ISSN 0820-8107

MARITIMES FOREST RESEARCH CENTRE
TECHNICAL NOTE NO. 131

EFFICACY STUDIES OF DIAZINON 500 EC AGAINST THE BALSAM GALL MIDGE ON BALSAM FIR CHRISTMAS TREES IN NOVA SCOTIA

The balsam gall midge Paradiplosis tumifex is an insidious pest of balsam fir Abies balsamea, affecting the Christmas tree industry. Small inconspicuous adult midges attack the opening fir buds in the spring, laying eggs on the underside of the newly forming needles. On hatching, the initial feeding of the larva stimulates the rapid formation of a gall which eventually all but surrounds it leaving only a small slit on the underside of the needle through which the larva can be reached. It is during this period of only a few days between hatching and gall formation that the insect can be controlled with insecticide. In heavy infestations, up to four galls can form on a single needle. Galls often contain more than one midge larva. Virtually, all of the current needles on an entire tree can be infected. Nevertheless, the galls are relatively inconspicuous and infested trees maintain a healthy appearance until fall when the mature larvae leave the needles, drop to the ground, and pupate in the duff. At this time the needles begin to turn yellow and drop from the tree. Because this event often goes undetected until the Christmas tree harvest is underway, the disastrous economic results are often sudden and unexpected.

A second midge, the inquiline Dasineura balsamicola is associated with the gall maker. Incapable of forming a gall itself, the inquiline must move into an already formed gall to survive. During the progression of a gall midge infestation which can be expected to develop over a period of three years, the inquiline population gradually increases. Because in each encounter the inquiline usually survives instead of the gall midge, the inquiline presumably becomes a factor in the final collapse of the gall midge infestation.

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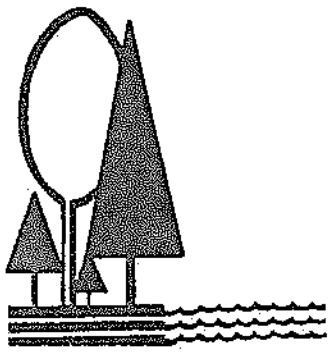

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An outbreak of the gall midge is presently underway in the Maritime Provinces and is most intense in the south shore area of Nova Scotia. This is the first sustained outbreak to occur in the region since 1960 and a special effort has been made to obtain a minor-use registration for Diazinon 500 EC, the only known effective control insecticide. What is at stake is the immediate fate of a significant part of the $14 million annual Christmas tree crop, the disruption of marketing procedures, and a general loss of prestige of the balsam fir Christmas tree.

Methods

In 1984, two 10-ha blocks of balsam fir located on Kirk's Christmas tree lots in Lunenburg Co., N.S. were treated using backpack mistblowers at a dosage of 1.7 L/ha Diazinon 500 EC (product) in 103 L water. One block received a single treatment, the other received two treatments 13 days apart. Fifty trees within each block were sampled by counting all the galls on each of three shoots per tree. Ten galls per shoot were dissected and the total needles per shoot, affected or otherwise, were estimated from the ratio of shoot length: number of needles. Spray was applied just as the needles were beginning to lengthen. An unsprayed block adjacent to the two treated blocks served as an untreated control in which 49 trees were sampled.

A second but smaller experiment was carried out at the Canadian Forestry Service (CFS) Experimental Christmas tree farm at New Ross, N.S. A single application of Diazinon 500 EC, at the same dosage as applied on the Kirk block, was compared with single treatments of 1250 g Sevin XLR in 70 L of water/ha, and Ambush TM (sprayed as part of spruce budworm Choristoneura fumiferana control) at 37 mL in 70 L water/ha. Block sizes were 0.13, 0.2, and 0.4 ha. Three shoots from each of at least five trees were sampled per block. Seven trees were sampled in the unsprayed control.

Preliminary field trials were carried out in 1983 to determine the minimum effective dose of Diazinon 500 EC. Three dosages at 0.8, 1.3, 1.7 L/ha were tested on each of 12 trees in two applications, 10 days apart. Samples of up to 12 shoots from each tree were taken after each application so that, in effect, several levels were tested. Applications were timed to coincide with the completion of gall midge hatching.

Results

The level of control achieved on the Kirk blocks is shown in Figs. 1 and 2. One application of Diazinon 500 EC at 1.7 L/ha (Fig. 1) provided adequate protection killing all the galls in 26% of the samples and 80 to 100% in 75% of the samples. Two applications gave near complete control, killing 100% of the galls on 52% of the samples and 80 to 100% control in over 94% of the samples.

Results of the preliminary studies in 1983 were not as successful, presumably because the spray was applied much later in the development of the midge, after the galls were fully formed. However, the results give some insight into minimum dosage requirements and suggest that efficacy falls off sharply at 1.3 L/ha (Fig. 3).

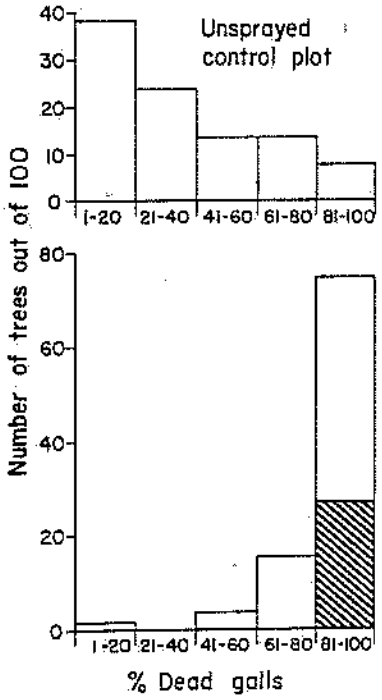

Fig. 1

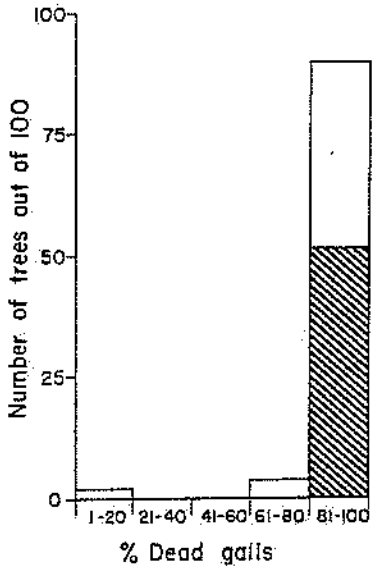

Fig. 2

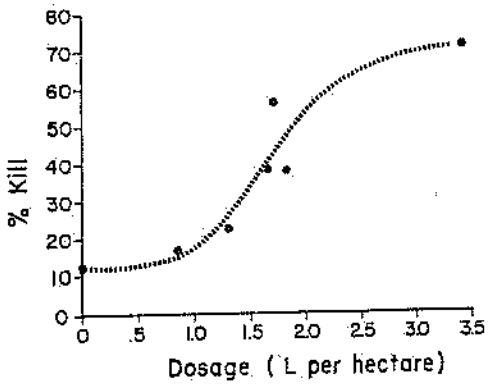

Fig. 3

Fig. 1. Effect of one treatment of Diazinon 500 EC at 1.7 L/ha on gall midge mortality compared with unsprayed control plot, 1984. Cross hatched portion of bar graph indicated the proportion of samples in which gall midge mortality was 100%.

Fig. 2. Effect of two treatments of Diazinon 500 EC at 1.7 L/ha on gall midge mortality, 1984. Cross hatched portion of bar graph indicates proportion of samples in which gall midge mortality was 100%.

Fig. 3. Relationship of gall midge mortality to varying dosages of Diazinon 500 EC (preliminary field tests 1983).

Experiments on CFS blocks resulted in an 82-88% kill for Diazinon 500 EC, 28% kill for Sevin XLR and 55% for Ambush TM. (Table 1).

Summary

The results obtained in this series of experiments support those of Osgood (1977) studying the insect in Maine, who obtained over 90% control with Diazinon 500 EC applied with both knapsack sprayer and helicopter at 1.7 L/ha. Two treatments of Diazinon 500 EC at 1.7 L/ha yielded highly satisfactory results. One treatment provided adequate control. Dosages of 1.3 L/ha, according to the 1983 tests appear to be less than satisfactory. Sevin XLR and Ambush TM produced unsatisfactory results. Because pesticides are applied during the egg laying period of the gall midge, absolute population estimates cannot be determined. It is not possible to determine the number of eggs, larvae, and adults that were killed before they were able to form galls. Mortality figures are based on the number of dead midge larvae in galls and are therefore conservative estimates of mortality.

Reference

[1]Osgood, E.A. 1977. Chemical control of the balsam gall midge and the balsam twig aphid in Maine. Amer. Christmas Tree J. Vol 21(2) 18-19.

Table 1. Field trials of Diazinon 500 EC, Sevin XLR and Ambush TM at New Ross N.S. 1984.

Treatment	Hectares treated	Trees sampled	% Gall midge mortality	No. of needles dissected
Diazinon 500 EC	0.13	5	88	60
Diazinon 500 EC	0.13	6	88	72
Diazinon 500 EC	0.13	5	82	60
Sevin XLR	0.20	5	28	60
Sevin XLR	0.20	6	43	72
Ambush TM	0.20	6	48	50
Unsprayed control	0.40	7	15	84

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March 1985

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