CONTACT AND RESIDUAL EFFECT OF LOW-VOLUME DOSAGES OF PHOSPHAMIDON TO *CHORISTONEURA FUMIFERANA* (LEPIDOPTERA: TORTRICIDAE) ON TWO SPECIES OF CONIFERS[1, 2]

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Abstract *Can. Ent.* 104: 1051–1054 (1972)

A series of low-volume spray treatments were conducted to study the contact and residual effect of two concentrations of the insecticide phosphamidon to fourth instar spruce budworm, *Choristoneura fumiferana* (Clem.), on balsam fir, *Abies balsamea* (L.) Mill, and red spruce, *Picea rubens* Sarg. Treatment of sprayed larvae on sprayed trees, unsprayed larvae on sprayed trees, and sprayed larvae on unsprayed trees, resulted in two principal conclusions: (*a*) Higher concentrations of phosphamidon (1% versus 0.5% active) accelerated mortality in all instances and (*b*) no statistical difference ($P = 0.1\%$) was found in the final mortalities between treatments in which only the foliage was treated and where both larvae and foliage were treated with phosphamidon.

Introduction

The organophosphate insecticide phosphamidon (O-[2-chloro-2-(diethyl-carbamoyl)-1-methyl-vinyl]-O,O-dimethyl phosphate) has been applied extensively over the forests of New Brunswick (Macdonald 1966, 1967) and Ontario in attempts to control infestations of the spruce budworm, *Choristoneura fumiferana* (Clem.). In spite of its extended use, information has been limited regarding the contact and residual action of the insecticide on conifers. More specifically, there has existed a lack of data pertaining to the effect of marginal and sub-marginal concentrations, i.e. LD50 and LD25 dosages, mortality rates on different tree species, and the combined effect of treatment of either or both insect and tree surfaces.

Procedure

In preparation for the spray treatments, 100 balsam fir, *Abies balsamea* (L.) Mill, and 100 red spruce, *Picea rubens* Sarg., trees of standard size (28 in. in height, 12 in. in width at mid-stem) were potted in the fall and allowed to break dormancy in April under greenhouse conditions at 70°F and 30% R.H. Larvae used in the trials were reared on foliage of balsam fir at 70°F and 65% R.H. to the fourth instar before treatment.

The contact and residual effects of phosphamidon were demonstrated by conducting treatments on balsam fir, and red spruce, at two concentrations (1% and 0.5% active). The treatments were applied in a modified spray chamber equipped with a Potter's intermediate nozzle (Nigam 1967) at a standard dosage of ½ Imperial gallon per acre, that was determined colorimetrically by comparing applied dosages to standard solution. The treatments carried out were as follows: (*a*) Sprayed larvae on sprayed trees, (*b*) unsprayed larvae on sprayed trees, and (*c*) sprayed larvae on unsprayed trees. A control procedure was conducted for each treatment using a solution of 0.1% rhodamine B dye with water. A total of 10 larvae were treated per tree species and 10 trees used for each treatment. Data obtained from mortality counts were corrected for natural mortality according to Abbott's formula (Abbott 1925).

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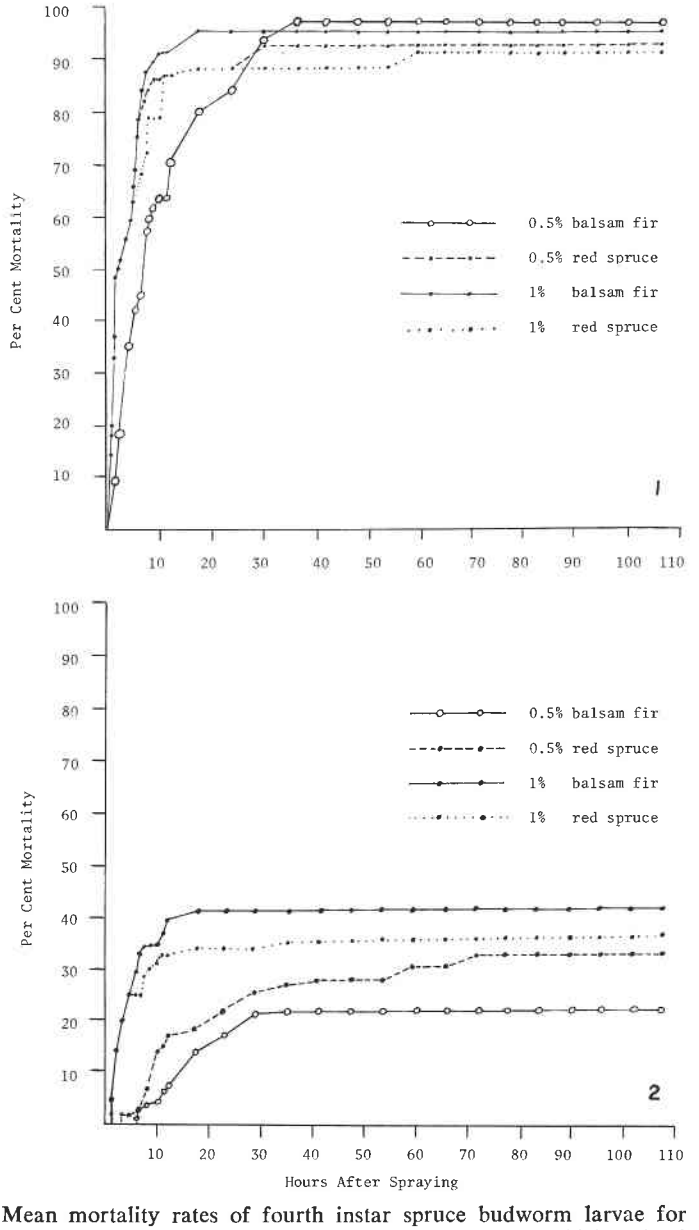

FIGS. 1–3. Mean mortality rates of fourth instar spruce budworm larvae for similar treatments in which both larvae and trees were sprayed (Fig. 1), in which only the larvae were sprayed (Fig. 2), and in which only the trees were sprayed (Fig. 3) with 1% and 0.5% active phosphamidon.

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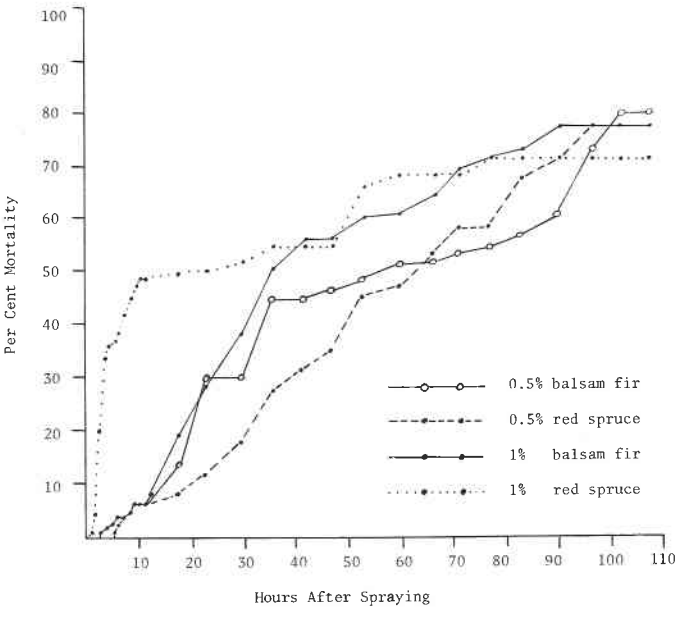

FIG. 3.

For all statistical tests, significant differences were defined as those for which the probability would be less than 0.1% if the null hypothesis were true.

Results and Discussion

A comparison of similar treatments indicated that marginal and sub-marginal concentrations of phosphamidon, i.e. 1% and 0.5% concentrations at ½ Imperial gallon per acre, did not significantly alter the mortality rate or final mortalities of larvae in instances where both the larvae and the trees were sprayed (Fig. 1). Mortality for these treatments reached approximately 90% within 12 hours and therefore did not result in a clear evaluation of how concentration of insecticide, tree species, or activity of the larvae influenced the mortality rate. It was theorized that mortality within the first 12 hours occurred almost entirely from contact and surface residues of phosphamidon.

Nor was significant difference observed in the final mortalities of similar treatments in which only the larvae (Fig. 2) or only the foliage (Fig. 3) were sprayed with phosphamidon at 1% and 0.5% active. The higher marginal concentration of 1% did, however, result in a faster mortality rate than the 0.5% dosage. For example, treatment of only the foliage of fir and spruce at 1% resulted in a 56% mortality after 42 hours as compared to a 32% to 44% mortality with the 0.5% treatment for the same period.

A comparison of final mortalities of different treatments indicated no significant differences in the following instances: (*a*) Treatments in which both larvae and trees were sprayed with 1% and 0.5% phosphamidon and treatments where only the trees were sprayed at both concentrations, and (*b*) treatments in which only red spruce were sprayed with 1% phosphamidon and larvae were sprayed with 1% on unsprayed balsam fir trees.

The fastest mortality rates (32% to 40% within 12 hours) were observed for the following treatments: (*a*) Red spruce, balsam fir, and larvae sprayed with both

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concentrations of phosphamidon, (*b*) red spruce sprayed with 1% phosphamidon, and (*c*) larvae sprayed with 1% insecticide and placed on unsprayed balsam fir and red spruce.

Four factors probably influenced the mortality of budworm larvae. These included concentrations of spray, activity of the larvae, morphology of tree species, and target surface. It was apparent that at marginal dosages with excellent droplet coverage, application to foliage was more important for satisfactory mortality than direct contact effect to larvae. The shape, position, and density of red spruce foliage can influence the accumulation of surface residues.

Larvae migrating toward the leaders on red spruce may have come in contact with less residue than larvae that migrated towards the obtuse lower branches. It was nevertheless concluded that the concentration of phosphamidon applied did not alter the final mortality of larvae in instances where both larvae and trees were treated and where application was made only to trees.

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