THE EFFECT OF AERIAL ULV ADULTICIDING WITH MALATHION AND NALED ON FIELD POPULATIONS OF *AEDES SOLLICITANS*[1]

D. J. SUTHERLAND, R. KENT AND J. DOWNING[2]

Mosquito Research and Control, Department of Entomology and Economic Zoology,
New Jersey Agricultural Experiment Station, Rutgers University
New Brunswick, NJ 08903

ABSTRACT. Malathion and naled were applied as aerial ULV, and their effect on field populations of *Aedes sollicitans* (Walker) was studied. The application rate for malathion 91% was 219 ml/ha (3 oz./a) and for naled (Dibrom 14) 73 ml plus 146 ml heavy aromatic naphtha/ha (1 oz. plus 2 oz./a). Fifty separate applications were made, approximately 1600 ha (4000 a) per application. The effect on field populations was variable with a decrease in reduction levels over the 3 days post treatment. Based on actual mosquito landing counts malathion provided a more extended depression of populations. However, areas receiving naled application contained greater mosquito populations prior to treatment which prevents absolute comparison between the two insecticides.

INTRODUCTION

ULV adulticiding by aircraft is a control technique employed by many mosquito control agencies. Much of the research on the technique has depended on the use of caged mosquitoes. While this is a convenient test method, caging has 2 disadvantages in that (1) it confines the insect and may stimulate activity thereby causing increased droplet impact on the mosquitoes or (2) some droplets can impinge on the screen thereby reducing the numbers of droplets reaching the mosquitoes. In practical mosquito control caged mosquitoes can be of value in judging the ULV application itself. However, in order to seek ways to improve the efficiency of ULV adulticiding as well as justify its value as a control procedure, it becomes necessary to study its effect on natural mosquito populations. During 1977 the New Jersey State Airspray Program treated approximately 81,000 hectares (200,000 acres) with malathion and naled for the control of adult *Aedes sollicitans* (Walker). The purpose of this report is to describe the effect of such measures on field populations of this mosquito.

MATERIALS AND METHODS

The acreage treated was located in the shore counties of New Jersey, close to the salt marsh breeding habitat. Fifty individual airspray applications were conducted with an average of 1600 hectares (4000 acres) per application. Two-thirds of the applications used naled; one-third used malathion. Sites treated included mixtures of forest and field with sparse shrub and ground cover. Although caged mosquitoes were employed, major data gathered consisted of landing counts (numbers of mosquitoes landing per min), taken daily 3 days before and 3 days after an application. The data from the 3rd and 2nd day before the spray were used to justify the need for and timing of adulticiding. A total of 2400 landing counts were taken at an average of 8 sites within each area treated. Additional information was obtained from untreated areas. Data were analyzed on the basis of percent reduction and also actual landing counts.

The application aircraft was a twin-engine Piper Aztec, capable of application speed of 150 mph using 8–14 nozzles (size ranging from 80015 to 8005) at

[1] Paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers University, The State University of New Jersey.

[2] Present address: Department of Entomology, University of Massachusetts, Amherst, Massachusetts.

40–50 psi. The insecticides were applied at the following rates: malathion 91% at 219 ml/hectare (3 oz/acre), naled (Dibrom 14) 73 ml plus 146 ml heavy aromatic naphtha/hectare (1 oz Dibrom 14 plus 2 oz HAN/acre). We have found that naled topically applied to adult mosquitoes is approximately 3 times as toxic as malathion. For field application we dilute naled to increase the droplet numbers and to reduce the corrosive properties of naled.

RESULTS AND DISCUSSION

Figure 1 is a summary chart of information collected from the 50 applications. Data have been transposed into the percent decrease or increase in mosquitoes landing per min on days 1, 2, 3 post treatment as compared to the day before application. Categories established for such decrease or increase are 100–80, 80–60, 60–40, 40–20, 20–0 percent. The frequency that these categories occurred on day 1, 2 and 3 after treatment is indicated at the left of the chart. The percent reduction or increase occurring after the 50 applications was so highly variable that no statistically significant differences between insecticides on such a basis could be found. However, a closer examination of Figure 1 does reveal certain important points: (1) the effect on field populations was highly variable as expected, but sometimes an actual increase (reinfestation) of

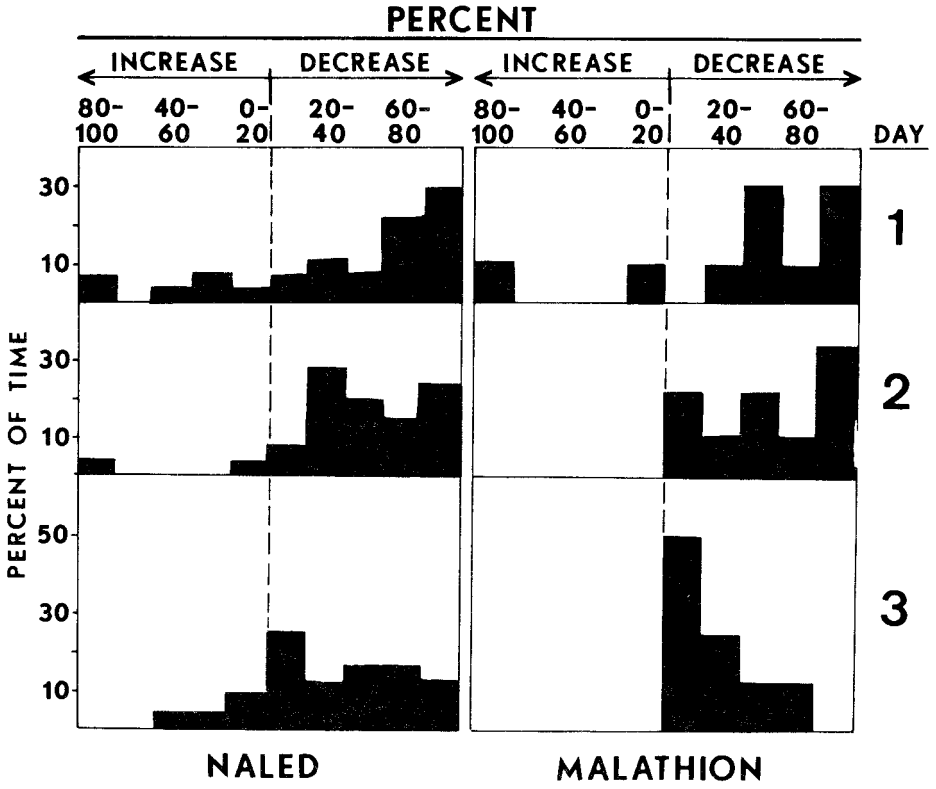

Figure 1. The frequency of various levels of increase or decrease of field populations of *Ae. sollicitans* during the 3 days after aerial ULV treatment with malathion and naled.

mosquitoes occurred in areas treated with either insecticide, (2) as expected with non-residual insecticides there is a general decrease over the 3 days of post treatment in the level of reduction, (3) on day 1 a higher frequency of upper reduction categories was evident after naled application, and (4) malathion always provided some level of reduction on the 2nd and 3rd days after application.

Data from which Figure 1 was derived are further summarized in Table 1, with numerical figures for the frequency (percent of time) when mosquito populations increased, decreased, and the decrease amounted to over 40% and over 60%. Both insecticides performed about equally on the basis of frequency of any level of reduction or increase on the 1st day after application. Frequency of the higher category of reduction (> 60%) was greater with naled. However, malathion on day 2 and 3 provided some level of population reduction. The droplet size of the malathion ULV was determined to be greater than that of naled, which could have enhanced malathion impact and residues on vegetation.

Since differences between insecticides could not be detected on the basis of percent reduction and increase of populations, subsequently all landing count data were transformed using $\sqrt{X}$ to reduce variability within plots (Zar 1974). The results of the ANOVA are given in Fig. 2. Significant differences ($P < .05$) occurred in landing counts in areas before treatment as well as on the 2nd and 3rd day after treatment. Areas selected for treatment with naled did have higher populations before treatment, and, therefore, naled was challenged to a greater degree than was malathion. One day after spraying, both insecticides had reduced populations to the same level. However, on days 2 and 3 post spray, landing counts in malathion-treated areas continued to decline while those in naled-treated areas rose. While the differences exceed those before treatment, it may still be argued that the insecticides were not equally challenged by the same population levels, environmental factors and conditions. Based on the use of caged mosquitoes during these studies, naled as applied in dilute form did penetrate canopied areas much better than did malathion, probably due to its smaller droplet size. However, while naled has the property of rapid knockdown, there was some indication of recovery from such knockdown.

The long flight range of *Ae. sollicitans* and its involvement in the transmission of eastern encephalitis (Crans 1977) make this species important in many areas. Current studies involving adulticiding of field populations of this mosquito indicate that ULV is a useful control measure, however variable, incomplete and temporary. Of great value is the knowledge derived from the studies that such adulticiding in 1977 reduced mosquito populations

Table 1. Percent of time during each of 3 days after aerial adulticiding when an increase or reduction in mosquitoes occurred, 1977.

		Percent of time			
Insecticide	Day	Increase occurs	Reduction occurs	Reduction >40%	Reduction >60%
naled	1	22.2	77.7	59.2	51.8
	2	8.0	92.0	56.0	36.0
	3	16.6	83.4	45.9	29.2
malathion	1	20.0	80.0	70.0	40.0
	2		100	66.7	44.4
	3		100	25.0	12.5

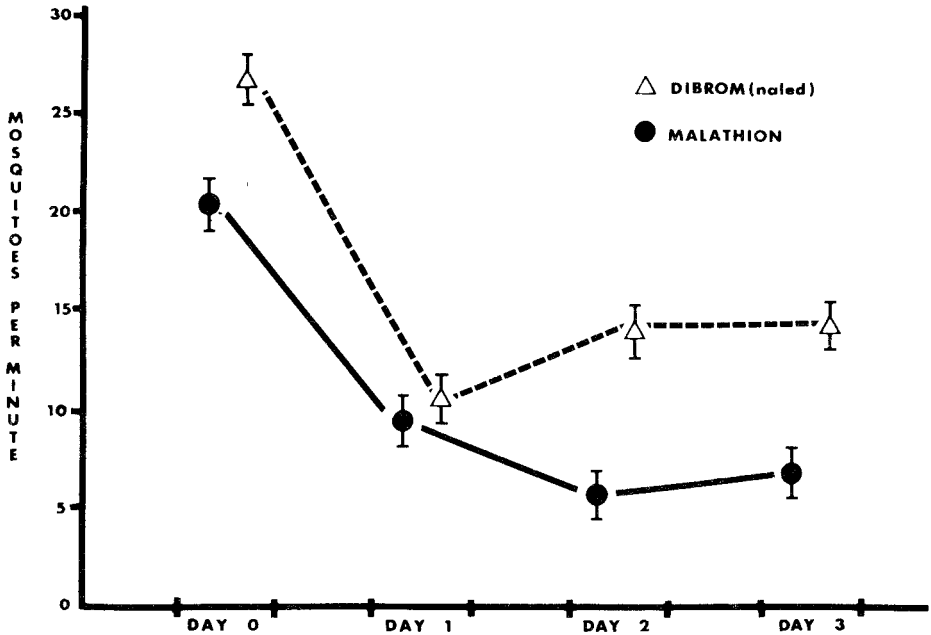

Figure 2. Mean landing counts (numbers of mosquitoes landing per min ± confidence intervals, $P < .05$) in areas 1 day before treatment (day 0) and 3 days after treatment with malathion and naled.

and provided relief to citizens and visitors 87% of the time during the 3 days post spray. This figure is useful in seeking to improve the efficiency of adulticiding and also to defend its value to the public.

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