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

per swath acre over the more inaccessible areas. Including both blocks and airplane spray, streams within an area of over 100 square miles were treated. (Travis, Collins, de Foliart and Jamnback, 1951).

In spite of early season fogging and the larval control measures mentioned in the paper cited previously, it was noted that in the latter part of the season of 1950 there was an increase of blackfly annoyance and that the species were chiefly different from those that were prevalent earlier. As with other groups of insects, the biologies of the different species of blackflies vary greatly. Since there are several annoying species of blackflies in the local streams it was thus demonstrated that control measures must be directed against particular species, a fact that hitherto had not been emphasized.

In the Adirondack region of New York more than 17 species of blackflies have been found in the course of these studies. Only three of these species are annoying to man in this region. One, *Prosimulium hirtipes* Fries, overwinters in the larval stage, pupating in late April and early May. It is believed that the other two annoying species, *Simulium venustum* Say and *Simulium tuberosum* Lundberg, overwinter in the egg stage, the larvae appearing in late May.

Larval control in 1949 and 1950 was based on a single treatment applied in late April, by which the larvae of *P. hirtipes* were almost entirely eliminated from treated streams. However, the larvae of *S. tuberosum* and *S. venustum* appeared in these streams between 2 and 4 weeks after treatment for *hirtipes* larvae. Studies of the species of annoying adults collected inside of the control area in 1950 revealed that *venustum* and *tuberosum* were present, sometimes in fairly large numbers, and constituted the predominant late-season annoying species. It thus appeared that suppression of the developing first generation *venustum* and *tuberosum* larvae would be necessary to develop an effective blackfly control program.

With this information in mind, two experimental treatments with plaster blocks were applied to nine streams during the 1951 season to determine whether or not they could be kept free of larvae of all annoying species of blackflies for the entire blackfly season. The Town of Webb crews also treated many streams a second time as a part of the routine control program. The first treatment was applied in late April to eliminate *P. hirtipes* larvae; the second, between May 27 and June 5 to eliminate first generation *S. venustum* and *S. tuberosum* larvae. It was found that streams so treated remained free of larvae of the annoying species until June 20 or later.

Since annoying adults are present in such diminished numbers after the beginning of July, it is concluded that the larvae found in streams in late June or after do not develop into a nuisance generation. The reasons for this are not entirely clear, but data gathered in 1950 and 1951 suggest that it may be because only the first of the several generations of *venustum* and *tuberosum* are attracted to man, at least in this area.

By treating streams twice, at the times, respectively, when the two annoying groups of blackflies are in the highly susceptible larval stage, the number of annoying adults emerging from streams inside of the control area can be reduced almost to zero. On the other hand, stream treatment to reduce the populations of blackfly larvae in general, without knowledge of the species involved, will generally result in much less effective control.

*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.