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THE TWENTY-FIFTH YEAR OF MOSQUITO CONTROL IN GREATER WINNIPEG, CANADA. 1951.

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Winnipeg is situated in Manitoba, Canada, midway between the Atlantic and the Pacific coasts, 460 miles north of Minneapolis, at the confluence of the Red and the Assiniboine Rivers. The Greater Winnipeg Anti-Mosquito Campaign controls an area of 250 square miles containing a population of 350,000 people, centering on the City of Winnipeg. The average annual precipitation is 20.47 in., including 5 in. of moisture from snow during the winter months. Our very rapid spring thaw in April results in the formation of many mosquito breeding places. In the warmer part of the summer flying mosquitoes may appear one week after eggs have been covered by rain water.

During the Red River flood of 1950 this campaign used methods and machinery for controlling mosquitoes which helped us considerably in 1951. In 1951 a Lawrence Aero-Mist was added to the two Tifa foggers to round out our heavy insecticide equipment. Where use of these mechanical applicators was not possible,

manual treatment by pressure sprayer was used.

We used 6% DDT water emulsion for water surfaces, and 5% DDT oil solution for fogging, and waste oil applied in certain instances. Water surfaces included ditches, clay pits, sloughs, river banks and marshy land. Fogging encompassed residential districts with special attention to parks, golf courses, community clubs and river banks. This two-way attack against mosquito larvae in the water and the flying adult in the air was again successful in providing effective control against mosquitoes for an 8-mile radius from the center of the city.

Rainfall between April and July was below normal, whereas August rains were 71% above normal. This worked to our advantage in the early part of the season.

Ditch maintenance was carried out by man power and by spraying willows with the power sprayer using 2, 4-D at 0.9 lb. per acre. This gave effective control of willows.

Pre-season application of DDT. As an

integral part of our anti-mosquito program, experimental work has been done since 1947 to test the prospects of controlling larvae in the early spring and summer by applying DDT during the previous fall, as follows:

During September, 1947, $2\frac{1}{2}$ acres of dry marsh were sprayed by hand using from 2-5 lbs. DDT oil solution per acre. During May, 1948, larvae were observed in the control plot, but in the treated plots larvae did not appear until 9 weeks later. The ground at this time was still covered with water.

During September, 1948, 6 acres of water in clay pits were sprayed manually with 3% DDT emulsion, (4 lbs. DDT per acre). No larvae appeared in 1949 in pits containing water throughout the entire season. In the same year 17 acres of dry marsh were also sprayed manually with DDT emulsion, (1.5 lbs. per acre). Larvae appeared in the control plot in April, whereas they did not show up in the treated plot before the water dried up at the end of May. In the latter instance heavy rain on August 13 promoted renewed breeding, observed on August 22 in the treated area.

During September, 1949, 8 acres of clay pits were sprayed (6% DDT emulsion at 3.75 lbs. DDT per acre) and no larvae appeared in 1950. The pits contained water until the end of the season. Also in September, 1949, 57 acres of dry swamp land were sprayed by machine (6% DDT emulsion at 3.2 lbs. DDT/acre). Larvae appeared in the control plot on June 21, but none appeared in the treated plot.

During September, 1950, 30 acres of dry marsh were sprayed by machine, (12% DDT emulsion at 3.7 lbs. DDT per acre). This area dried up by the end of May and no larvae had appeared up to that time.

During September, 1951, 2 acres of slough were sprayed by machine (6% DDT emulsion at 3 lbs. DDT per acre). This area will be under observation in 1952.

The campaign executive felt that the foregoing observations should be tested

more exactly by chemical and bioassay methods. Funds and personnel not being available to the campaign for this type of work a co-operative set-up was arranged between: (a) The Division of Entomology, Department of Agriculture, Canada; (b) The Department of Health and Welfare, Province of Manitoba, Canada; and (c) The Greater Winnipeg Anti-Mosquito Campaign, City of Winnipeg, Manitoba.

By kind permission of Dr. H. E. Gray, Head, Stored Product Insect Investigations, Ottawa, Mr. B. Berck, chemist in the Winnipeg laboratory was allowed to act in an advisory capacity. Dr. H. M. Malcolmson, Director of Environmental Sanitation, Manitoba Department of Health and Welfare, allowed us to use laboratory facilities under the supervision of Mr. W. M. Ward, Chemist-in-charge, in which to carry on the necessary experiments. The mosquito campaign staff collected specimens and did the tests in the laboratory under the above supervision.

On April 30, 1951, samples of water, vegetation and soil were taken from an area that had been sprayed by machine in September, 1949, and also in 1950 at 3.2 lbs. and 3.7 lbs. DDT per acre respectively.

A second round of samples of soil and vegetation were taken on July 20 and analysed for DDT. By this time the water had dried up.

Laboratory findings. In April *vegetation* samples averaged 32.7 p.p.m. DDT, ranging from 4 to 39.8 p.p.m., while in July the sample contained 17.3 p.p.m. DDT.

In April *soil* samples averaged 0.922 p.p.m. DDT, ranging from 0.155-5.4 p.p.m. DDT, whereas in July soil samples averaged 0.334 p.p.m. DDT, ranging from 0.116-0.552 p.p.m. DDT.

In April *water* samples averaged 0.0297 p.p.m. DDT, ranging from 0.0073-0.1065 p.p.m. DDT.

The April *moss* sample contained 15.9 p.p.m. DDT, whereas the July moss sample contained 14.9 p.p.m. DDT.

Substantial amounts of DDT were therefore found in the water, on vegeta-

tion and in the soil of the treated area. Water samples contained a substantial amount of DDT, but this was much less than that of soil and vegetation. The DDT content of the vegetation and the soil was reduced from April to July, but that of the moss appears to have changed very little.

Bioassay. The important question of the larvicidal effectiveness of the DDT in the samples tested chemically also engaged our attention. Dr. C. R. Twinn, Head, Veterinary and Medical Entomology Unit, Ottawa, kindly supplied eggs of *Aedes aegypti* L. mosquitoes with recommendations for laboratory rearing of the larvae for use in the bioassays. Filtrates and solutions of the field samples were used.

These tests were inconclusive, as in some cases where third and fourth instar larvae were used no mortality resulted after 24 hours exposure although chemical tests of the field sample showed up to 36 p.p.m. DDT. On the basis of the above laboratory findings it seems reasonable to suppose that the DDT present in the samples was not sufficiently transposed to the water, within the limits of the methods of bioassay that were used.

Aedes aegypti larvae were also used to test water samples taken from ditches and clay pits which had been sprayed by machine with 6% DDT emulsion in routine work during the summer. Larvicidal effectiveness was noticeable from 3-6 weeks after spraying, both when the sample came from the surface and from the bottom.

Hatching efficiency of *Aedes aegypti* eggs. It was found that 6 out of 10 filter papers with eggs attached produced no

larvae when soaked with distilled water. In the course of reading through literature relating to this subject, work done by Gjullin, Yates and Stage was noted in which amino acids and extracts of vegetation were used to stimulate hatching of mosquito eggs. Using modifications of rearing media suggested by these authors we found it possible to rear larvae from eggs which were otherwise considered sterile when distilled water alone was used.

SUMMARY

1. Mosquito control in the Greater Winnipeg district during its 25th year again gave satisfaction to residents of that area. The cost was less than 4 cents per capita.
2. The use of DDT in spray and in fog gave good control of larvae and flying mosquitoes, and will be used in 1952. DDT resistant mosquitoes have not been noticed.
3. In tests covering the period 1947-1951, DDT applied in the fall has controlled larval breeding the following spring and summer for a period of 6 weeks up to 6 months following the spring thaw.
4. Chemical tests under the supervision of Mr. B. Berck, of samples from particular test areas showed that there were still substantial amounts of DDT in the water, vegetation and soil 10 months after the DDT was applied.
5. Bioassays using *Aedes aegypti* mosquito larvae in the laboratory following the chemical tests for DDT in water, soil and vegetation, failed to indicate toxic qualities of the DDT residues in the samples taken.

If you have not already purchased a copy of Bulletin #2, "Ground Equipment and Insecticides for Mosquito Control," place your order soon. The information it contains is indispensable to mosquito control workers. Copies of the Bulletin are still available at \$2.00 each. Orders should be sent to Mr. C. T. Williamson, Suffolk Co. Mosquito Control Commission, Yaphank, N. Y.