

abatement programs throughout the country and elsewhere in the world.

#### CONCLUSIONS

Investigations have been initiated aimed at evaluating present mosquito control

methods and developing new methods. This will take the form of a large-scale, all-out attack via the biological approach, the results of which are expected to increase efficiency in California mosquito control procedures.

## MOSQUITO CONTROL ON A COMMUNITY-WIDE BASIS

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Health and comfort—at surprisingly economical cost—can be achieved on a community-wide basis through modern mosquito control. Scores of U. S. communities have learned this in recent years. There is increased interest in such control, and in the methods to achieve it.

Prior to the introduction of DDT the main effort of most communities in mosquito control was the application of oil or other larvicide to mosquito breeding ponds in and around the area to be protected, or drainage and filling operations so far as practicable. Such procedure, although resulting in a fair degree of control, at times was largely offset by the adult mosquitoes drifting in on prevailing winds from surrounding untreated areas. That has indeed been the experience at Fargo, where larviciding operations were continued for years, but have of late shifted over almost entirely to the application of DDT for the primary purpose of controlling the adult mosquitoes.

The predominating species of this area are *Aedes vexans* and *A. dorsalis*. They constitute about 75 per cent of the mosquito population. They are noted for their flight dispersal ability and are regarded with particular concern as important vectors of encephalitis. Others of the 31 species recorded by Post and Munro<sup>4</sup> (1949) as of lesser consequence but

troublesome at times are *A. sticticus* and *Culex tarsalis*.

Heretofore, DDT has been applied to the residential and park areas of Fargo by means of ground operated sprayers or fog machines. In 1950 a serious invasion of mosquitoes and blackflies, and scattering infestations of cankerworms prompted an application of DDT by airplane because of its speed of coverage as compared with ground operated equipment. Although mosquitoes are controlled by ½ pound of DDT per acre it was decided to make the application sufficiently heavy (1 lb.) to control the other pests mentioned.

The application was made during the period June 13-15. A local aerial spray agency, which used the Stearman type of biplane equipped with a spray boom mounted underneath the lower wing, furnished the materials and made the application. A total of 1,500 acres, comprising the residential area of Fargo and adjoining parks, was covered with the spray at the rate of 1 lb. of actual DDT per acre at a total cost of \$3,000.00. This, on the area basis, represented a cost of \$2.00 per acre; or, on the basis of the 38,000 population of Fargo, about 8 cents per person.

The blessed anonymity of the research scientist was denied in this spraying

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<sup>4</sup> Post, R. L., and Munro, J. A. Mosquitoes in North Dakota. *Bimonthly Bulletin*, 11 (5): 173-183, 1949.

operation. On the contrary, attention of the entire community was focused on the project. Radio stations and daily newspaper headlines told of the steps leading to the community-wide spraying. Everyone in the community was on the alert to praise or condemn—every outlying resident with a hive of bees, every old maid with a pet cat, every amateur ornithologist, entomologist, botanist and zoologist had opportunity to take notice of this operation. It was as obscure and reticent as a circus parade.

The control achieved was spectacular. Within 24 hours following the aerial application, in all portions of the city and its parks the mosquito and blackfly population had dropped from what were considered serious infestations to negligible or almost zero populations. The cankerworm infestation was also controlled.

Possibly because this was the first aerial insecticidal coverage of Fargo, the results were watched by the people with particular interest. Some concern was expressed that the 1 lb. rate of DDT might have an injurious effect upon gold fish in lily ponds, bees and other beneficial insects and birds. This had been anticipated in that trained observers spent considerable time both before and after application of the treatment to determine the possible effect of the DDT on these forms of life.

Examination of a lily pond containing 26 goldfish on which the aerial spray had fallen showed no mortality of the fish. To the owner's surprise the fish continued to remain healthy and active throughout the season. No reports were received from anyone of DDT injury to goldfish in other pools.<sup>1</sup>

There was no evidence that the spray had had any effect upon honeybees. It should be mentioned that at the time of the application most of the bee pasture

then available was in fields outside the area of treatment. There was, however, a 15 per cent mortality of ladybird beetles observed, also an apparent reduction in the number of bumble bees. It was difficult to ascertain the bird population with any reasonable degree of accuracy. Shortly following the application of DDT the birds shifted their feeding location from among the branches where they had previously fed to the ground to feed on the fallen and dying cankerworms. No dead birds as a result of the spraying were observed in a careful inspection throughout the park and residential sections of Fargo covering a period of the week following the application. It should also be mentioned that although the citizens of Fargo were on the alert to observe and report any injury which might result from the application nothing of a serious nature was reported. The most serious were reports of automobiles being speckled by the spray which was easily remedied by washing. There was also some objection expressed to the plane flying at a low altitude over the housetops, but as the pilot had obtained the necessary permission from the Civil Aeronautics Commission he was not subject to censure.

A program such as this requires careful planning, also securing the cooperation of the various agencies which can help. The city officials, civil aeronautics, experiment station, radio and press—all had important roles in the project. All agencies cooperated.

The planning took into account financing, whether it would be municipal funds, public subscription, or donations. Timing of the application was considered vitally important. The insecticidal application must be made neither too early nor too late and at the proper rate. The application should be made only under favorable weather conditions.

The success of the program was attested by hundreds of congratulatory phone calls by people in Fargo who felt that the aerial application represented a very worthwhile spending of public funds.

<sup>1</sup> A subsequent aerial application of DDT at the same rate (1 lb. per acre) made in August 1950 resulted in killing 2 per cent and 16 per cent of the goldfish in two pools respectively according to the owners' reports.