

## PRESENT STATUS OF INSECTICIDES IN NEW JERSEY AND THE NORTHEAST<sup>1</sup>

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It is advantageous periodically to survey mosquito control activities to determine significant trends. The objective of this communication is to present information concerning insecticide usage for mosquito control in the northeastern United States, with particular attention to the types of insecticides, their relative amounts and extent of usage, newer insecticides, and insecticide status as influenced by public opinion and area growth and development.

In order that many interests and opinions could be represented, questionnaires were sent to some 32 agencies or individuals throughout the area. The information presented is a summation of data derived from the questionnaires and/or discussions with personnel from the following states, as shown in Figure 1: Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, and Vermont. This general area is confronted with upland mosquito control problems as well as those of salt marsh, the salt marsh extending along the coastline intermittently from Delaware to Massachusetts.

In some states, such as Delaware, Connecticut and Rhode Island, the central agency concerned with mosquito control was solicited for information, while in other states representatives in the various state districts were consulted. In New Jersey, a complete survey was undertaken in order to give information concerning total amounts of insecticides used. Mosquito control personnel throughout the area from Delaware to Massachusetts enjoy

the benefits of mutual association and co-operation. However, it will be evident that insecticide usage varies from state to state. It should also be remembered that water management plays an important role in mosquito control throughout the area and such measures are predicted to increase.

EXPLANATION OF SYMBOLS USED IN TABULATING INSECTICIDE USES. The current use of insecticides in the various states is summarized in tabular form at the end of the discussion of each state's statistics. Information includes the insecticides, their formulation, the mosquito stage against which used and the area of mosquito activity (UL, upland larviciding; UA, upland adulticiding; SL, salt marsh larvicid-

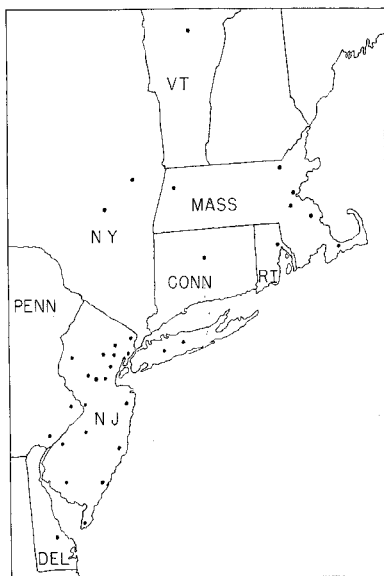


FIG. 1.—Approximate locations of source of information on the status of mosquito insecticides in the northeastern states.

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ing; SA, salt marsh adulticiding) and means of application (S, ground application equipment; A, airspray; F, fogging). Catch basin treatments are indicated by (C). Where concentrations and dosages were given or are apparently consistent throughout a state, this information is included also.

DELAWARE. Mosquito control in Delaware is the concern of the State Highway Department in cooperation with the University of Delaware. Resistance of *Aedes sollicitans* to DDT and BHC in Delaware was reported during the years 1952-1959 (Darsie and Cannon, 1952; Darsie, Krause, and Beadle, 1957; Darsie, 1958; and Darsie and Sutherland, 1959), and this has resulted in DDT and BHC being used only on a minor scale in those parts of the State where resistance to these insecticides is not evident. In 1962-1963, excellent larval control of salt marsh species was obtained on an experimental basis with Baytex at 0.05 lb./acre as air-sprays. At such a concentration some slight effect on shore birds was noted, and in 1964 Baytex will be used at 0.03 lb./acre. In larval control Dibrom (naled) has given inconsistent results. Dibrom (naled), however, will be used at 0.05 lb./acre in 1964 as an adulticide of salt marsh species.

has been used for adult upland control at 0.2 lb./acre, but this most likely will be replaced by Dibrom (naled) in 1964. It is expected that fogging with 5 percent malathion and 3 percent Lethane will be continued on a limited basis this next year.

NEW JERSEY. Mosquito control in New Jersey is the direct responsibility of 19 active County Mosquito Control Commissions. It is a state in which it has been estimated that 80 percent of the mosquito control methods are water management (Smith, 1962). In early 1964 the estimate of the dollar value of drainage equipment was \$1,027,034 and the actual amount spent in 1963 on drainage has been estimated at \$1,494,841 (Black, 1964). In the same year approximately 1-1½ million dollars were spent on the supplementary activities including chemical control (Jobbins, 1964).

Annually since 1961, surveys for larval and adult resistance of salt marsh and upland species have been conducted throughout the State (Sutherland and Haggmann, 1962, 1963). Only one population, that being *Aedes sollicitans* from Cape May County at the southern tip of the State in 1961, has ever been suspected of being DDT resistant. Because of this, it has not been necessary to utilize large amounts of the newer insecticides. Also of importance is the relatively short interval of climatic conditions favorable for mosquito development. The performance and economy of DDT is such that it is the most widely used insecticide.

The insecticides and formulations currently recommended and used in New Jersey are listed in the table. General recommendations are followed by the mosquito commissions and are offered to municipalities and other personnel interested in small-scale mosquito control.

All of the recommended materials and formulations at some time in 1963 were used in controlling larvae and/or adults of salt marsh mosquitoes. The largest amount of salt marsh chemical control by mosquito commissions, however, was accomplished by using DDT granules,

INSECTICIDE AND USES IN DELAWARE

Baytex, 0.03 lb./acre	SL
Dibrom, 0.05 lb./acre	SA, UA
New Jersey Pyrethrum Larvicide	UL
DDT(C)	UL
Fuel oil without insecticide (C)	UL
Vapona (C)	UL
Malathion, 0.2 lb./acre	UA
Malathion, 5% plus Lethane, 3% (F)	UA

In upland situations, larval control includes a small amount of larviciding with pyrethrum in one county in isolated and urban areas. In 1963 catch basin treatments consisted of fuel oil with and without DDT, but in 1964 it is planned that Vapona dispensers will be used. In the past few years malathion as an airspray

DDT-oil spray with 5 percent spreader, and to a lesser extent fuel oil as larvicides. High solvent content of DDT granules has been found to greatly increase the efficiency of such formulations. Some adulticiding of salt marsh species with DDT fogs and sprays was conducted. Of the total amount of DDT used by County Mosquito Commissions in 1963, approximately 42 percent was employed in larval and adult control of salt marsh species. Almost  $\frac{1}{2}$  (44 percent) of this 42 percent was used in the most southern part of the State for control of salt marsh species.

Chemical control of upland mosquito problems also utilizes each of the recommended materials and formulations. Fifty-eight percent of the DDT was used by County Mosquito Commissions in 1963 in upland areas. Of this amount, approximately 42 percent was used in fogging operations (including the amounts supplied to municipalities and sometimes with pyrethrum added), and 57 percent in the form of DDT oil solution and DDT granules formulated with heavy aromatic solvents was used for larviciding including catch basins. Approximately 244,000 catch basins were treated on an average of 3-5 times during the season, 77 percent receiving at least some DDT in oil treatments, the remaining being treated solely with fuel oil. In the treatment of catch basins and the larviciding of polluted waters in mid-summer DDT is very often replaced by fuel oil alone.

Certain insecticides are recommended for limited use and are applied only by trained and qualified personnel of the mosquito commissions. Baytex and malathion are used on a limited basis in upland larviciding. Baytex as an emulsion has been found to be highly effective on heavily polluted and carefully impounded bodies of water at rates not exceeding 0.5 lb. actual/acre. Malathion at 0.5 to 1 lb. actual/acre under similar circumstances also has been satisfactory. At one percent Baytex emulsion at  $\frac{1}{2}$  to 1 pint per catch basin has performed exceptionally well.

The total amounts of insecticides used

by New Jersey County Mosquito Commissions in 1963 were as follows: DDT, Tech., 139,081 lbs.; fuel oil without insecticide, 86,091 gals.; pyrethrum (2 percent), 250 gals.—(equivalent to 7550 gals. New Jersey Larvicide); Baytex, 4920 lbs.; malathion tech. 90 percent, approximately 52 gals.

The New Jersey State Mosquito Control Commission is responsible for another part of the mosquito control program, namely the airspray program. Six New Jersey counties shared in the program in 1963. Granular larviciding included the following amounts of actual insecticide: 11,185 lbs. DDT at 1 lb./acre, 400 lbs. Baytex at 0.25-0.5 lb./acre, and 160 lbs. endrin at 0.2 lb./acre. Adulticiding with oil solutions included 35,885 lbs. actual DDT as a 5 percent solution at 0.1 lb./acre and

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INSECTICIDES AND USES IN NEW JERSEY

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Fuel oil without insecticide, (C) $\frac{1}{2}$ pint/basin, (S) 10-25 gal./acre	SL	UL
Fuel oil, 0.25% spreader, (C) $\frac{1}{2}$ pint/basin, (S) 10-25 gal./acre	SL	UL
DDT, 5% in fuel oil, (C) $\frac{1}{2}$ pint/basin, (S) 0.25 lb. DDT/acre (F) 20-40 gph at 3-5 mph, (A) 1-2 qts./acre	SL	UL
DDT, 5% in fuel oil with 0.25% spreader, (C) $\frac{1}{2}$ pint/basin, (S) 0.25 lb. DDT/acre	SL	UL
DDT, 0.5% emulsion, (hydraulic S) to cover foliage	SA	UA
DDT, 2% emulsion, (mist S) to cover foliage	SA	UA
DDT, 0.5% wettable powder suspension, (S) to cover foliage	SA	UA
DDT, 5-10% granules, 0.5-1.0 lb./acre	SL	UL
DDT, 2-10% dust, 0.5-1.0 lb./acre	SL	UL
N. J. Pyrethrum Larvicide, (S) to cover water surface (S) space spray, depending on weather	SL	UL
Pyrethrum synergized, same as Pyrethrum Larvicide	SA	UA
Malathion, 1.5% oil solution, (F) 20-40 gph at 3-5 mph	SL, SA, UL, UA	SA
	SA	UA

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107 gals. malathion tech. (90 percent) as 1.8 percent solution at 0.05 lb./acre. Malathion is used where there is a possible residue hazard, but its effectiveness as an adulticide when compared to cost does not exceed that of DDT. Baytex, endrin and DDT were applied as granules on diked hay meadows in a program whose objective is to develop a larvicide formulation which can be applied early in the season and function in such a way as to release insecticide periodically with each flooding for the remainder of the season. Endrin at the above dosage appears to be best suited for this purpose. No damages to wildlife have been noted over and above those normally caused by the practices of salt hay farming. It is planned that evaluation of such limited chemical control measures will continue.

PENNSYLVANIA. Most of the mosquito control activities in Pennsylvania are not highly organized with the exception of two counties in the eastern part of the State. Mosquito control is almost exclusively concerned with upland larval control which mainly utilizes DDT granules, DDT-oil solutions and pyrethrum larvicide. Adult control measures are restricted to fogging with DDT and pyrethrum.

#### INSECTICIDES AND USES IN PENNSYLVANIA

Salt marsh control measures same as Jersey	
DDT, spray, granules, wettable powder	UL
DDT (F)	UA
Pyrethrum (F)	UA
N. J. Pyrethrum Larvicide	UL

NEW YORK. In upper New York State mosquito control activities are not organized and control measures are left up to independent contractors or individual communities, the latter generally having appropriations insufficient for basic mosquito control programs. Malathion, Dibrom (Naled) DDT and lindane are used, based on U.S.D.A. Leaflet #84.

On Long Island two counties conduct large mosquito control programs. Over

15,000 lbs. of DDT were used in salt marsh larviciding as DDT sprays and granules. Fuel oil is used to a lesser extent. In upland areas, larviciding includes DDT, fuel oil, pyrethrum larvicide and on a limited scale, Baytex. Pyrethrum larvicide is used where wildlife is a concern. Catch basin treatments with Baytex will increase in 1964. Malathion is used to a greater extent than DDT in fogging.

#### INSECTICIDES AND USES IN NEW YORK

New York Upstate: U.S.D.A. Leaflet #84	UL, UA
Long Island: Fuel oil without insecticide	SL, UL
DDT, 2-2.5% oil solution (C)	UL
DDT, 5% oil solution (F)	UA
DDT, emulsion (S)	SL, UL
N. J. Pyrethrum Larvicide	UL
Baytex (C)	UL
DDT, 10% granules	SL
Malathion, 1% oil solution (F)	UA

CONNECTICUT. Mosquito control in Connecticut is under the direction of the State Department of Health and is mainly devoted to the salt marsh problems. Of 10,000 acres under control measures, only 500 acres received insecticide application in 1963. This included DDT emulsions and granules for larviciding and DDT emulsions for adulticiding.

#### INSECTICIDES AND USES IN CONNECTICUT

DDT, emulsion	SL, SA
DDT, 10% granules	SL

RHODE ISLAND. Water management also plays an important role in mosquito control in Rhode Island, approximately 90 percent of the activities being in this area. The remaining 10 percent is chemical control conducted on a voluntary basis by 27 of the 39 cities and towns in the State. The Division of Entomology and Plant Industry, Department of Agriculture and Conservation provides technical and partial financial aid at the request of cities and towns to participate in the State subsidy program. Over 5000 lbs. of DDT were used in 1963. Catch basin treatments are

limited to 2 large cities, over 90 percent of such treatments being fuel oil. Of interest are some of the mixed formulations, particularly those for fogging, which are offered to such cities and towns by insecticide formulators.

total of over 37,000 lbs. actual DDT was used in 1963 by agencies contacted in the State.

**OTHER STATES.** Of the remaining States in New England, little is known concerning the status of insecticides. This is mainly due to the fact that in Vermont, New Hampshire and Maine, mosquito control is not on an organized basis as in other states. In Vermont, the Department of Agriculture advises mist spraying of DDT for adult control. Little larviciding is attempted except Lindane "tossits" on a very limited basis.

The present status of insecticides is influenced by many factors. One of these factors is the newer insecticides which may come into use in the near future. Newer insecticides which are being evaluated on an experimental basis, at least in one state in the northeast, include the following: Vapona in dispensers, fogging, misting; diazinon granules as an adulticide; Baytex granules, endrin granules, SD 7438 at 0.025 lb./acre, AC 52160 at 0.005 lb./acre, AC 43913 at 0.01 lb./acre as larvicides.

In 1962, another development occurred which could have had and might still have, an effect on insecticide status everywhere, namely the concern over the effects of pesticides in general on man and his environment. Most mosquito control personnel in the northeast feel that their mosquito control activities have not been affected by public concern towards the use of insecticides. This may be due to (1) the fact that less public sentiment against insecticide usage arose than was actually anticipated, and (2) there is no evidence that the use of chemicals for mosquito control has led to widespread harm to wildlife. In certain states, namely Long Island in New York, and Massachusetts, there has been some opposition by residents to insecticide spraying. In both Massachusetts and New York legislation was passed which provided for the creation of a State Pesticide Board which could make regulations concerning insecticides and their application. Recent action of the Pesticide Board provides for the licensing of persons

INSECTICIDES AND USES IN RHODE ISLAND

DDT, 6% oil solution (S)(A)	SL, UL
DDT, wettable powder	S
DDT, 10% granules, 2 lb./acre	UL
DDT, 1% oil solution (S)	UL
N. J. Pyrethrum Larvicide	SL, UL
Fuel oil without insecticide (C)	SL, UL
Malathion, 0.5 lb./acre	SL
BHC plus pyrethrum	SL, UL
Chlordane plus malathion (F)	SA, UA
DDT, chlordane plus lindane (F)	UA
Baytex, 1 1/2 oz./acre (A)	S, U

**MASSACHUSETTS.** Insecticides currently used by five mosquito control projects and by one independent contractor in Massachusetts are shown in the table below. Most mosquito control efforts are directed toward upland problems. Control of salt marsh species employs DDT ground and air-sprays mainly, with some Baytex being used on a limited basis. In the upland areas in the eastern and western parts of the State, DDT is used to a much greater degree than other materials and mainly as a larvicide. DDT granular formulations apparently are not employed. Dieldrin in some areas is utilized for pre-hatch and catch basin treatments. Malathion seems generally to be favored for fogging, with Dibrom being used on a limited basis. A

INSECTICIDES AND USES IN MASSACHUSETTS

DDT, oil solution	SL	UL
DDT, emulsion (A)(S)	SL, SA, UL, UA	
DDT, wettable powder (A)(S)		UL, UA
N. J. Pyrethrum Larvicide		UL
Fuel oil without insecticide (C)(S)		UL
Malathion oil solution (F)(S)		UA
Malathion, emulsion (S)		UL, UA
Baytex, emulsion (C)(A)	SL, SA, UL, UA	
Dibrom (F)		UA
Dieldrin, 2%, (C) 1/2 pint/basin		UL
Dieldrin, 2% granules		UL

applying insecticide to property of another person except under or in buildings. In Rhode Island legislation has recently been passed to provide for licensing of personnel advertising insecticide application services.

There is evidence that mosquito control personnel have asked themselves the question "what are insecticides doing to man and his environment." Many such persons believe that the use of DDT and other materials of long residual life in the north-east has reached its peak and possibly will begin to decrease. Much more emphasis will be placed on permanent control measures such as water management and drainage. The use of insecticides in mosquito control, however, will never be substantially decreased since in the future, as the predicted development of the huge urban city from Boston to Washington proceeds, man will create new mosquito problems.

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