

PRELIMINARY STUDIES OF LARVICIDES ON SNOW-WATER MOSQUITOES

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Snow-water, or mountain, mosquitoes create a nuisance problem to timber and road workers, vacationists, resort owners, and others in many places in the West. The treatment of swales or ponds in mountain areas several months before the melting snow causes mosquito eggs to hatch has been considered for several years, but only since the advent of DDT and other new insecticides has there been much hope for adequate control. Since larval development is usually complete before roads are passable in the spring, control measures against the immature stages are exceedingly difficult. The tests reported in this paper were initiated in Oregon on October 31, 1946, to determine the value of using some of the new insecticides during the fall when roads are open.

Yates and Gjullin (1947) reported that DDT applied at the rate of 1 pound per acre 51 days before flooding was effective against floodwater *Aedes* mosquitoes along the Columbia River. Soil samples taken on plots treated with 3 pounds per acre indicated that some of the toxicant remained in the soil nine months after treatment even though several floods had occurred.

Prelarvicide Tests.—A long, narrow, marshy swale near Diamond Lake known to be a prolific source of mosquitoes was divided into four 1-acre plots and treated with DDT-oil solutions and a dust mixture. Soil samples collected at the time of spraying showed viable eggs to be present. The water was covered with ice 1 inch thick and snow from 1 to 6 inches deep. The oil solutions were applied with a hand sprayer, and the dust was broadcast by hand. Ten per cent of DDT plus 20 per cent of xylene in Diesel oil was used at the rate of 2 pounds of DDT per acre on two plots and 1.6 pounds on another

plot. Five per cent of DDT in talc was applied to one plot at the rate of 0.9 pound of active ingredient per acre. Two plots were also treated in the Odell Lake area, one with DDT in Diesel oil at 3.2 pounds per acre, and the other with the DDT-xylene emulsion at 4.5 pounds.

Examinations of these areas were made on May 14, 1947, while the roads were still blocked with snow. Dipping throughout the treated plots (water depth 12 inches) at Diamond Lake failed to show a single larva, but in the untreated areas they were present in great numbers. Even the lowest dosage of 0.9 pound of DDT in dust form gave perfect results. Water samples taken at this time proved to be highly toxic to third- and fourth-stage mosquito larvae. Collections showed 65 per cent to be *Aedes communis* (Deg.), 32 per cent *A. hexodontus* Dyar, and 3 per cent *Aedes* sp.

No larvae were found in the plots located in the Odell Lake area. Although they appeared to be likely areas for mosquito breeding, soil samples taken at the time of treatment failed to show any eggs, and the results are therefore of doubtful value. The plot on which the DDT-xylene emulsion had been applied contained water from 2 to 3 feet deep. The examination of this plot during the spring and summer showed white sheets of DDT on the bottom surface in the exact places where the material had been applied in the fall. Water samples taken from several of the plots at intervals during the summer proved to be toxic to third- and fourth-stage larvae of *Culex tarsalis* Coq. Even 11 months after the treatment water samples gave 95 to 100 per cent mortality of second- and third-stage larvae of *C. tarsalis* and *Anopheles* sp. Presumably some of the DDT goes into solution in the water in an amount sufficient to be toxic to the

TABLE 1. Results of Field Tests with DDT Formulations on Snow-Water Mosquito Larvae in the Cascade Mountains and Near Diamond Lake, Oregon.

Material Used	Dosage of DDT	Tests	Mortality in 24 Hours
	Pounds Per Acre	Number	Per Cent
DDT, 1.25 per cent in Diesel oil	0.05	5	99
	.02	9	93
	.01	5	92
	.005	3	79
DDT dust, 5 per cent	.2	3	95
	.1	2	94
	.04	2	84
	.02	2	78
DDT-xylene emulsion (1 part of DDT to indicated million parts of water)	125	1	100
	250	4	98
	500	9	94
	750	2	64

larvae. The importance of the long-lasting effect of prelarvaciding treatments for mosquito control in mountain areas is considered great.

Field Tests.—Small-plot field tests were conducted during May and June against mountain mosquito larvae with three formulations of DDT—a solution, a dust, and an emulsion. A high percentage of the larvae were in the fourth instar at the time of testing. About half the tests were made in open and shaded mountain meadows in the Cascade Mountains along the Santiam River, and the others in the vicinity of Diamond Lake over typical marsh areas containing a good growth of grass. The plots ranged in size from 100 to 1,800 square feet, but were much too small to give the best results. With larger plots the drift of insecticide would be minimized. Some of the oil solutions were applied with a Flit gun, producing an atomized spray, whereas a small pressure gun was used for the others.

TABLE 2. Results of Laboratory Tests Which Several New Insecticides Against Fourth-Instar Larvae of Snow-Water Mosquitoes.

Chemical and Concentration (1 part of DDT to indicated million parts of water)	Tests	Mortality in	
		24 Hours	48 Hours
	Number	Per Cent	Per Cent
Gamma-benzene hexachloride ¹			
350	2	86	100
500	5	66	89
600	3	39	83
DDT			
350	2	82	100
500	4	57	89
600	4	38	85
Chlorinated camphene			
350	1	64	96
500	4	28	88
600	3	20	52
Chlordane			
350	2	70	98
500	4	22	91
600	4	35	73
Methoxy analog of DDT			
350	1	68	96
500	4	49	89
600	3	31	59
Checks on different lots	3	8	17

¹ 100 per cent made from a sample containing 83 per cent of gamma isomer.

Slightly better results were obtained with the pressure gun, which produced larger particles. The emulsions were applied as a spray and by pouring the material on the water. A small bulb duster was used in applying the dusts. In a few cases the slow movement of water from the treated plots reduced the concentration of the emulsion and no doubt reduced mortalities of larvae.

Samples of larvae taken from test plots at Santiam proved to be 100 per cent *Aedes communis*. The water temperature was 62° F. at the time of treatment. Larvae from the plots near Diamond Lake were identified as follows: *A. communis* 35 per cent, *A. fitchii* (F. and Y.) 25 per cent, *A. increpitus* Dyar 25 per cent, and *A. cineris* Meig. 15 per cent. The water temperature was 44° F.

A summary of all the field tests is given in Table 1. Only the 24-hour mortality counts are shown. The 48-hour readings could not be obtained in all cases, but the mortality was, of course, greater than for the 24-hour counts. The oil treatments at 0.01 pound of DDT per acre and the dust treatments at 0.1 pound per acre gave more than 90 per cent mortality, and the oil at 0.05 pound gave 99 per cent.

Laboratory Tests.—A series of laboratory tests with various insecticides were made on fourth-instar mosquito larvae collected in mountain areas. Identification of the several lots used showed 93 per cent *Aedes communis*, 6 per cent *A. hexodontus*, and 1 per cent *Aedes* sp. Acetone solutions of DDT and some of the newer chemicals—gamma-benzene hexachloride, chlorinated camphene, chlordane, and the methoxy analog of DDT—were used in beakers containing the larvae in 600 ml. of water. The temperature ranged from 50° to 60° F. in the various tests.

DDT at 1 part in 600 million parts of water killed about 85 per cent of the larvae in 48 hours (Table 2). Previous tests had shown that one-half this concentration was required to give 90 per cent mortality of *Aedes vexans* (Meig.), and *A. sticticus* (Meig.). DDT and gamma-benzene hexachloride were about equally toxic to mountain species and chlorinated camphene, chlordane, and the methoxy analog of DDT were somewhat less effective.

Literature Cited

- YATES, W. W., and C. M. GJULLIN. 1947. Pre-hatching applications of DDT larvicides on floodwater *Aedes* mosquitoes. MOSQUITO NEWS 7:4-6.