THE APPLICATION OF LARVICIDE BY AIRPLANE FOR CONTROL OF BLACKFLIES (SIMULIIDAE)

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A previous paper by the same authors (Travis *et al,* 1951) described blackfly control operations which included strip spraying by helicopter to eliminate blackfly larvae from the streams in a portion of the Town of Webb, in the northern part of Herkimer County, New York. The method consisted of spraying parallel strips one swath wide, one-fourth of a mile apart across an area of almost 40 square miles. It was thought that the maneuverability of the helicopter at slow speeds would make it especially suitable for this type of work, but it was found unnecessary to take advantage of this feature.

The results were considered sufficiently promising to warrant the inclusion of aerial larvicide treatments in the regular control program without the addition of the helicopter fogging, which had been a feature of the original large scale control effort.

In 1951, therefore, the aerial fogging was omitted, and the aerial larviciding was done by fixed-wing planes. Some larviciding was also done with DDT-impregnated plaster blocks in a tract adjacent to the one which was treated from the air.

Procedure. The planned operations pattern was for two Piper Cubs to fly adjacent parallel 100-foot swaths ⅛ mile apart. Each plane had 2 spray nozzles calibrated to deliver 0.35 gallon per minute at 60 pounds tank pressure. It was estimated that at 60 miles per hour a dosage of 0.1 pound of DDT (½ pint of solution) per *swath* acre would be delivered. One acre 100 feet wide would be 435.6 feet long. There would be 12.12 such acres in a swath a mile long.

At ⅛ mile apart beginning at one side of the plot and finishing on the side opposite there would be 9 such swaths in a plot 1 mile square. Thus, 9 swaths of 12.12 acres each would be 109.08 acres in each square mile actually covered by spray. This means that on an over-all "square acreage" basis (the usual method for calculating spray dosages over water for mosquito control), the dosage would be 109.08 × .1 or 10.9 pounds DDT per square mile or 0.017 lb. per acre. This difference between the dosage per acre on a regional basis and the dosage per swath acre should be kept in mind. In this paper, unless otherwise noted, the references are to *dosage per swath acre.*

The spray, as in 1950, consisted of 20% DDT, 20% fuel oil and 60% auxiliary solvent (Sovacide F). The entire acreage, comprising some 90 to 100 square miles, required approximately thirteen 54-gallon drums of solution and 1260 pounds of DDT. Calculating from these figures an average dosage of .019 lb. of DDT per acre was applied, a figure which is surprisingly close to the .017 lb. per acre calculated as the theoretical dosage on a regional basis.

Results: Effects on larvae in individual streams. Calculation of the actual dosages applied is complicated by the fact that through an error in mixing, one sector, a section about 16 miles long and 4 miles wide, was covered first at the rate of only .017 lb. *per swath acre,* using a 3.2% DDT solution with the usual swath pattern. After this error was discovered, the section was re-sprayed with full strength solution (20% DDT). On this second coverage the pilot did not fly the swath pattern, but rather attempted to cover selected streams in order to save material and flying time. Results of this method indicate that a combination of a regular pattern in some sections with topical

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treatment in others may prove to be the best procedure.

Even the lighter dosage apparently caused a substantial reduction in larval population, estimated at 72%. After the supplementary treatment the populations in all but three streams were reduced virtually to zero (Table 1).

TABLE 1.—Reduction in numbers of blackfly larvae in streams treated by aircraft with DDT. (Treated at the rate of 0.017 lb. [1st spray] and partially at the rate of 0.1 lb. [2nd spray] per swath acre).

Stream	Blackfly larval populations * Before treatment	After 1st spray	After 2nd spray
2nd Okara outlet	70	30	0
Indian Brook	2000	150	0
North Branch Ind. Brook	1000	rare	0
Safford Pond outlet	70	0	0
1st Little Safford inlet	150	50	30
2nd Little Safford inlet	150	50	30
3rd Lake Creek	20	rare	0
Pole OF #38 stream	50	20	0
Pole CYNY #861 stream	30	10	–
Old Forge Dam	100	30	0
1st stream south of Indian Brook	400	20	200

* Units used are number of larvae per 10 attachment units, which were generally grass blades, or stones 4 to 8 inches in diameter.

Of the three streams showing poor control the "first stream south of Indian Brook" was the same stream that showed poor control in 1950 (Travis *et al,* 1950). This stream and the other two ("Little Safford Inlets") were small streams, hardly more than 2 feet wide, and contained many dead leaves. The explanation for the poor control in these three streams is still uncertain. The most obvious explanation is that they were so small that they were missed, or had insufficient surface exposed to the spray swath because of overhanging vegetation.

Several streams that had not been seen before treatment were examined after the spraying. In one of these, Lily-pad Pond Outlet, living larvae were numerous, but there were also many thousands of dead larvae which had been washed downstream and were caught by their silken threads, virtually strained out by fallen spruce trees the branches of which were partly submerged. It was noticed that most of the larvae which survived were nearly ready to pupate.

The poor kill in this stream may have been due to the fact that mature larvae are more resistant to the insecticide, as suggested by Gjullin, Cross and Applewhite (1950).

Observations in one of the small (width 3 to 4 ft.) streams in the area treated with 0.017 lb. of DDT per swath acre showed that the maximum effect was achieved in the comparatively short period of time of 1½ hours, although this extremely light dosage did not result in complete eradication of the larvae. Five-minute samples were taken at half-hour intervals with a square-foot sampler (see Travis, *et al,* 1951 for technique), beginning a half hour before treatment. At the time of the second sample the plane was laying down a spray swath about 300 yards upstream from the sample point. The figures obtained in these successive samples are given in Table 2.

TABLE 2.—Five-minute samples taken from a stream treated by aircraft (1951). (Treated at the rate of 0.017 lb. DDT per acre.)

Time	Number of Blackfly larvae
12:35 p. m.	2
1:05 " *	–
1:35 "	7
2:05 "	68
2:35 "	108
3:05 "	47
3:35 "	30
4:05 "	20
4:35 "	7
5:05 "	1

* Plane passed about 800 feet upstream at 1:05 p.m. The spray could be seen and smelled.

It is significant that the numbers of arthropods other than blackfly larvae carried downstream during this period of observation did not increase, the average number both before and after treatment being less than one per sample.

Other observations also indicated that no serious reduction in populations of arthropods other than blackfly larvae resulted from the treatments described. These observations will be presented in a later paper.

Results as indicated by collections of adult blackflies. The ultimate objective of the treatments was, of course, the abatement of the nuisance of the biting blackflies, and the degree of this abatement is the real measure of the success of the treatments.

The figures on relative numbers of annoying adults were obtained by estimating the numbers flying about the observer at the end of a 10-minute observation period. The accuracy of these estimates was checked from time to time by net counts. In an effort to obtain a more accurate and detailed picture of the population trends of these blackflies, a total of 309 observations were made during the blackfly season in 1951. In the corresponding period in 1950, 172 observations were made. These observations were made at widely separated points inside and outside of the control area. Observations made in June are summarized in Table 3 .

TABLE 3.—Occurrence of high and low counts of blackfly adults in treated and untreated areas in June 1951.

Numbers of flies	No. of observations at indicated frequency	
	In treated area	In untreated area
Less than 1	45	28
1 – 5	5	15
6 – 10	0	9
11 – 20	2	11
20 +	0	2
Totals	52	65

It should be noted that the number of annoying blackflies inside of the control area includes observations in marginal control areas where control was sometimes relatively poor. Annoying blackflies were rare in the village of Old Forge during the 1951 blackfly season.

Literature Cited

TRAVIS, B. V., D. L. COLLINS, G. DE FOLIART AND H. JAMNBACK. 1951. Strip Spraying by Helicopter to Control Blackfly Larvae. *Mosquito News* 11(2):95–98.

THE IMPORTANCE OF CORRECT TIMING OF LARVAL TREATMENTS TO CONTROL SPECIFIC BLACKFLIES (SIMULIIDAE)

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In the central Adirondacks, blackflies are annoying to man from mid-May until early July. Until the advent of DDT, no satisfactory method of controlling these pests was known. In 1948, a blackfly control program was initiated in the Town of Webb in the central Adirondacks. DDT fog dispersed by both helicopter and ground fogging equipment proved to be an effective, although expensive, method of killing adult blackflies.

In 1949, a larval control program was undertaken in an effort to develop less expensive methods of control. DDT-impregnated plaster of paris blocks, placed in streams containing blackfly larvae, when properly used gave adequate control. Dosages of 0.0005 to 0.001 p.p.m. for 24 hours reduced larval blackfly populations almost 100% and had very little effect on the populations of other aquatic arthropods.

In 1950, DDT in oil solution was applied by aircraft, at the rate of 0.1 pound