

## ADULT MOSQUITO CONTROL A USEFUL EMERGENCY TOOL

ROBERT L. VANNOTE, Secretary

Passaic Valley Mosquito Control Conference, Morris Plains, New Jersey

Mosquito control as commonly practiced, is carried on with public funds largely on private properties. Until recently, such work has been directed principally toward treatment of mosquito breeding water to reduce the opportunities for multiplication of these insects. Much of such mosquito breeding water, and consequently the bulk of such work, is concentrated on lands of little or no economic value.

The older methods of control have included a program of surveys and planning, leading to the considered use, each in its proper place, of both permanent and temporary control measures.

Permanent control may include filling or draining, or other measures to assure the permanent elimination of mosquito breeding water; it may consist of carefully engineered systems of ditching, as of a tidal salt-marsh, to provide for alternate flushing by, and prompt withdrawal of the tidal water; or it may employ dikes and tide gates or pumps to exclude tidal water while providing for the escape or removal of rain water.

Temporary control may include spraying, dusting, or otherwise treating mosquito breeding water with oil, or with other mosquito larvicide materials, with the addition more recently of space treatment with pyrethrum, DDT, or other mosquito "adulticides," applied as sprays or as aerosol fogs, and of residual applications of such insecticides to vegetation and other mosquito resting places for the destruction of adult mosquitoes after emergence. Temporary control includes, also, inspection, correction of yard nuisances such as neglected rain barrels, clogged eave troughs, and other temporary accumulations of water, as well as public

education to enlist popular cooperation and support.

Temporary control is a very important part of mosquito control work, and must be given a prominent place in any mosquito control program. When a community is plagued by mosquitoes or by mosquito borne disease, unless noticeable relief can be given promptly, or at least a convincing demonstration area established, public patience and public support from those who pay the bill will be short lived.

Many things can upset the most skillfully planned and executed mosquito control program. Only those mosquito control programs which are financed by Federal funds for critical health reasons can hope to receive financial support sufficient to control mosquitoes under all conditions. Elsewhere it must be a compromise between how much the community can, or is willing to pay for relief, and how much mosquito annoyance it will tolerate.

Permanent control, where practicable, will usually involve a greater initial cost; but, even with provision for subsequent maintenance, is usually less expensive in the long run. Temporary control, having to be repeated over and over again, is usually more expensive in the long run; but gives prompt results at less initial cost.

For these reasons the available funds are best divided with a considered balance between permanent and temporary control, planned to provide as much permanent control as is compatible with a satisfying degree of immediate overall temporary control and an adequate reserve to meet peak-load emergencies.

Provision for meeting peak load emer-

gencies is important, because any mosquito control program is vulnerable to abnormal weather conditions, adverse tides or winds, or periods of excessive rainfall that produce an exceptional abundance of mosquito breeding water and peak emergence.

Such conditions may result in a temporary loss of control for days or weeks, depending on species of mosquito and breeding potential, with a corresponding loss of public confidence.

Prior to 1935 no means was available to the mosquito control worker by which he could cope successfully with a brood of adult mosquitoes after emergence. It was then accepted by the mosquito control worker and his public alike, that mosquito control as limited by economic considerations was practicable in periods of normal rainfall, but must be expected to break down during the one or two periods of excessive rainfall usually expected in midsummer.

The development of pyrethrum larvicides in 1931 and the four years following, introduced a new and effective weapon, which provided effective means of combating adult mosquitoes regardless of abundance; and methods for its use were developed to protect outdoor assemblies from annoyance by these insects.

By mixing one part of the pyrethrum larvicide stock emulsion with nine parts of water and applying it with a power or hand sprayer at the rate of 30 to 50 gallons per acre, adult mosquitoes are killed, and further flights repelled. Under average conditions of annoyance (20 to 50 *vexans* per night per trap) such an application made in the early afternoon provides good protection until the following morning. Under more severe conditions a second application around the margins of the treated area may be required.

This was a great stride forward and although it was impossible to treat whole communities by this method, public functions such as games, carnivals, fairs or block parties could be handled as a public convenience. Individuals could purchase

the materials and thus protect their own yards.

Public reaction to this type of control was immediate. While spraying, comments could be heard to the effect that "the Mosquito Commission is really on the job." When such work was necessary, the before and after conditions were so marked that no one could doubt the effectiveness of the work. The committees responsible for outdoor public gatherings soon competed with one another to secure the service and often advertised "Area under control by the County Mosquito Commission."

In most counties using this method, control policies had to be adopted to rule on the applications for treatment. To strictly public functions with no profit motive, such as public celebrations, church or Boy Scout outings, etc., the services were free. Semi-public functions such as benefit carnivals were required to pay costs of materials and labor. Private functions were urged to make private arrangements for the service. To my knowledge the largest area receiving this type of treatment was the Morris County Grange Fair involving some 40 acres with the protection of some 30,000 persons.

The development of DDT as an insecticide for mosquito control by the U. S. Department of Agriculture at the Orlando station opened a new door to adult mosquito control.

It is now practicable to spray large areas by airplane for the control of adult mosquitoes after brood emergences, with amazing results. The experience of Suffolk County on Long Island, N. Y., has demonstrated that emerging broods of adult salt-marsh mosquitoes can be effectually destroyed by the aerial application of 2 quarts of 1 per cent DDT in fuel oil per acre. Under the direction of Mr. C. T. Williamson over 20,000 acres of open salt-marsh are under regular spray control, utilizing this method to reinforce the normal salt-marsh ditching. Adverse tides or winds no longer create a situation where mosquito control need break down.

The adult mosquitoes may even be killed before they reach the upland and spread out.

Our experience in the Passaic River Valley in New Jersey is interesting to relate, as the flood water breeding potential totals some 20,000 acres. During periods of brood emergence, traps in nearby towns catch as high as 2,000 *Aedes vexans* and *trivittatus* per night. In the mosquito flight range of the Valley we have one and a quarter million residents, and assessed property valuations computed at 100 millions. The mosquito broods move in a vast front spreading out from the flood areas at the rate of about 1½ miles per day. The movement can best be described as a "percolation" through the grasses and low shrubs.

For two successive years we have been able to halt the movement and reduce annoyance to a reasonable point by the application of 3 per cent DDT in Shell horticultural oil base at the rate of 3 quarts per acre. The terrain involved was open fields, low dense woods and shaded residential areas, in each case approximately 800 acres. The cost was approximately 75 cents per acre. The rate of application and the high concentration of DDT were necessitated by the screening canopy of vegetation. As we were covering a residential area the special oil base was used to prevent spotting of vegetation, house paint and clothes drying in yards.

The aerosol fog units such as the Todd (Fig. 1), Bessler (Fig. 3), trucks equipped with venturi exhaust type generators, and the Hession (Fig. 2), offer another approach to the problem.

During the early summer of 1946 a Todd Fog Unit was purchased for experimental use. A 5 per cent solution of DDT in fuel oil was used as a standard fog insecticide. One of our tests involved 4 square blocks of residential area in the borough of Chatham. The area was fogged at night under good conditions. For the following 3 days, mosquitoes in the test

area were not annoying; although on the 3rd day they had again drifted in.

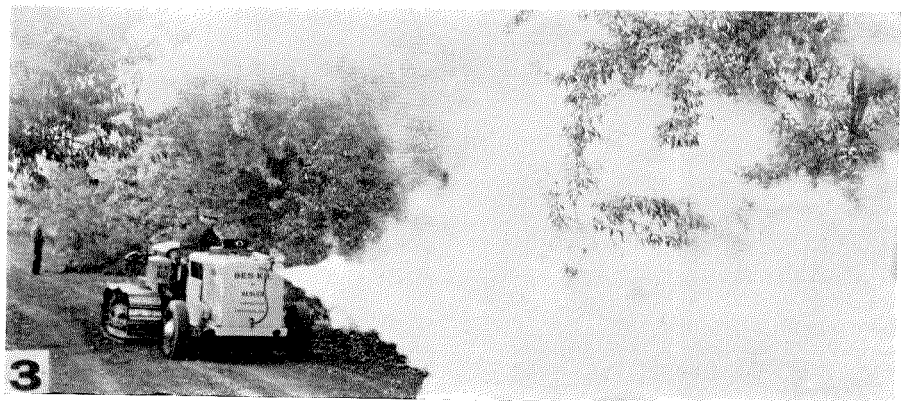
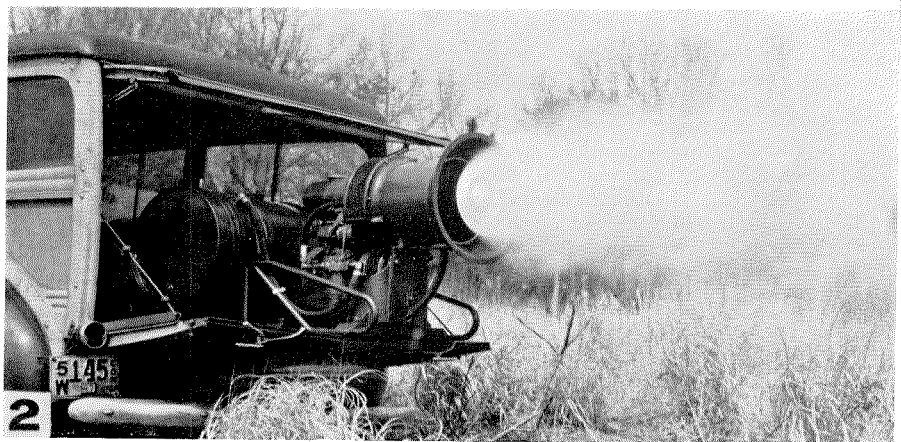
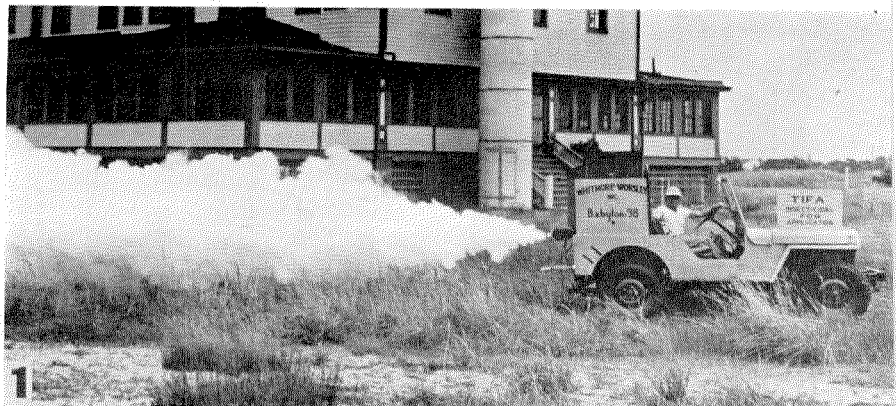
The results were so startling that the residents of the borough exerted sufficient pressure to compel the borough officials to purchase a machine. By agreement, the Mosquito Commission operated the machine at cost on an experimental basis.

Chatham, with a population of 5,500 covers an area of some 5 square miles, having 26 miles of streets laid out in a rectangular pattern, with the shortest distance between the streets approximately 300 feet. During the month of August the entire borough was fogged 5 times with the equipment in operation for 18 days of approximately 5¾ hours of operation per day. A total of 433 gallons of 5 per cent DDT in fuel oil were used.

Observations indicated that the fog unit was of little value when a brood was in motion, as no residual effect develops from the dry fog. However, when the strength of the migration was cut down by aerial spraying of the surrounding area, the fog unit cleared out the mosquitoes already present, and gave excellent protection in the areas covered.

The fog unit was used at the Morris County Grange Fair in August of 1946 with excellent results. Compared to previous experiences with pyrethrum larvicides, a reduction in labor was effected from 81 hours to 41 hours and a reduction in materials from 2,640 spray gallons of pyrethrum larvicide to 78 gallons of 5 per cent DDT in fuel oil.

In 1947, tests were continued with the Todd Insecticidal Fog Applicator, and a Hession Microsol Field Unit was also purchased and put into use. It was observed at once that the two machines did not conflict in their operations. The Todd unit produced a dry fog that was particularly suitable for residential type work leaving practically no residual effect; however, its use was greatly limited by wind and atmospheric conditions. The Hession machine produced aerosol particles of much larger size; moreover, the volume was so great that a definite resid-



al deposit could be demonstrated as far as 200 feet from the machine. The coarser Hession mist is much less influenced by atmospheric conditions and provides the nearest approach to airplane treatment with ground equipment.

For outdoor assemblies the Hession residual deposit is a distinct advantage and there the danger of damage to paint or vegetation is of little consequence. The Todd was reserved for residential areas where its dry fog is preferable because safer for ornamental plants.

Tests outlined for 1948 include the wide testing of the Hession and the Beskill (similar to Todd) units for residential as well as for area control, and for control of both adults and larvae. The Hession unit offers unique advantages for larval control in large open areas, since the output can be regulated to exceed 180 gallons per hour, the type of mist produced tends to hug the ground, and the 120 mile per hour initial velocity gets it well started in the proper direction.

The successful tests already made of adult mosquito control with aircraft and ground equipment, clearly justify a further appraisal of this new tool and its possibilities.

At the present time and under our conditions, adult mosquito control must be considered an emergency measure, and not to be adopted as the principal means of mosquito elimination. The standard procedures of temporary and permanent control cannot yet be replaced due to such reasons as:

1. The high cost of adult control.
2. The complicated factors involved.
3. The inability to operate such equipment for long periods due to weather conditions.
4. The possible damage to vegetation or useful insect and wildlife due to continuous applications of DDT.

As an emergency measure adult mosquito control serves several important functions: It makes it possible to cut down the peak abundance of a brood that would otherwise spoil a season's record for effectual control; it can provide a quick clean-up of disease-bearing mosquitoes in residential areas; and, it can provide temporary relief at community functions located beyond the zone of normal control.

The operation of equipment for adult mosquito control is a job for experts, particularly where such operations are conducted in populated areas. Only those with a broad background of mosquito control work are equipped to evaluate all the complicated community problems that can arise from such a procedure. I refer to such matters as advance publicity, police protection with respect to traffic problems and the wild antics of children, technical operating procedures, and the necessary follow-up checks.

Public reaction should be understood in order to avoid accidents due to fright or confusion; and here the proper kind of publicity may avoid many complications. Permissive laws should be carefully examined to determine authority to operate over private residential lands, and insurance coverage should be checked. If mosquito annoyance is severe, public response and demand will be so immediate and pressing that the control agency may be hard pressed to meet the demand.

In conclusion, I wish to point out that we have a new tool in our mosquito control kit. It answers emergency conditions when normal control is out of balance. It brings control work out of the breeding place and directly in public sight. Expert planning and operation are required to control its operation, especially until such time as continued research can establish wholly safe and fool-proof procedures.

FIG. 1—TIFA, Todd Insecticidal Fog Applicator.

FIG. 2—Hession MICROSOL.

FIG. 3—The Besler BES-KIL.