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0.25 per 100 cm² respectively. Within each pair of logs, the attack density on the treated log was consistently lower than on the check log. On the untreated logs, all the attacks were judged as successful i.e., the egg galleries contained progeny and/or live female parent(s). On the treated logs, only 52.38% of the attacks were successful, the difference being highly significant ($X^2_{[1df]} = 32.48$, $p<0.01$). Exactly half of the unsuccessful galleries contained neither eggs nor live female parents; the rest had only dead female parents. The egg galleries in the treated logs were often crooked and branched, similar to atypical egg galleries produced in trees treated with systemic pesticides (Frye and Wygant, J. Econ. Entomol. 64:911-916, 1971). The average length of the egg galleries in the treated and check logs was 3.98 cm and 9.97 cm respectively ($t_{[97df]} = 13.84$, $p<0.01$).

Initial attacks and attack accumulation were not monitored, but periodic visual observations indicated that initial attacks were delayed on the treated logs by about 10–15 days. Therefore, delayed attacks could, in part, be responsible for the shorter mean egg gallery length in the treated logs. However, in these logs, there was no significant differences in the average lengths of successful and unsuccessful attacks (4.95 cm vs 3.29 cm).

Brood per attack averaged 23.70 and 2.44 (equal to 15.2 and 0.61 progeny per 100 cm²) in the check and treated logs ($t_{[97df]} = 13.98$, $p<0.01$. At the time of sampling, 63.4% and 100% of the progeny, respectively, were in the egg stage. Delayed attacks on the treated logs could be responsible for this result. However, because the viability of the eggs was not investigated, we do not know what effect the treatment may have had on their ability to hatch.

In summary, the diesel oil treatment resulted in 61% reduction in attack density, 48% reduction in successful attack, 60% reduction in gallery length, 89% reduction in progeny per attack, and 96% reduction in progeny density. We conclude that diesel oil shows promise in preventing attacks and establishment of broods by spruce beetles on spruce logs. Further tests are needed to evaluate survival of established broods in treated logs and logging residue. — L. Safranyik and D.A. Linton, Pacific Forest Research Centre, Victoria, B.C.

Ambrosia Beetles in Alder. — Red alder (*Alnus rubra* Bong.) is one of the most important hardwoods in Pacific Coast forests. The wood is used for cabinet work, furniture, and core stock (Hosie, Native trees of Canada, 1969). Because red alder was believed to be less affected by ambrosia beetles, the industry suggested that it could be used as spacers in lumber packaged for export, thus replacing waste softwoods that often show severe beetle damage. Any evidence of ambrosia beetle damage on wood products can lead to quarantine problems on the export market. Hence reports of ambrosia beetle attacks on red alder were investigated as to their extent and circumstances.

During the spring and summer of 1980, ambrosia beetles attacked many red alder trees that had been treated with 2,4-D in the summer of 1979. The herbicide had been applied by the hack-and-squirt technique to red alder trees in a 100 ha stand of alder and Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) near Caycuse, B.C., as a silvicultural treatment to release the Douglas-fir.

The ambrosia beetle attacks were mostly in trees killed or severely damaged by the herbicide. Entrance holes were usually found in areas where the sapwood was discolored by a dark-brown stain. Live beetles and their progeny identified by R.W. Duncan of the Pacific Forest Research Centre as *Trypodendron lineatum* (Oliv.) and *Gnathotrichus retusus* (Lec.), formerly known as *G. alni* Blackman (Bright, The insects and arachnids of Canada. Part II. 1976), were found in typical full-sized galleries in the attacked trees.

The production of host and secondary attraction to ambrosia beetles in coniferous trees is generally thought to be related to the abundance of terpenes in these trees. The fact that ambrosia beetles detected and successfully established broods in red alder trees that contain little or no terpenes (Von Rudloff, pers. comm.) indicates that the requirement for terpenes may not be essential.

The incidence of attacks by ambrosia beetles was less on felled alder that had not been treated with herbicides.

The significance of the relationship between felling date and incidence of ambrosia beetle attack in reducing insect damage has been shown for Douglas-fir (Dyer and Chapman, Can. Entomol. 97(1):42–57, 1965). The possibility of such a relationship for red alder has not been explored.

It is recommended that alder timber intended for packaging lumber for the export market be carefully examined for evidence of ambrosia beetle damage before processing. — W.W. Nijholt, Pacific Forest Research Centre, Victoria, B.C.

MISCELLANEOUS

The Use of Phyllotaxis in Estimating Defoliation of Individual Balsam Fir Shoots. — In studies of the relation of growth loss of balsam fir (*Abies balsamea* [*L.*] Mill.) trees to defoliation by the spruce budworm (*Choristoneura fumiferana* [Clem.]), it was necessary to accurately estimate defoliation at the individual shoot level and to assess variability within branches, whorls, and the entire tree. This note describes a method for determining accurate post-defoliation estimates of the original number of needles on a balsam fir shoot. The method was used to check the accuracy of visual estimates of defoliation made throughout the crowns of seven balsam fir trees.

The pattern of leaves on a stem, scales on a pine cone, or florets on a sunflower is generally a spiral. The study of these arrangements, called phyllotaxis or phyllotaxy, began in the 18th century (for a review of the history of phyllotaxis, see Adler [J. Theor. Biol. 45:1-79, 1974]). Because there is a definite pattern to the