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BEETLE TRAPPING METHODS

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Until the early 1970's, chemical insecticides were routinely used on stored timber and lumber to prevent attack by woodboring beetles. In retrospect, the most shocking use of such materials was the aerial application of DDT at a dose of 1.12 kg per ha directly onto log booms stored in fresh water lakes and coastal inlets of BC (Lejeune and Richmond 1975). With the banning of DDT in 1970, the trend in woodborer management turned to trapping of ambrosia beetles (Coleoptera: Curculionidae, subfam. Scolytinae) and other woodborers, including longhorned beetles (Cerambycidae), flatheaded borers (Buprestidae) and wood wasps (Hymenoptera: Siricidae).

There are three objectives of trapping programs. **Detection** is usually done at ports of entry to detect unwanted introductions of exotic species. In Canada, this is mainly the responsibility of the Canadian Food Inspection Agency. **Prevention** trapping to intercept woodborers before they can infest stored timber and lumber is now routinely practiced for ambrosia beetles on the BC coast (Borden et al. 2001), and for other woodboring beetles and wood wasps in the interior (Allison et al. 2004). **Suppression** is the goal of some trapping programs, e.g. for the exotic brown spruce longhorned beetle in Nova Scotia (J. Sweeney, Canadian Forest Service, Frederickton, NB, pers. comm.).

The design of traps generally includes three components: a **barrier** to arrest incoming beetles, a **bucket** (a generic term comprising a wide range of catching receptacles), and a **bait** to draw insects toward the trap. In various types of traps these are designed and put together to exploit the host finding **behaviour** of the target insects. This an imperfect art.

One of the earliest types of traps was the glass barrier trap fitted with a water-filled trough in which ambrosia beetles were caught (Chapman and Kinghorn 1958). This trap could be modified to catch living insects (Nijholt and Chapman 1968). It could be used alone, or on top of the bait, a greenhouse cage emitting an upward plume of odour-laden air that had passed over a conifer bolt infested by ambrosia beetles. It was used only for research. Another early type of trap, that was efficacious, but never used operationally, was insecticide treated logs placed upright or horizontally over a catching receptacle (Lindgren et al. 1982).

Operational mass-trapping programs for ambrosia beetles were made possible by the adoption of sticky coatings (e.g. Stickem Special) applied to hardware cloth traps formed into cylinders or a right angle vane configuration. These were used to prevent attack on stored lumber (McLean and Borden 1977, 1979) and logs (Lindgren and Borden 1983) in commercial trapping programs run on a contract basis for coastal timber harvesting and milling companies (Lindgren 1990). Despite their effectiveness, sticky traps required labourious procedures to coat them with the sticky material, to remove and count the captured beetles or to count them on the trap surface, and to clean and re-coat the traps. They were hated by all who used them.

Hatred for sticky traps stimulated various inventors to design efficacious replacements. The best and most widely used of the host of replacements is the multiple-funnel trap (Lindgren 1983). It consists of 4-16 vertically aligned funnels (usually 12) with a removable collecting cup (the bucket) affixed to the bottom funnel. Baits are hung from the “legs” connecting the funnels, and are placed either in the open central column of funnels, or if too large on the outside of the trap. The trap is marketed by Pherotech International Inc. (see above). Wet and dry trapping options are available. Other non-sticky barrier traps include the Norwegian drainpipe trap, a vertical column with holes through which the beetles enter (Bakke et al. 1983), the schlitzfalle trap, an upright, thin, rectangular “box” with multiple entry slits on both sides (Staack 1985), and the cross-vane Intercept trap (Advanced Pheromone Technologies Inc., Marylhurst, Oregon).

Baits for all of the trap types have the common design of a reservoir to hold the volatile attractant, surrounded by some form of barrier through which the attractant molecules pass at a more or less controlled rate. Small amounts of highly-active pheromones are released from small reseviors, e.g. Pherotech bubble caps and flexlures. Larger amounts of host volatiles, e.g. α-pinene and ethanol, are usually released from some form of large plastic pouch hung on the outside of a trap.

Recent research has focussed on designing better traps for large woodborers. Peter de Groot of the Canadian Forest Service in Sault Ste. Marie found a water-filled pan with a bait suspended above the water to be very effective in trapping large woodborers (de Groot and Nott 2001). This trap was affectionately dubbed the "Peter Pan trap". Improvements to this trap designed to increase trapping efficacy included black plastic pipe or cross-vane barriers standing in the water. When baited with α-pinene and ethanol the cross-vane trap was particularly effective (McIntosh et al. 2001). However, even when fixed to the ground with strong guy wires, it tended to blow over, dumping the catch. Even worse, it caught unacceptably high numbers of birds, bats and chipmunks. Therefore, it never saw operational implementation.

Morewood et al. (2002) retained the cross-vane design, using durable black "puck board" suspended over a collecting funnel and bucket or cup. This trap was as effective as the cross-vane trap standing in a water-filled pan, and eliminated unwanted by-catch of flying and terrestrial vertebrates. However, because the trap had to be large to be optimally effective, the puck board was too heavy and expensive to warrant commercialization. This led to a collaborative effort between researchers at Simon Fraser University and at Pherotech International Inc. that ultimately resulted in a new commercial trap, the colossus trap. Made of cross vanes of durable plastic sheeting, attached to a collecting funnel of identical material, to which is affixed a removable plastic cup, it can be collapsed for shipping and storage. The colossus trap has proven to be very effective when used against the brown spruce longhorned beetle in Nova Scotia (J. Sweeney, Canadian Forest Service, Frederickton, NB, pers. comm.), and woodboring beetles in the southeastern USA (D.R. Miller, US Forest Service, Athens, GA, pers. comm.).

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