

# TEMPORARY MOSQUITO CONTROL IN MARYLAND<sup>1</sup>

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**ABSTRACT.** A Maryland mosquito control program has been operational for 20 years. This program provides for both temporary and permanent control measures with cooperative funding from state and local sources. Temporary control measures such as spraying and/or larviciding have been expanded from 82 communities in 1956 to 1485 cities, towns, developments and recreational areas in 1975. Adulticiding was done with mist sprayers and thermal foggers until 1971 when ULV ground equipment was introduced into the program. There has been limited use of aerial spraying. Adulticide applications have increased from 1.189 million acres sprayed in 1972

to 3.46 million acres sprayed in 1975. This increase was due mainly to the change in technique from mist spraying to ULV applications. Larviciding also expanded from 178 communities in 1970 to 703 communities in 1975. Abate 1G® and Flit MLO® are the principal larvicides.

Other activities of the program include: field evaluations of insecticides and equipment, surveys, light trapping, calibration of ULV equipment, and monitoring susceptibility to insecticides.

Two public opinion polls indicated strong public support for the program.

While this great nation celebrates its Bicentennial, 1976 marks the completion of the 20th consecutive year of a state mosquito control program in Maryland. Although the Maryland legislature passed a mosquito control law in 1939, funds were not appropriated to support actual work until 1956. This law was recodified in 1973, but regulations governing mosquito control work were not changed, except to transfer authority from the State Entomologist to the Secretary of Agriculture. The regulations under which operations have continued for twenty years provide for both temporary and permanent control work. Temporary work, including spraying, fogging, larviciding and the like, can be done if the city, county or local taxing areas agree in writing to defray 50% of the cost. Permanent work, including upland ditching and marsh ditching, can be done with 25% of the cost provided by the local taxing area.

A discussion of mosquito control in

Maryland would not be complete without acknowledging the contributions of certain persons. Dr. E. N. Cory and Dr. G. S. Langford laid the foundation for the present program. They pioneered in mosquito control work during the 1930's and experimented with chemical control when residual insecticides became available. It was Dr. G. S. Langford and Dr. William E. Bickley who guided the growth and development of the present program through the first fifteen years of its existence. Dr. Robert Altman has directed the program for the past 5 years. Perhaps one of the best indicators of program acceptance is the continued growth in the number of participating communities. When funding started in 1956, there were 82 communities participating in the program. There has been growth in the program every year and by 1975, the number had grown to 1485 cities, towns, developments and recreational areas. The communities serviced have also increased in size. This growth, even in counties where a portion of the cost is paid by individual home owners or civic associations, indicates excellent community acceptance.

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As recently as 1970, adult control was done with mist sprayers and a few thermal foggers. Limited use of aerial spraying, although effective, proved too costly for most communities, except during severe emergencies. Although mist sprayers were highly effective (Foster and Joseph 1968, Mallack et al. 1970) they had several limitations which favored experimentation and replacement as soon as better equipment could be found. Studies were begun in 1965 to evaluate concentrated spray techniques and equipment (George et al. 1968). By the time commercial equipment was available, evaluations in Maryland indicated ULV ground equipment was adaptable to the program. The first ULV unit was placed in service in 1971 on a field evaluation that continued through 1972. Data from this field evaluation indicated many advantages of ULV equipment and techniques. These advantages include speed, mobility, economy, simplicity, effectiveness, and community acceptance.

In the fall of 1972, the decision was made to begin replacing mist sprayers with ULV aerosol generators. There were 13 ULV units operating in Maryland in 1973, 33 units in 1974 and 52 units by 1975. At least 62 units are planned for the 1976 season. The results of this change of technique are evident in the number of acres sprayed. During 1972, using mist sprayers, an estimated 1.189 million acres were treated; in 1975 with ULV equipment, this total had increased to 3.46 million acres without major budget increases.

Significant growth has also occurred in larvicide activities. During 1970, there were 178 communities being inspected and larvicided. This number had increased to 703 communities in 1975.

Continued expansion of temporary mosquito control is likely to occur in Maryland in the years ahead. There are

several reasons for this forecast, namely, (1) Permanent control measures involving marsh and upland ditching have become increasingly complex and costly. (2) The population is continuing to grow and spread into the suburbs. (3) People are becoming more outdoor oriented. (4) Even in communities which have experienced significant mosquito reductions, the populace wants mosquito control, and community participation continues. (5) The publicity resulting from St. Louis encephalitis in the most populated Maryland counties has stimulated interest, concern and increased requests for participation in the program. However, expansion can only take place if increased resources are made available.

A thorough understanding of the species of mosquitoes causing problems in Maryland has been obtained during the past 20 years. Light traps, landing collections, bait traps and larval collections have all been used. There are now 55 mosquito species known to occur in Maryland. Many of these species are rare or do not create annoyance problems. However, continued monitoring of populations is recognized as an important part of the program.

Field evaluations of temporary control techniques have been carried out each year by Maryland Department of Agriculture entomologists. These evaluations provide data on the efficacy of insecticides and equipment in current use. Testing of new equipment and insecticides is also done to provide information needed to recommend program improvements. During 1974 and 1975 community evaluations were made with 4 insecticides in areas of high salt marsh mosquito populations. Results of these tests were reported by Berry and Ludlam (1976) who found Baygon® MOS produced outstanding results against *Aedes sollicitans*. When applied as a ground ULV aerosol at .03 lb. ai/acre, there was a 97% reduction of

adult mosquitoes landing on observers 2 hr after treatment. Even when the above application rate was cut in half, a reduction of 90% occurred. Malathion was tested against *Ae. sollicitans* as above at maximum label dose (.05 lb. ai/acre) and a reduction of 79% occurred. The effectiveness of malathion ULV increased to 83% when applications were made at dawn and improved to 89% with pre-dawn treatments. Both Baytex® 93% and pyrethrum 5% were evaluated, but did not equal the effectiveness of Baygon or malathion. Baytex 93% at .0125 lb. ai/acre (1.0 fl. oz./min @ 10 mph) produced 40% reduction in 4 hours and pyrethrum 5% applied at .0019 lb. ai/acre (4 fl. oz./min @ 10 mph) produced a 1 hr reduction of 60%. Mount et al. (1975) noted the effectiveness of Baygon as ULV aerosol against *Ae. taeniorhynchus* and *An. quadrimaculatus* in Florida.

Approximately 50 tests with caged mosquitoes were completed in Maryland in 1975 using 3 common pest species and 7 insecticides. These cage tests corroborated the results of community tests with Baygon and indicated nearly complete kill up to 300 feet downwind 1 hr after exposure at .03 lb. ai/acre. Cage tests also indicated that Baytex produced excellent results when 24 hr mortality was determined. This insecticide was found to act very slowly compared to other products tested, thus confirming observations by Mount and Pierce (1973).

Droplet determinations and equipment calibrations are a time-consuming requirement of the malathion label. An employee has been trained to do the work. Written records are maintained for each unit. Initially ULV applications of malathion were made at 4.3 fluid ounces per minute at 10 mph, but this was reduced in 1975 to 4.0 fl. oz./min. at 10 mph. Concurrent with this reduction in discharge rate, we found the mass median diameter of discharged

droplets also dropped by .8 micron. The droplet collecting method of Beidler (1975) will be evaluated in Maryland during 1976.

The effectiveness of mosquito control with insecticides depends not only on good application methods, proper timing, and good equipment, but continued susceptibility of target species. Susceptibility levels of several species have been monitored using the methods described by the World Health Organization. Base line susceptibility data were obtained for *Culex pipiens* larvae in 1967 when Abate was introduced into the Maryland program. Tests indicated an LC 90 of .0020 ppm. In 1974, similar tests were conducted with larvae from the same area where Abate had been in use for 8 seasons and the LC 90 of *C. pipiens* larvae has increased slightly to .0026 ppm.

Malathion applications to caged adult mosquitoes reared from field collected larvae continue to show satisfactory mortality. This is also true with wild populations when the evaluation is by landing rate counts. Large quantities of malathion have been used for mosquito control in Maryland. Since 1960, the annual use figure has increased each year. Although malathion still appears quite effective, monitoring to detect resistance will continue to be a function of the Maryland program.

There have been 2 opinion polls in Maryland to sample public reaction to the mosquito control program. In 1969, a survey was conducted at random in 17 communities. Adult mosquito control at that time included, but was not limited to, malathion mist spraying in the areas surveyed. Replies were overwhelmingly favorable (94%) to the program. Over half of the unfavorable replies indicating that the effort was "not much help" explained that more spraying was needed (Agricultural Review, Sept. 1971).

In 1972, six communities were

selected for a 12-week evaluation of ground ULV equipment and insecticides. A survey was made following this test by distributing 1,000 questionnaires. There were 358 replies which in summary indicated that ultra low volume applications were an improvement to the previous mist spraying program and were quite acceptable to community residents. This questionnaire also indicated that few persons found mosquito control spraying or ULV applications very irritating or objectionable.

education through press releases to encourage home owners to eliminate on-premise breeding. During the past 4 years the program has kept ahead of inflation by conversion to ULV spraying from a more costly technique; but this conversion has been nearly completed. Improving the program or additional expansion will henceforth require additional resources.

State agencies in Maryland are now required to prepare 5 year plans with goals and objectives. These plans project orderly growth and the resources

	No. of replies	% replies			
		Acceptable	Objectionable	Very irritating	No opinion
Malathion mist spray	62	83	8	3	6
Malathion ULV	112	91	7	0	2
Pyrethrum ULV	75	91	4	3	2
Dibrom ULV	75	84	8	5	3
All of above	34	97	3	0	0

Only one of the 358 who replied in this survey favored decreasing mosquito control work in their community. In fact, 49—72% of the replies favored increasing the program and 17—34% favored keeping it the same. Some replies favored change and suggested more source reduction, aerial spraying, or biological control.

The temporary program in 1976 will place increased emphasis on larviciding and control of *C. pipiens*. Abate and Flit MLO will be used in most areas. Most adulticiding will be with ULV malathion. There will still be several mist sprayers and one thermal fogger operating in Maryland. A surveillance program with sentinel chickens is planned in the Baltimore Washington Corridor. It is hoped that this will provide advanced warning of St. Louis encephalitis virus activity in an area where the virus was most active in 1975.

There will be increased emphasis on

needed to accomplish it.

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