

EFFICACY OF FENITROTHION, PROPOXUR AND CARBARYL APPLIED BY TRUCK-MOUNTED COLD AEROSOL GENERATOR AGAINST RICELAND MOSQUITOES¹

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ABSTRACT. Fenitrothion was very effective 24 hr. posttreatment against both *Psorophora columbiae* (Dyar & Knab) and *Anopheles quadrimaculatus* Say at 236.5 ml/min in open canopy, but was not as effective against *An. quadrimaculatus* in heavy canopy. At 24 hr., a dosage of 59.1 ml/min. fenitrothion was very effective against *Ps. columbiae* in the open at all swath widths. This dosage did not penetrate the canopy to control *An. quadrimaculatus*. Knockdown at one hr. posttreatment was poor for both species in all instances, averaging less than 31%.

Propoxur (.757 kg ai/3.79 liter) killed 100% of caged mosquitoes at all swath widths and

canopy cover at dosages of 177.4 ml/min., 24 hr. posttreatment. Knockdown at 1 hr. posttreatment averaged above 95%. At rates of 177.4 ml/min. and higher, propoxur penetrated heavy canopy affording good control. Propoxur (.454 kg ai/3.79 liter) effectively controlled both mosquito species at all swaths and times.

Sevin® (carbaryl) 4 oil effectively controlled *Ps. columbiae* at all dosage rates only at distance 0. The rate of 236.5 ml/min. gave the only satisfactory results against *An. quadrimaculatus* at 0 distance. Sevin® 4 oil did not seem to be well adapted for ultra low volume (ULV) applications.

ULV nonthermal ground aerosols have become a widely accepted method of adult mosquito control, and there is a continuous demand for new and effective ULV aerosols as adulticides.

Mount and Pierce (1971) evaluated propoxur and fenitrothion, and found that fenitrothion was only slightly less effective than the fenthion standard against *Aedes taeniorhynchus* (Wiedemann). Propoxur was about equal to the malathion standard against *Ae. taeniorhynchus*. Coombes and Meisch (1976) evaluated propoxur against *Psorophora columbiae* (Dyar and Knab) and *Anopheles quadrimaculatus* Say and reported effective control.

Mount et. al. (1975) tested a new formulation of propoxur (.454 kg ai/3.79 liter) and found this formulation to be 2.4 and 3.2 × more effective against *Ae. taeniorhynchus* and *An. quadrimaculatus* respectively than propoxur (.757 kg ai/3.79 liter).

MATERIAL AND METHODS

Propoxur (454 kg ai/3.79 liter and .757 kg ai/3.79 liter), fenitrothion (93%), and Sevin® 4 oil, were evaluated against Arkansas riceland mosquitoes, *Ps. columbiae* and *An. quadrimaculatus*. During 1976–77, propoxur 454 kg ai/3.79 liter and .757 kg ai/3.79 liter, fenitrothion, and Sevin® 4 oil were evaluated against caged, field collected riceland mosquitoes at the University of Arkansas Experiment Station at Stuttgart, Arkansas.

Mosquitoes were collected on the experiment station with hand-held, battery-operated aspirators. Adults were drawn into a plastic tube, and anesthetized using carbon dioxide. Approximately 20 were placed in each treatment cage, 8.59 cm × 5.08 cm high non-waxed .264 liter cardboard ice cream cartons with 16 mesh galvanized screen wire ends. The cages were then attached to steel stakes and suspended ca. 1.52 m off the ground at 15.24 m, 30.48 m, 60.96 m, and 91.44 m intervals, perpendicular to and downwind from the spray route for the "open canopy" test.

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Cages were placed in the center of 1.83 m × .914 m wide privet hedge at 15.24 m, 30.48 m, 60.96 m, and 91.44 m perpendicular to and downwind from the spray route; this was the "heavy canopy" test. The purpose of this test was to evaluate efficacy against mosquitoes in wooded areas or resting in vegetation.

Propoxur (.454 kg ai/3.79 liter and .757 kg ai/3.79 liter) was applied in both open and heavy canopy tests using a truck-mounted Leco® HD Cold Aerosol generator. All dosage rates or tests were replicated a minimum of 3 times; each rate had an untreated control. After treatment, the mosquitoes remained in the treatment cages and were offered cotton pads soaked in 10% sugar solution. One hr and 24 hr mortality observations were taken. All mortalities were corrected by Abbott's formula.

Propoxur (.454 kg ai/3.79 liter) was used at 352.94 ml/min. at 3.1 kmh. At all heavier rates, .757 kg ai/3.79 liter material was used. At these heavier rates, the capacity of the machine was extended as rates were 352.94 ml/min. at 6.2 and 12.4 kg at 3 psi. The rate of 29.41 ml and 88.23 ml/min. was applied at 6.2 kmh. Wind speed during the tests did not exceed 6.2 kmh and was usually under 3.1 kmh. The temperature was ca. 26.67°C.

Similar tests were performed for fenitrothion applied at rates of 59.146 ml and 236.584 ml at 6.2 kmh. Wind speed and temperature was approximately the same as for the propoxur study.

During the 1978 field season, Sevin® 4 oil was evaluated in a similar manner. Sevin® has been extensively evaluated in the past, and this new formulation showed some promise. The mosquitoes were collected and handled in a similar manner as previous tests but both *Ps. columbiae* and *An. quadrimaculatus* were evaluated at 0, 15.24 m, 30.48 m, 60.96 m, 91.44 m swath widths. The treatment cages were 20.32 cm ice cream cartons with 16 mesh screen wire tops and bottoms. The 236.58 ml rate was obtained by discharging this amount per minute at 6.2 kg/h and 3 psi. The 118.29 ml and 477.17

ml/min. rates were obtained by delivering 236.58 ml/min. at 12.4 and 3.1 kmh. respectively. The 0 distance was immediately next to the path of the vehicle. Wind velocities were ca. 3.1 kmh and the temperature was ca. 29.44°C. All dosage rates were replicated 3 times, and some had 6 replications. The mosquitoes remained in the treatment cages and were offered a 10% sugar solution from soaked cotton pads. Mortality observations were made after 24 hr, and the mortalities were corrected with Abbott's formula.

RESULTS AND DISCUSSION

Propoxur, (.757 kg ai/3.79 liter) killed 100% of the caged mosquitoes at all swath widths and canopy cover levels to dosages as low as 177.438 ml/min. at 24 hr. (Table 1). Knock-down at 1 hr posttreatment was very good and averaged well above 95%. At 88.72 ml/min. mortality dropped to less than 50% at 60.96 ml and 91.4 ml downwind for both *An. quadrimaculatus* and *Ps. columbiae*. Results of applications of 29.573 ml/min. were erratic and even fewer mosquitoes were killed. This seemed to indicate that too little material was applied for even coverage and effective reduction. At rates of 177.44 ml/min. and higher, propoxur penetrated the heavy canopy affording good control even in dense cover. Propoxur (.454 kg. ai/3.79 liter) effectively controlled both species at all swaths and times. Propoxur readily killed both species, but *Ps. columbiae* was slightly more susceptible.

Fenitrothion was very effective at 24 hr. against both *Ps. columbiae* and *An. quadrimaculatus* at 236.58 ml/min. in open canopy but was not as effective against *An. quadrimaculatus* in heavy canopy (Table 2). At 24 hr. a dosage of 59.15 ml/min. fenitrothion was very effective against caged *Ps. columbiae* in the open at all swath widths and also was effective against caged *Ps. columbiae* in heavy cover except at 30.48 m. This dosage did not penetrate the canopy effectively enough to control *An. quadrimaculatus*; only 28% reduction was observed at 91.44 m.

Table 1. Efficacy of ULV propoxur .454 kg ai/3.79 liter and .757 kg ai/3.79 liter aerosols against field collected adult *Anopheles quadrimaculatus* and *Psorophora columbiae* placed in open and heavy canopy at the Rice Branch Experiment Station at Stuttgart, Arkansas, 1976.

Dosage rate and species	Canopy	Percent mortality swath widths (m.) hours posttreatment							
		15.24 m		30.48 m		60.96 m		91.44 m	
		1 hr	24 hr	1 hr	24 hr	1 hr	24 hr	1 hr	24 hr
709.752 ml/min¹									
<i>Anopheles</i>	Open	99	100	100	100	100	100	100	100
<i>Psorophora</i>		100	100	100	100	100	100	100	100
<i>Anopheles</i>	Heavy	100	100	100	100	97	100	100	100
<i>Psorophora</i>		100	100	100	100	100	100	100	100
354.876 ml/min									
<i>Anopheles</i>	Open	100	100	100	100	100	100	100	100
<i>Psorophora</i>		100	100	100	100	100	100	98	100
<i>Anopheles</i>	Heavy	90	100	96	100	96	100	96	100
<i>Psorophora</i>		96	100	100	100	90	100	80	100
177.438 ml/min									
<i>Anopheles</i>	Open	100	100	100	100	98	100	100	100
<i>Psorophora</i>		100	100	100	100	100	100	100	100
<i>Anopheles</i>	Heavy	92	100	100	100	96	100	100	100
<i>Psorophora</i>		100	100	100	100	100	100	100	100
88.719 ml/min									
<i>Anopheles</i>	Open	100	100	96	96	0	0	0	9
<i>Psorophora</i>		100	100	100	100	12	48	22	30
<i>Anopheles</i>	Heavy	64	100	95	95	36	21	4	4
29.573 ml/min									
<i>Anopheles</i>	Open	0	22	100	100	59	95	0	0
<i>Psorophora</i>		100	100	93	93	33	47	5	10
<i>Anopheles</i>	Heavy	24	33	45	82	0	15	0	0
<i>Psorophora</i>		17	41	76	93	7	21	0	13

¹ Formulation used at this dosage was .454 kg/3.79 liter. All others were .757 kg/3.79 liter.

Knockdown at 1 hr after treatment was poor for both species in all instances, averaging less than 31%.

Sevin® 4 oil controlled *Ps. columbiae* more effectively than *An. quadrimaculatus* (Table 3). However, *Ps. columbiae* were effectively controlled at all dosage rates only at 0 distance; 236.58 ml/min. gave the only satisfactory results against *An. quadrimaculatus* at 0 distance. The Sevin® 4 oil against *An. quadrimaculatus* produced erratic results, overall; 473.17 ml/min. gave good control at 15.24 m, 30.48 m, and 60.96 m. No explanation was found for the poor results of this dosage rate at the distance of 0 ft.

Observations indicated that the viscos-

ity of Sevin® 4 oil adversely affected the ULV generator's output of particle size. This may account for the irregular results, and also the low mortality at the greater swath widths. It also provided considerable "clean-up" problems. Tanks and lines of the ULV generator had to be removed and flushed several times. Sevin® 4 oil does not seem to be well adapted for ULV applications.

Literature Cited

- Coombes, L. E. and M. V. Meisch. 1976. Quick knockdown mosquito control with ULV compounds applied by cold aerosol generator. Ark. Farm Research 25 (5):6.

Table 2. Efficacy of ULV fenitrothion (93%) ground tests against field collected caged adult *Psorophora columbiae* and *Anopheles quadrimaculatus* at Arkansas Rice Branch Experiment Station, Stuttgart, Arkansas, 1976.

Dosage rate and species	Canopy	Percent mortality <i>Anopheles quadrimaculatus</i> <i>Psorophora columbiae</i> swath widths hours posttreatment							
		15.24 m		30.48 m		60.96 m		91.44 m	
		1 hr	24 hr	1 hr	24 hr	1 hr	24 hr	1 hr	24 hr
59.146 ml/min									
<i>Anopheles</i>	Open	41	100	38	100	18	100	2	96
<i>Psorophora</i>		47	100	66	100	43	100	56	100
<i>Anopheles</i>	Heavy	39	71	—	—	20	50	20	28
<i>Psorophora</i>		26	100	11	0	12	95	0	83
236.584 ml/min									
<i>Anopheles</i>	Open	76	100	100	100	0	100	0	100
<i>Psorophora</i>		55	100	67	92	50	100	13	95
<i>Anopheles</i>	Heavy	30	90	17	79	2	59	0	10
<i>Psorophora</i>		31	100	47	100	23	84	2	100

Table 3. Efficacy of Sevin® 4 oil applied by cold aerosol generator against riceland mosquitoes contained in cages at various swath widths at the Rice Branch Experiment Station, Stuttgart, Arkansas, 1978.

Dosage rates	% Mortality 24 hours posttreatment swath widths									
	0	<i>Ps. columbiae</i>				<i>An. quadrimaculatus</i>				
		15.24 m	30.48 m	60.96 m	91.44 m	0	15.24 m	30.48 m	60.96 m	91.44 m
437.168 ml/min	100	35	53	12	0	22	80	100	74	45
236.584 ml/min	97	47	55	32	30	96	51	62	59	21
188.292 ml/min	99	49	33	22	21	53	38	11	3	0

Mount, G. A., and N. W. Pierce. 1971. Eleven promising insecticides evaluated as ultralow volume cold aerosol against *Aedes taeniorhynchus* (Wiedemann). Mosq. News 31:77-80.

Mount, G. A., N. W. Pierce and K. F. Baldwin. 1975. Ultralow volume ground aerosols of propoxur (Baygon® Mos) for control of adult mosquitoes. Mosq. News 35:490-92.

ERRATUM

Please refer to the article, "Cytogenetic Observations on *Anopheles dirus* of the *Leucosphyrus* Complex," Vol. 40(4):585-592. The third line of the second paragraph on page 585 in column 2 should read "1 pair of subterocentric"; Figure 8, the free end of 3R is indicated as 9, this should be 29.