LOW VOLUME AERIAL INSECTICIDE APPLICATION FOR THE CONTROL OF *AEDES SOLLICITANS* WALKER [1]

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Because of the continued success of ultra-low volume (ULV) application of insecticide against *Aedes sollicitans* Walker in Kentucky, (Knapp and Roberts 1965, Knapp and Pass 1966a, 1966b, Knapp 1967, and Knapp and Gayle 1968), investigations on the application and effectiveness of different insecticides were continued during the spring of 1966.

MATERIALS AND METHODS. A Piper Super Cub airplane modified for low-volume spraying was equipped with two modified Fischer EA–12 electro atomizers.[3] One atomizer was secured to each side of the plane by brackets attached to the plane's spray boom (Figs. 1, 3). The atomizers consisted of a 12-volt series-wound motor driving a stainless steel rotating screen. In normal practice the insecticide is fed into a molded polypropylene manifold and through orifices directed toward the rotating screen. The speed at which the screen rotates determines the particle size; however, in these tests the screen was rotated at the maximum speed of 6,400 r.p.m. A model AD–240A 12-volt Stewart Warner electric fuel pump containing Telfon® gaskets and diaphram was used to pump the insecticide from a stainless steel tank to the atomizer. The pump and the tank were mounted in the luggage compartment of the plane (Fig. 2). A coiled 2/8″ copper recirculating line ran from the pump to the tank. This line was insulated with plastic tubing and served to warm the insecticide on cool mornings to insure an even flow through the atomizer. A 12-volt solenoid valve was placed in the recirculating line and in the line leading to the atomizer. The latter line was of 2/8″ polyethylene. When spraying was desired, one switch located on the instrument panel in the cockpit turned the recirculating solenoid valve off and the spray line solenoid valve on. The pump was on a separate switch. Another suction line attached to a two-way valve on the pump was used to clean the system with solvents. The inner walls of the tank were washed by the solvent being recirculated and forced through small jets inside the tank. A valve was mounted at the lower end of the bottom of the tank for draining.

Because the fuel pump was only capable of producing 8 lbs. psi, the atomizer was modified in such a way that the 2/8″ tubing fed the insecticide directly into the center of the rotating screen (Fig. 2). A needle valve was inserted into this line to regulate the flow rate. In this manner the insecticide flowed onto a stainless steel splash plate that held the screen in place. By centrifugal force insecticide was thus thrown through the screen and was dispersed into a fine droplet spray.

Depending upon the insecticide and the dosage rate, 1 or 2 of these electric atomizers were used.

Insecticides tested were: naled, 14 lbs. per gallon; fenthion, 8 lbs. per gallon; Baygon® (O-isopropoxyphenyl methyl carbamate), 2 lbs. per gallon; trichlorfon, 4 lbs. per gallon; malathion, 10.2 lbs. per gallon and dichlorvos, 93 percent active (approximately 11.6 lbs. per gallon). The

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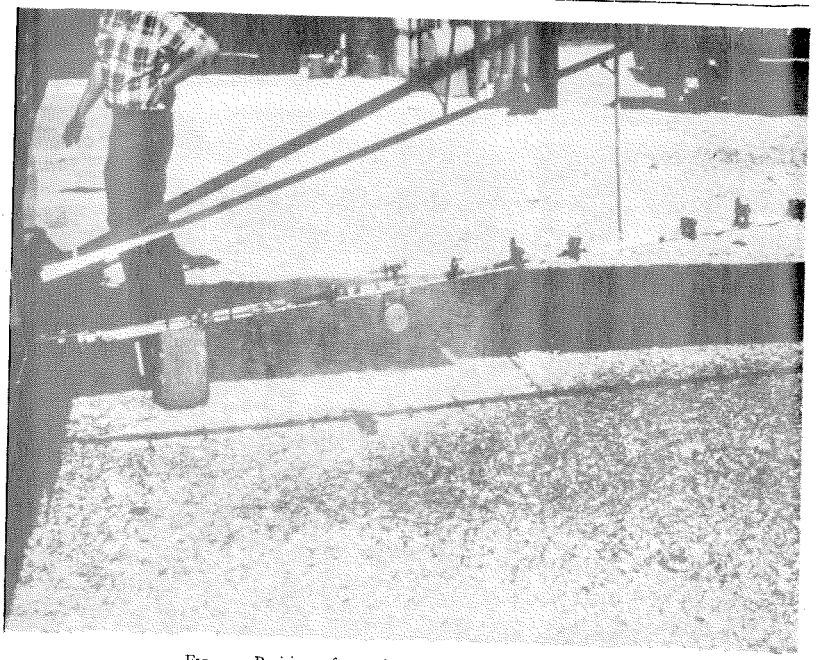

FIG. 1.—Position of atomizer on right boom of plane.

latter two were combined in a 5:1 weight ratio.

Applications of insecticides requiring a higher dosage rate than the fuel pump could produce were applied by use of the plane's own spraying system as described by Knapp and Pass (1966).

All treatments were applied between 7 to 8 p.m. and 5:30 to 7:30 a.m. Central Daylight Time. The airplane was flown at an altitude of 75 to 100 feet and at an air speed of 80 m.p.h. An effective swath width of 100 feet was used for calculating the dosage per acre. The areas used in these tests ranged from 200 to 300 acres. Pre-spray and post-spray adult mosquito counts were taken by counting the number of mosquitoes on and in the immediate vicinity of the person within 30 seconds as described by Knapp and Pass (1966). This was repeated in five locations within each test area. The test sites were sparsely populated consisting mainly of swamps bounded by densely wooded areas.

The weather was good, with wind speeds from 0 to 4 m.p.h. and temperatures varying from 65 to 80° F.

Two different rates of naled, 0.05 lb. (0.5 fluid oz.) and 0.10 lb. (1 fluid oz.), were applied with one electric atomizer. Two tests at 0.05 lb. per acre and 1 at 0.1 lb. per acre were applied in the evening whereas one of each was applied during the morning hours.

Baygon ULV was compared to Baygon in water at the rate of 0.05 lb. per acre. The Baygon ULV was applied at 3.2 fluid oz., whereas the Baygon in water was applied at the rate of 64 oz. per acre. Two electric atomizers were used for applying Baygon ULV, and the plane's own spray system was used to apply the Baygon in water. In the latter application, 17 Spraying Systems Company Tee-Jet® nozzles No. 730385 were used. Eight of these nozzles were placed on the left boom and nine on the right. A boom pressure of 40 psi was used on this test. Both ap-

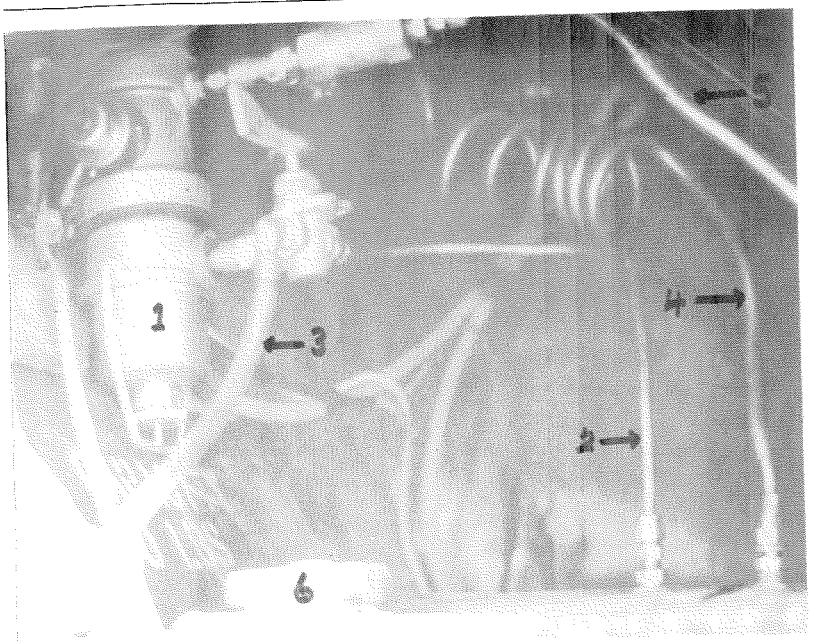

FIG. 2.—Fuel pump (1), suction line from tank (2), suction line for cleaning pump and tank (3), insulated recirculating line (4), insulated outlet line to atomizer (5) and tank (6).

plications were made during the evening hours. Baygon and fenthion combination was applied with two electric atomizers at the rate of 0.04 lb. per acre respectively (3.2 fluid oz.). Malathion was mixed with dichlorvos at the ratio of 5 to 1 and applied during the evening hours at the rate of 0.15 lb. of malathion to 0.03 lb. of dichlorvos (2.4 fluid oz.) per acre. Two treatments of trichlorfon was applied at the rate of 0.3 lb. (9.7 fluid oz.) per acre. Trichlorfon treatments were applied using the plane's spray unit. Four 8ooe Tee-Jet nozzles, two mounted on each side of the plane was used in this test.

The type of foliage cover that each test was applied over is shown in Table 1.

RESULTS AND DISCUSSION. The results of the various treatments are shown in Table 1. The density of the foliage cover had some influence upon the percentage reduction of adult mosquitoes. This can especially be seen in comparing the two evening applications of naled at 0.05 lb. per acre. In areas having a medium-to-heavy foliage a 44 percent reduction of adult mosquitoes was seen at 2 hours after the application as compared with approximately 99 percent reduction of mosquitoes for the area having light-to-no-foliage cover. The same dosage rate applied during the morning hours at a temperature of 68° F. showed that the mosquitoes were adequately reduced within 1 to 1½ hours, although the control started to decline after 6 hours. This decline may have been because the adult mosquitoes were not so active at the time of spraying, owing to the low temperature.

Naled applied at 0.1 lb. per acre over areas of little to no foliage showed little difference between the morning and evening application. However, again the morning application was not as effective as the evening application, whereas no

TABLE 1.—Effectiveness of various aerial applications of insecticides against *Aedes sollicitans* Walker adults.

Compound	Time application [a]	Temp. (°F.)	Fluid oz./acre	Pound per acre	Pretreatment Type foliage [b]	Pretreatment no. adults 30 sec.	% Reduction—hours following treatment 0.5	1.0	1.5	2.0	6.0	10	24	36
naled	PM	80	0.5	0.05	1, 2	60	0	78 [c]	87	98.9	100	100	..	90
naled	PM	70	0.5	0.05	4, 5	15	..	..	..	44.0	100	100	100	86
naled	AM	68	0.5	0.05	5	38	43	83	96	..	97	66	..	..
naled	PM	80	1.0	0.10	1, 2	64	88 [d]	97	..	..	100	100	100	84
naled	AM	65	1.0	0.10	2	30	85	100	..	..	..	100	85	..
Baygon ®:water	PM	80	64.0	0.05	2	24	0	..	76	98.0	..	99	99	96
Baygon ®:	PM	81	3.2	0.05	2, 5	24	0	0	89	..	..	94	95	89
Baygon ®: fenthion (4:1)	AM	78	3.2	0.04: 0.04	3, 4	12	..	..	..	84.0	95	88	95	..
malathion: dichlorvos (5:1)	PM	80	2.4	0.15: 0.03	3, 5	24	..	..	92	..	88	80	83	..
trichlorfon	AM	64	9.7	0.30	4	40	88	..	..	..	68 [e]	46 [e]	..	..
trichlorfon	AM	64	9.7	0.30	4	14	91	..	..	..	96	65	..	..

[a] All treatments applied between 7 to 8 p.m. and 5:30 to 7:30 a.m., Central Daylight Saving Time.

[b] 1=4–6″ grass, 2=waist high grass, 3=light foliage—numerous open spaces, 4=medium foliage—few open spaces, 5=heavy foliage—very few open spaces.

[c] 47 percent at 45 minutes.

[d] 66 percent at 15 minutes.

[e] Adult emerging from pupae.

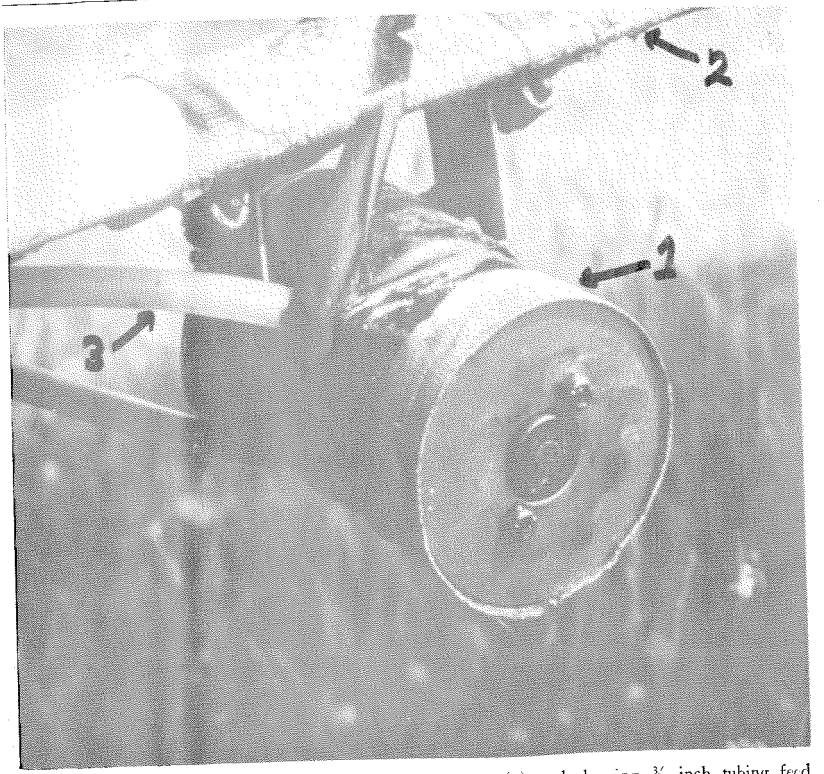

FIG. 3.—Close up of atomizer (1) attached to plane boom (2) and showing ⅜ inch tubing feed line (3).

reduction was found during the morning application in the same time period.

Very little difference in reduction of mosquitoes was seen between the Baygon in water and the Baygon ULV application, even though Baygon ULV application was applied over areas having a denser foliage than the area where the Baygon in water was applied. In general, the Baygon water application showed slightly better reduction. However, the gallonage of the solution needed for applying the same dosage rate as compared with the amount needed for the ULV is a disadvantage. Although the rapidity of knockdown of adult mosquitoes was not as great as it was with naled and trichorfon, adequate reduction occurred within 1½ to 2 hours after application. No advantage was seen in the reduction of adult mosquitoes by the use of Baygon and fenthion combination. The advantage of this combination has been reported by Knapp and Gayle (1968) in that Baygon was found ineffective as a larvicide but very effective as an adulticide, whereas fenthion was less effective as an adulticide but very effective as a larvicide.

The use of dichlorvos in malathion at the rate of 0.03 lb. of dichlorvos to 0.15 lb. of malathion per acre was advantageous in the knockdown of adult mosquitoes. However, 6 hours later adult mosquitoes began to increase. In previous tests, malathion applied at the same rate did not give any appreciable reduction of mosquitoes (Knapp and Roberts, 1965; Knapp and Pass, 1966). Knapp and Gayle

(1968) also found that when malathion was mixed with naled at the ratio of 0.154 to 0.017 lb. per acre a more rapid knockdown of adult mosquitoes occurred than with malathion alone. The two tests with trichlorfon at the dosage rate of 0.3 lb. per acre were not comparable because in one test the area treated had considerable numbers of pupae and the emergence of the pupae immediately after treating affected the percentage reduction of adults. However, in the test where pupae did not emerge until after the 6-hour count, 91 percent reduction of adults occurred at ½ hour and a 96 percent reduction at 6 hours after the application. Larvae of *Aedes sollicitans* placed in 32 oz. waxed cartons within the area treated with trichlorfon showed a 98 percent reduction of larvae 12 hours after treatment and a 100 percent reduction in 24 hours after treatment.

CONCLUSIONS. These tests show that insecticides are available, either alone or in combination, to give a rapid reduction of adult mosquitoes. The tests also show that the percentage reduction will vary owing to time of application and to the type of foliage cover in the area.

The use of Fischer EA electric atomizer served our purpose for a simple method of applying the insecticides. However, the insecticide used damaged the motor coverings and the electrical wire leading to the motor.

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