OPERATIONAL AND SCIENTIFIC NOTES

A New Concept in Aerial Spraying. During the summer of 1958, Jefferson County (Texas) Mosquito Control District tried a new procedure for applying mosquito adulticide by airplane.

The standard procedure for the District has been to fly swaths 100 to 150 feet apart. A solution of malathion in oil, calculated to give a deposit of 0.1 lb. per acre, was used. In our particular case, the concentrate contained 0.4 lb. of malathion per gallon of oil solution. The pressure and nozzles of the Piper Super Cub were adjusted to the proper rate, 1 qt. per acre. The maximum area possible in one day has been about 4,000 acres.

In an effort to increase the efficacy of our air spray operations, we increased the amount of insecticide per gallon and widened the space between swaths. Although the evaluation of this method is incomplete, we are satisfied with the progress. Currently, swaths spaced approximately 400 feet apart are being used. The nozzle arrangement and pressure are unchanged. The concentration of malathion has been increased to 1 lb. per gallon of oil. The rate of application of the insecticide, figured on a per acre basis of the entire area, is still 0.1 lb. per acre. No attempt is made to secure an even coverage of the entire area. Perhaps a better description of the operation is: we establish a series of barrier strips through which the mosquito must move to get out of the treated area. Probably the best procedure for applying the insecticide in these widely separated swaths is to lay the first swath as a barrier strip along the down wind side of the area being treated. Subsequent swaths will be laid at 400 feet intervals back towards the first swath.

The kill within the area has been equal to the kill with the blanket, or even, coverage method. The killing time is increased. Probably the killing time is reduced in the areas actually treated, but due to the time lag created by those mosquitoes caught between swaths wandering into the lethal concentration, the over-all time is greater. The reduction of population in a given area is slower by a matter of 2–3 hours than the original method.

Use of the new method of treatment, in an area where the people affected are able to watch the airplane, has resulted in considerable criticism. The population has been educated, during the past five years, to a low-flying airplane working a 100-foot swath. Perhaps as time goes on, the public reaction will change.

There are still many problems to be solved in connection with the new method of treatment. So far, it has been used only where the area lies at a right angle to the wind direction. We do not know the effect, if any, if the 400 feet barrier swaths are laid with the wind. We have arbitrarily kept our rate per acre the same as with the old method. We do not know the necessity for maintaining this high a concentration. Perhaps the concentration could be lowered with equally good results.

We have proven to our own satisfaction during the past summer that the 400-foot swath is effective and economical. We have been able to treat in excess of 8,000 acres per day without undue strain on the pilot. In fact, 8,000 acres takes less time than a 4,000 acre day did with the narrow swath procedure.

There are some pilot difficulties to overcome in the new method as most duster-sprayer pilots are accustomed to the narrow agricultural swath. The 400-foot swath is very difficult to estimate. Our pilot, who has become accustomed to the new schedule, prefers it to the old method. If any other District has any information on this subject, we will be very glad to hear from them.—George A. Thompson, Director, Jefferson County Mosquito Control.

Surfacing Time as a Simple Criterion of Normality in *Anopheles* Larvae.—In toxicological tests on *Anopheles* larvae a moment comes when it is essential to estimate rapidly and accurately the normality of the larvae. Movement of an insect is usually taken to indicate the presence of life but does not necessarily indicate normality. In order to make the criterion of normality objective and as simple as possible, a study was made on the speed with which normal feeding and fasting third and fourth stage larvae of the LTD strain of *Anopheles quadrimaculatus* Say (Diptera, Culicidae) rise to the surface after being pipetted to the bottom of a liter of distilled water.

The larvae were reared as previously described (Jones, J. C., 1957. A new standard for the rapid detection of DDT tolerance in *Anopheles quadrimaculatus* larvae and pupae. Mosq. News 17: 1–9.) Uniform and healthy looking larvae of the third and fourth stages were washed just before pipetting them individually with a large-mouth glass pipette to the bottom of a glass liter, beaker of distilled water. The time required for a larva to reattach perfectly to the air-water interface and assume its natural horizontal stance was taken (= *surfacing time*), and the larva was then quickly submerged again until it had undergone 5 consecutive submergences. If larvae did not rise to the surface in 5 minutes, they were brought to the air-water interface and then re-submerged. A series of numbered larvae were kept without food (fasting) in 20 ml. of distilled water for 24 to 96 hours before testing their ability to rise to the surface.

TABLE 1.—Mean surfacing time (seconds) of well-fed fourth stage *Anopheles quadrimaculatus*

Age in fourth stage	No. larvae	Submergence 1	2	3	4	5
		Seconds to rise to air-water interface				
1 hour	5	25.8	38.4	38.8	57.7	73.0
24 hours	5	12.3	23.4	47.8	40.3	33.6
	5	39.3	45.3	53.4	48.2	48.4
48 hours	5	57.5	26.8	41.8	45.3	56.8
	5	34.0	36.0	21.2	22.9	21.0
72 hours	5	60.6	73.2	59.0	68.2	86.6
	5	64.6	47.3	46.8	77.3	60.6

TABLE 2.—Surfacing time of fasting fourth stage *Anopheles quadrimaculatus* larvae

Age in fourth stage when fast begun	No. larvae	Submergence 1	2	3	4	5
		Seconds to rise to air-water interface				
		Fasted 24 hours				
1 hour	5	22.7	22.2	20.6	30.2	33.8
24 hours	5	8.2	38.9	29.0	36.7	18.8
48 hours	5	17.7	5.7	5.9	6.7	17.6
72 hours	2	42.5	10.2	35.8	20.2	8.4
		Fasted 48 hours				
1 hour	5	9.4	28.6	7.1	23.5	32.5
24 hours	5	5.1	39.9	8.9	5.2	22.9
48 hours	2	5.1	5.7	7.2	7.5	4.4
		Fasted 72 hours				
1 hour	5	15.2	14.9	72.7	85.7	159.2
24 hours	4	10.1	5.4	4.6	13.6	6.3
48 hours	1	8.2	5.0	6.4	6.0	4.6
		Fasted 96 hours				
1 hour	4	5.9	4.7	6.4	6.0	7.4

RESULTS.—Five well-fed third instars surfaced in 11 to 100 seconds (mean of 42.2 seconds). Seventeen third stage larvae, after fasting 24 hours, surfaced in 6 to 195 seconds, with a mean surfacing time of 32.3 seconds, there being no marked differences between the 5 different submergences which varied from 26.4 (standard error 7.4) to 39.7 (standard error 10.9) seconds. When these seventeen larvae were starved an additional 24 hours, 4 were found dead, and all but one of the remaining 13 had molted to the fourth stage. Four of the molted larvae when submerged remained submerged at each of the 5 trials for 5 minutes. The eight remaining fasting fourth instars surfaced in from 5 to 272 seconds, with a mean surfacing time of 68.7 seconds (fasted 48 hours). There was a 2- to 3-fold decrease in the speed with which they were able to surface after the first submergence. The single fasting third stage larva at 48 hours very rapidly surfaced in from 8 to 27 seconds (mean, 15 seconds).

Table 1 shows that most well-fed fourth instars surface within one minute or less (first three submergences), the 3-day old ones surfacing more slowly than the younger ones. Twenty-four to ninety-six hour fasted fourth instars rise to the surface significantly faster than well-fed specimens (Table 2).

On the basis of the data described in this note it is suggested that *Anopheles* larvae be considered normal if they are able to surface within 1 minute at either the 24 and/or 48 hour points in toxicological tests.—Jack Colvard Jones, Department of Entomology, University of Maryland, College Park, Maryland. Scientific Article No. A699, Contribution No. 2922 of the Maryland Agricultural Experiment Station, Department of Entomology.

RESULTS OF FIELD TESTS WITH NEW COMPOUNDS AS MOSQUITO LARVICIDES. (A cooperative project between the Entomology Research Branch of the U. S. Department of Agriculture and the

TABLE 1.—Effectiveness of several insecticides against fourth-instar *Aedes nigromaculis* and *Culex tarsalis* larvae in field tests. Average of 2 or 3 tests.

Insecticide	Percent mortality in 24 hours at indicated dosage per acre					
	0.4 lb.	0.3 lb.	0.2 lb.	0.1 lb.	0.05 lb.	0.025 lb.
Aedes nigromaculis						
Chrysanthemumic acid esters						
6–bromopiperonyl	97		86			
Piperonyl	56		75			
6–chloropiperonyl	98		91			
6–chloropiperonyl plus piperonyl butoxide	—		97			
6–bromopiperonyl plus piperonyl butoxide	—		98	98	85	
2, 4–dimethylbenzyl plus piperonyl butoxide	—		99	98	82	
o–methylbenzyl plus piperonyl butoxide	—		—	86	69	
Organic phosphorus compounds						
Am. Cyanamid 12008	—		—	—	97	69
Dow ET–57 (sampled as ET-14)	—	100	80	72	—	
Trithion (Flowable 4)	—	—	—	62	46	
Culex tarsalis						
Chrysanthemumic acid esters						
6–bromopiperonyl	82					
6–chloropiperonyl	44					

Bureau of Vector Control of the California Department of Public Health. David M. Hawbecker, field aid of the California Bureau of Vector Control, assisted with most of these experiments.) A number of new materials were tested as mosquito larvicides in California in 1957. The most promising were the chrysanthemumic acid esters. Chrysanthemumic acid is a synthetic material similar to that found in the chrysanthemum flowers, from which pyrethrum is obtained.

The chrysanthemumic acid esters have a very low toxicity to warm-blooded animals. They are only one-eighth as toxic as pyrethrum and one-third as toxic as allethrin.

The tests were made on fourth instar *Aedes nigromaculis* and third and fourth instar *Culex tarsalis* larvae in irrigated pastures. The test plots were 1/16 acre in size, and the water ranged from 2 to 10 inches in depth. The insecticides were applied as emulsions with a 1-gallon compressed air sprayer. Pretreatment and post-treatment counts were made by taking 20 dips in each plot. The results are presented in table 1.

Against *Aedes nigromaculis* some of these materials were effective at 0.4 pound per acre. Their effectiveness was increased by the addition of piperonyl butoxide, 5 parts to 1 part of the toxicant. Tests with *Culex tarsalis* indicate that they may be less effective against this species. However, heavier grass growth and floatage may have been partially responsible for the reduced mortality in these tests.

Three organic phosphorus compounds were also tested. American Cyanamid 12008 was the most effective of these materials. Mortalities of *nigromaculis* in these tests were slightly lower than those obtained by Labrecque *et al.* (LABRECQUE, G. C. GAHAN, J. B. and NOE, J. R. Toxicity of some new organic phosphorus compounds to anopheline larvae. N. J. Mosquito Extermin. Assoc. Proc. 43:172–175.), against *Anopheles crucians* and *quadrimaculatus*. C. M. Gjullin, *Entomology Research Division, Agr. Res. Serv., U.S.D.A.* and Lawrence L. Lewallen, *Bureau of Vector Control, California Department of Public Health.*

RELATIONSHIP BETWEEN APPARENT MORTALITY AND DDT CONCENTRATION IN *Anopheles* LARVAE. —Parker made the interesting observation that 15 to 25 percent of *Aedes aegypti* larvae, showing signs of being mortally affected by DDT immediately after a one-hour exposure to 0.025 to .04 p.p.m., could completely recover within 24 hours. (A. H. Parker, 1957. The susceptibility of *Aedes aegypti* larvae of different ages to DDT and dieldrin, and the relevance of the results to the formulation of standardized susceptibility tests for mosquito larvae. Ann. Trop. Med. and Parasitol. 51(2):201–215.)