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TECHNICAL NOTE

SPRUCE BUDMOTH CAN BE CONTROLLED WITH AERIAL APPLICATIONS OF FENITROTHION INSECTICIDE TO ADULTS

Aerial spray applications of fenitrothion to white spruce plantations at a rate of 105 g in 0.8 1/ha of formulation will control spruce budmoth adults and limit their oviposition. The reduction in number of eggs provides significant protection to trees the following year. Control was effected through either one or two applications, determined by the rate of adult emergence, which is influenced by weather conditions. Timing of the applications was determined by moth trapping. Daily counts of moths caught in pheromone traps also reflect the efficacy of a particular spray treatment and indicate whether another treatment is necessary.

INTRODUCTION

The spruce budmoth, Zeiraphera canadensis (Mut. & Free.), is a serious pest of white spruce, Picea glauca, plantations in New Brunswick (Neilson, 1985). Development of an effective, affordable control option for this pest has been a priority for Forestry Canada - Maritimes Region, but control attempts against larvae to save foliage in the current year have had only limited success. Permethrin® insecticide has been effective, but can only be applied just prior to egg hatching in the spring (Helson et al. 1989). Furthermore, because of the perceived environmental concerns with Permethrin® in water courses, it has not yet been registered for such use. Aerial spray trials from 1980 to 1985 against budmoth larvae with a variety of insecticides did not demonstrate any substantial efficacy. The insecticides tested were: Orthene®, Sumithion®, Matacil 180F®, Dylox®, Zectran UCZF 19®, Thuricide 48 LV®, Futura XLV®, and SAN 415®. As a last measure, spraying budmoth adults was tried. From what was known at the time (1985), they did not appear to migrate very actively and were

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Forestry Canada - Maritimes Region
P.O. Box 4000, Fredericton, N.B. E3B 5P7
P.O. Box 667, Truro, N.S. B2N 5E5
P.O. Box 190, Charlottetown, P.E.I. C1A 7K2

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present in the stands for some time before any significant numbers of eggswere laid, making them a good potential target. Permission was granted that year to Forest Patrol Limited to treat a considerable area of white spruce plantations with a range of dosages of fenitrothion and aminocarb insecticides. The results of part of that series of trials with fenitrothion and subsequent trials in 1986 are described.

INSECTICIDE AND AIRCRAFT

Fenitrothion was an initial choice because it was already registered for use against larvae of spruce budworm, a large body of information was available on it, and it was readily available. Most importantly, it had been tested against spruce budworm in the early 1970s.

Formulations used in operational trials against budmoth were either oil or water emulsions. The standard application rate was 0.8 L/ha of total formulation per application.

Applications of sprays were by Thrush Commander or Turbo Thrush aircraft equipped with either Micronair AU 3000 or 4000 rotary atomizers. The blades of the Micronairs were set to allow for maximum RPMs.

ADULT BEHAVIOR AND MONITORING

Observations of budmoth adult behavior indicated that 1) males emerged first, 2) no discernible large-scale migration occurred between plantations, 3) when adults were most active (evening), even the slightest puff of wind would cause them to fly to the inner part of tree crowns, and 4) there appeared to be a lag in egg laying following adult emergence (Turgeon et al. 1987). These observations suggested that the adults could be killed easily, causing a reduction in the population for the next year. Concurrent with our work on control of budmoth, the New Brunswick Research and Productivity Council was successful in identifing their pheromone. Consequently we had a potential method of assessing male adult activity.

TEST SITES

The tests were conducted on white spruce plantations located on private land of J.D. Irving Ltd. in northwestern New Brunswick. Plots ranged from 75 - 500 ha, and tree height varied from 2 - 4 m. For the purposes of this report, data were selected from those plantations with complete insect and damage assessments. In 1985, data were available from only one block per treatment except in the case of the 1X 140 g/ha treatment. In 1986, because of the semi-operational nature of the test series, we had the opportunity to extensively sample four replicates of the 1X 105 g/ha treatment and three replicates of the 2X 105 g/ha treatment (Table 1).

SAMPLING

Efficacy was determined from 1) estimates of pre-treatment third instar larval populations in treatment plots and non-treated controls, compared with egg population density (eggs/shoot base), 2) larval populations in the following year, and 3) resultant damage in the following year based on the four point damage index system. The best estimator of efficacy was eggs deposited per L3 density the same year (Table 1). Furthermore immediate impact of spray treatment was demonstrated by plotting moth trap catches daily (Figures 1, 2).

TIMING OF SPRAY TREATMENT

Identification of the budmoth pheromone provided a method of timing the spray treatment. At the time, dealing with an untested system and knowing very little about its sensitivity, it was not known if this could be done. Three pheromone traps baited with lures (rubber septa loaded with pheromone) were deployed 50 m apart in each test site. The traps, either Multipher or Pherocon-II-C, set out by July 4th in both 1985 and 1986, were examined daily and the moth catches per trap plotted (Figures 1, 2). In 1985, based on the data as it flowed in from the test sites, the plots were treated on the rising portion of the trap plot data. As it turned out, this was the time to spray. Since then, this method has been used as the standard for timing subsequent years' spray operations against budmoth.

RESULT AND CONCLUSIONS

1) The range of dosages tested in 1985 demonstrated that a single dose of less than 140 g/ha of fenitrothion could be effective against adult budmoth. This set the stage for tests in 1986 when a compromise dose of 105 g/ha was used. Since that series of trials, the same dose (105 g/ha) has been used in subsequent years.

2) In both 1985 and 1986, there was a clear difference in the egg/larva ratio between treated and unsprayed control sites, and a significant reduction in damage the following year (Table 1).

3) Ultra Low Volume (ULV) sprays can be used to treat extensive areas quickly and to respond to trap catch data effectively. Pheromone traps were shown to be useful tools for timing sprays of fenitrothion against budmoth adults, and also to provide information to evaluate spray efficiency. For example, Figure 1 indicates no further spray is needed and Figure 2 indicates a further treatment.

PITFALLS

The successful application of this control procedure, aside from the normal variation associated with any pesticide application, is dependant on three contingencies:

1) a reliable moth trapping system, as failure of pheromone-baited lures could compromise an operation (trap catches can also be affected by cold night temperatures);

2) a short adult emergence period - as a long moth emergence period can affect efficacy and necessitate more than one application of fenitrothion; and

3) a careful and informed interpretation of moth trap data, as misinterpretation could result in spraying too early or too late.

FUTURE NEEDS

1) Fenitrothion should be registered for control of budmoth at a dosage of 105 g/ha and two applications should be permitted,

2) Pheromone traps baited with effective lures should be used in the timing of spray treatments,

3) Back-up systems should be developed for timing of spray applications, and

4) A users' manual should be prepared.

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E.G. Kettela
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Table 1. Summary of results of spray trials with fenitrothion against adults of the spruce budmoth, Zeiraphera canadensis

Year	Treatment (g/ha)	No. Reps	Mean Larvae/ Branch	Ratio of eggs/shoot base to larvae/ branch in same year	Damage index To Shoots in Following Year
1985	210 1X	1	22	0.51	1.1
	140 1X	2	11	0.12	1.2
	140 2X	1	9	0.24	1.1
	70 1X	1	12	0.01	1.1
unsprayed controls	-		13	5.6	3.5
1986	105 1X	4	6	0.40	1.4
	105 2X	3	5	0.10	1.1
unsprayed controls	-		10	6.8	4.0

* Damage Index 1 = N.1, 4 = severe.

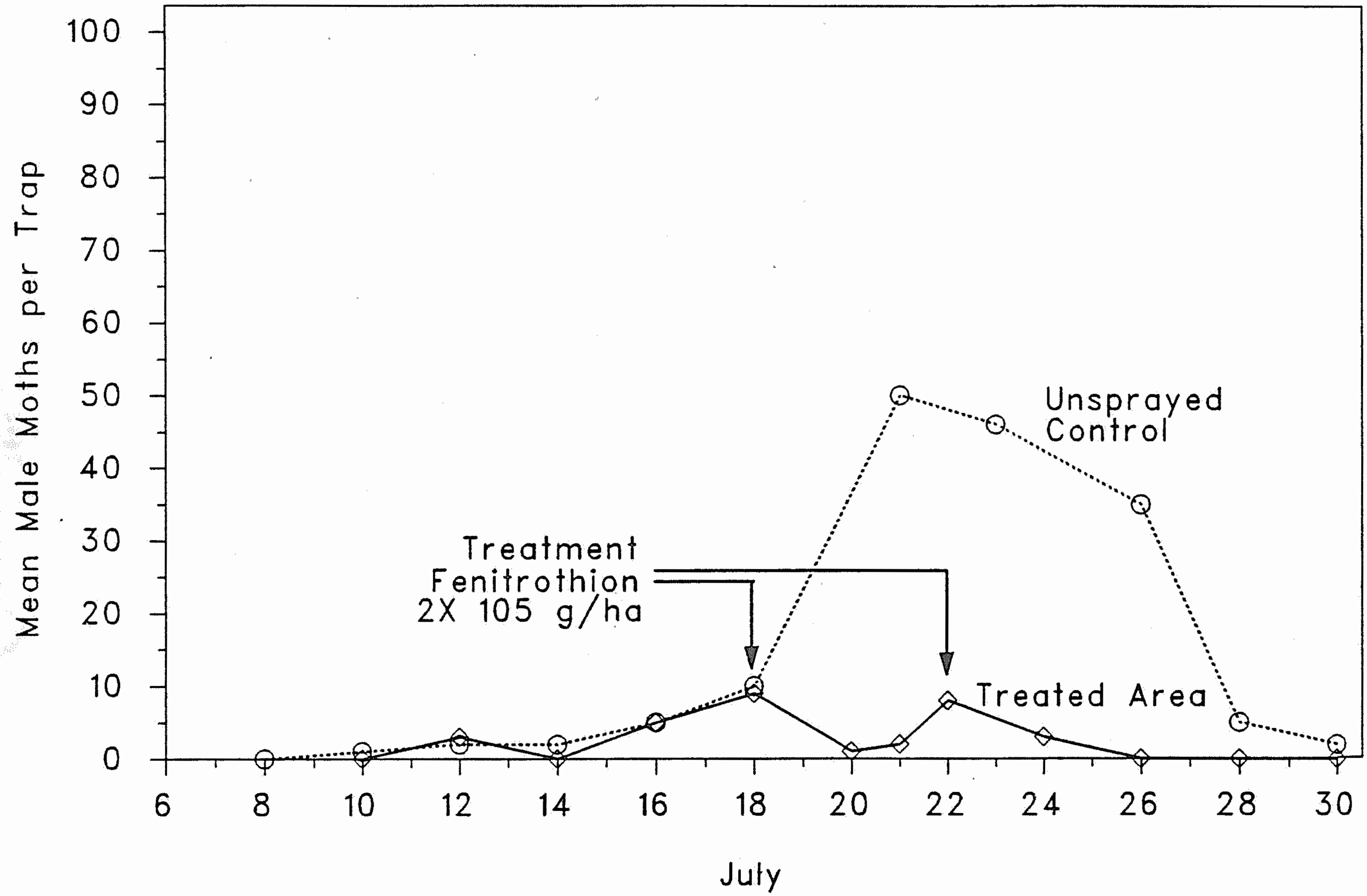

Figure 1. Mean daily number of male Zeiraphera canadensis caught in pheromone traps baited with pheromone impregnated rubber septa, for treated and non-treated areas in northern New Brunswick, 1985.