branching pupal niches are evident on plywood veneer or on the tangential face of lumber (Figure 4).

The effect of ambrosia beetle damage on wood products grade

The biggest commercial loss caused by ambrosia beetles is in the degrade of lumber due to the presence of the dark-stained pinholes. The loss is particularly significant because the beetles bore into the sapwood where the most valuable clear lumber is located.

Under the grading rules for export, no pinholes are permitted in clear grade lumber; a piece of otherwise clear lumber having even a few ambrosia beetle holes can be reduced from clear to common grade, which may sell on the domestic market for one-third or less of the clear price.

Many companies will not permit ambrosia beetle holes in any grade of export lumber, even if they are permitted in the grading rules. This is because several countries in the European Economic Community, as

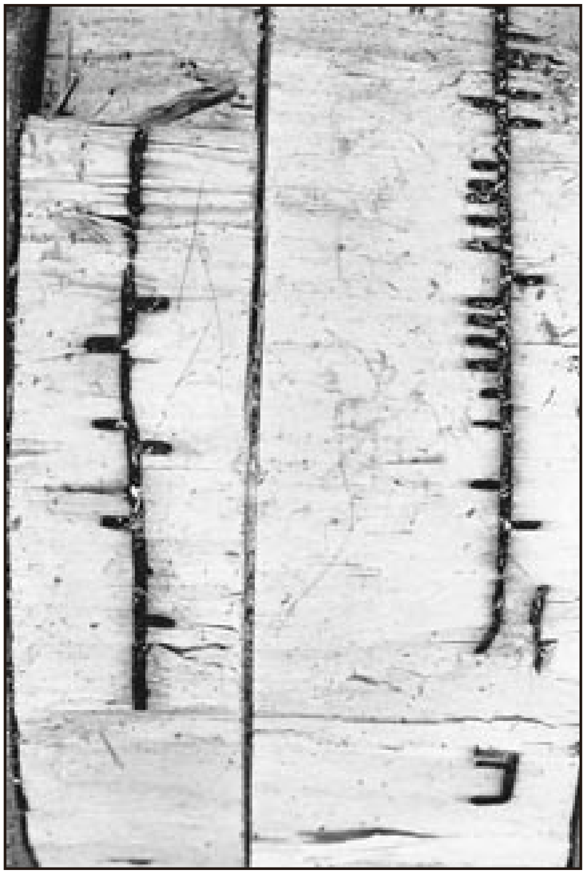

Figure. 3. *Trypodendron lineatum* brood developing in gallery. The larval, pupal and callow adult stages can be seen.

well as Australia and New Zealand, will not accept timber damaged by ambrosia beetle for fear of importing live insects. Companies may have to bear the costs of quarantine, fumigation, or even rejection of the shipment if damage is detected.

Ambrosia beetle damage on plywood veneer often degrades the more valuable face-stock to core stock. The importance of protection from ambrosia beetles will increase as the availability of quality face-stock is reduced through logging of old-growth trees.

How to minimize ambrosia beetle damage

At present there are no chemical pesticides registered in Canada for use against ambrosia beetles. It is doubtful that adequate, sustained chemical coverage could be achieved to provide complete protection to logs. Also, safety concerns for the worker and the environment make the chemical pesticide option unfeasible.

While there is no way to eliminate ambrosia beetle damage, the following management options can minimize the problem:

1. Effective log inventory management

The best way to reduce ambrosia beetle damage is to minimize the number of susceptible logs exposed during beetle flight periods. This must be done within the constraints governing log inventory, including market and weather conditions.

Logs should be processed as quickly as possible after felling. Logs felled in the fall and winter should not be left in the woods or dryland sorting areas later than mid-March. If this is unavoidable, these logs should be given first priority for removal and processing.

2.Water misting of high-value logs

Water, applied as a fine mist during the beetle flight period, has been a successful and cost-effective means of protecting high-value logs from attack in dryland sorting areas. The major limitation of this system is that an abundant source of water (tens of thousands of litres per hour) is required. This restricts the use of water misting to sites adjacent to the ocean or very large lakes. Other disadvantages include wet working conditions and frequent maintenance to clear debris from the intake line and replace or repair equipment damaged by corrosion or log-moving machinery.

3. Mass-trapping beetles with pheromone-baited traps or trap logs

The pheromones, as well as some of the host chemicals used by the major ambrosia beetle species to recognize suitable trees, have been identified and can be produced synthetically. These chemicals, used in combination with traps, show considerable promise as a means of physically reducing beetle populations in timber processing areas. Sticky traps or the more convenient multiple-funnel traps baited with pheromone can remove millions of beetles from a single dryland sort. Alternatively, pheromone-baited or unbaited logs can be set out in place of or in addition to traps. These trap logs can be of lower grade but must be of the appropriate vintage and of sufficient quality to be attractive to the beetle.

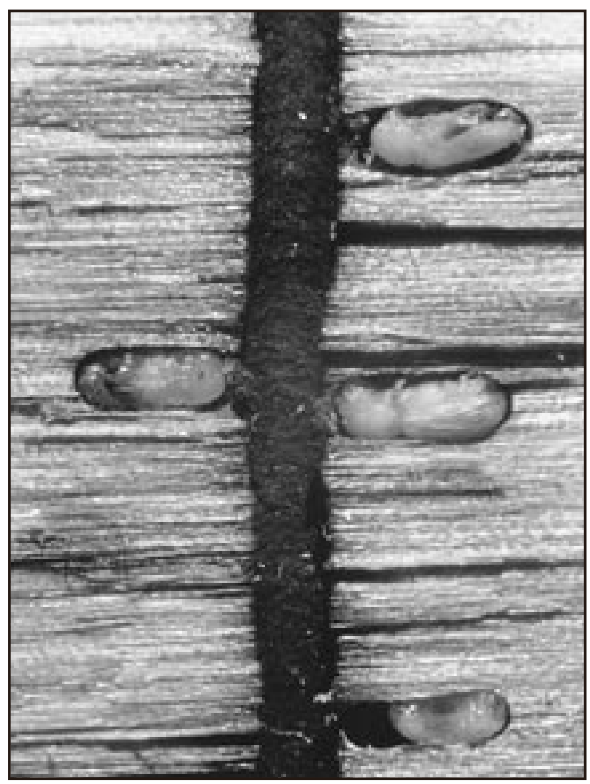

Figure 4. Tangential view of ambrosia beetle gallery. This type of damage is common on plywood veneer.

The trap logs are then processed through a chipper after they have absorbed beetles but before the beetles have had time to reproduce (approximately 10 weeks). Several disadvantages of trap logs make the use of artificial traps more appealing:

a)Trap logs are difficult to handle.

b) Logs vary considerably in attractiveness to the beetle.

c) Timing is critical; if forgotten or left too long the beetle will breed in the trap log and add to the problem.

d) Logs lose their attractiveness as they become colonized by beetles.

e) It is difficult to estimate the number of beetles trapped.

While many beetles can be removed by mass trapping, it has yet to be determined if the proportion of the beetle population that is trapped is high enough to reduce damage and be cost-effective. Research is continuing on this topic.

Selected references

Borden, J.H.; McLean, J.A. 1981. Pheromone-based suppression of ambrosia beetles in industrial timber processing area. Pages 133-154 *in* E.R. Mitchell, editor. Management of insect pests with semiochemicals: concepts and practice. Plenum Press, New York.

Lindgren, B.S. 1983. A multiple funnel trap for Scolytid beetles (*Coleoptera*). Can. Entomol. 115:299-302.

McLean, J.A. 1985. Ambrosia beetles: a multimillion dollar degrade problem of sawlogs in coastal British Columbia. For. Chron. 61:295-298.

McLean, J.A.; Stokkink, E. 1988. Challenges in implementing ambrosia beetle pest management programs in British Columbia. Pages 179-187 *in* T.L. Payne and H. Saarenmaa, editors. Integrated control of scolytid bark beetles. Proceedings of the IUFRO working party and XVII international congress of entomology symposium, Vancouver, B.C., Canada, July 4, 1988. Virginia Polytechnic Inst. and State Univ.

Nijholt, W.W. 1978. Evaluation of operational watermisting for log protection from ambrosia beetle damage. Can. For. Serv. Pac. For. Res. Cent. Rep. BC-P-22-78.

Nijholt, W.W. 1978. Ambrosia beetle: a menace to the forest industry. Can. For. Serv. Pac. For. Res. Cent. Rep. BC-P-25.

Nijholt, W.W. 1975. The striped ambrosia beetle *Trypodendron lineatum* (Olivier): An annotated bibliography. Can. For. Serv. Pac. For. Res. Cent. Inf. Rep. BC-X-121.

Prebble, M.L.; Graham, K. 1957. Studies of attack by ambrosia beetles in softwood logs on Vancouver Island, British Columbia. For. Sci. 3:90-112.

Richmond, H.A.; Nijholt, W.W. 1972. Water misting for log protection from ambrosia beetles in B.C. Can. For. Serv. Pac. For. Res. Cent. Rep. BC-P-4-72.

Shore, T.L.; McLean, J.A. 1985. A survey for the ambrosia beetles *Trypodendron lineatum* and *Gnathotrichus retusus* (Coleoptera: Scolytidae) in a sawmill using pheromone-baited traps. Can. Entomol. 117:49-55.

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Reprinted June 1998
PDF Version June 2000