RESULTS OF FIELD TRIALS WITH DDVP IN MOSQUITO CONTROL

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Late in 1951 and early in 1952, the organic phosphates, beginning with EPN, began coming into use as mosquito larvicides in California. By 1953 both parathion and malathion were being used to some extent and proved satisfactory. Their use steadily increased until by 1956 some 85,000 pounds of phosphates were used on some half-million acres annually (1).

Malathion and parathion are the two materials used, with the less hazardous malathion being preferred.

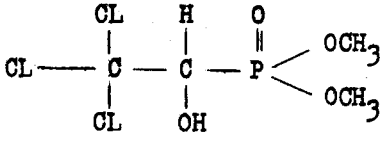
During the latter part of the 1955 and 1956 season, some areas of California's central valley noted that mosquito control with malathion was becoming more difficult. At the Twenty-Fifth Annual Conference of the California Mosquito Control Association, Inc., at San Jose, California, January 21–23, 1957, this increasing difficulty of control with malathion was the subject of considerable discussion. It was reported that in the San Joaquin Valley fourth instar larvae of *Culex tarsalis* had developed a degree of resistance to malathion of up to 33 times the normal LD 90. Adult *Culex tarsalis* in the laboratory appeared resistant to malathion up to 93 times the normal LD 50. No noticeable resistance was noticed to parathion. This may or may not be a maximum level of resistance of this species towards mal-

thion or it may be a trend toward, for all practical purposes, complete resistance. It does point up the necessity for continued research and the development of new materials or methods.

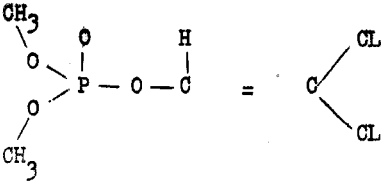
During the 1956 season, the Southeast Mosquito Abatement District, which takes in the southeasterly portion of Los Angeles County, California, had an opportunity to cooperate in work with one of the newer organic phosphates, DDVP.

This volatile, fast acting material had, in limited work, shown remarkable insecticidal powers, particularly against resistant house flies.

DDVP was discovered and its chemical structure determined by the research personnel of the Communicable Disease Center, U. S. Public Health Service (2). While conducting tests on the toxicity of vapors of various insecticidal compounds, other workers in the department had observed that one of the organic phosphate compounds under test gave unusually high fly mortality initially but that continued aeration produced no highly toxic vapors. This suggested that the initial effectiveness was due not to the compound itself but to a highly volatile impurity. The material in which the highly volatile impurity was found, Bayer L 13/59 (Dipterex) is a commercial preparation of 0,0, dimethyl, 2,2,2-tri-chloro-1-hydroxyethyl phosphonate with a structural formula:



Brilliant analytical work established that this highly volatile impurity was 0,0-dimethyl 2,2-dichlorovinyl phosphate.



The pure material is a straw-colored liquid, of about the consistency of water. Its boiling point is 84° at 1 mm.

Mammalian toxicity: Tests indicate that DDVP is about 1/10 as toxic to rats as parathion. Based on tests with rats, DDVP is not quite so toxic, relatively, as dieldrin. DDVP in common with the other organic phosphates is a cholinesterase inhibitor.

Insecticidal Properties: According to data on its insecticidal properties released by the C.D.C., U.S.P.H.S., DDVP is about 10 times as toxic as Bayer L 13/59 and equal to parathion against house flies. It has been found effective against a wide range of insects including stored products pests, cockroaches, flies, and mosquitoes.

Because of its volatility it has relatively little residual effect.

In August 1956 cooperative experimental work was initiated with Alco Chemical Company to determine the potentialities of DDVP for mosquito control. The material used in the tests was a 24.6 percent (2 lbs. DDVP per gallon) emulsifiable concentrate formulated by Alco. The site was a local cut and fill dump located in an area with a high water table. There were numerous pools of two to three foot depths available, all highly polluted with dump refuse. Three pools with a surface area of about 3,500 feet each were used for test purposes. Each of the pools had medium to heavy populations of immature forms of all stages at the time of treatment. The larval populations consisted of about 75–80 percent *Culex stigmatosoma* Dyar and 20–25 percent *Culex pipiens* Linn.

The material was applied in dilutions of 1:100, 1:200 and 1:400 or at the rates of approximately 1, 2 and 4 ounces actual DDVP per acre in 10 to 15 gallons of water. Applications were made with a 3-gallon tank type compressed air sprayer. By walking slowly around the entire periphery of the pool the coarse spray could be directed until the entire pool surface had been treated. The treatments were applied during the morning and observations made two, four and six hours later and daily thereafter. The 1:100 and 1:200

dilutions resulted in a complete kill of all stages of mosquito larvae and pupae within six hours. The 1:400 dilution killed 85–90 percent of all active stages within the six-hour period but did not give a complete kill after twenty-four hours.

Egg raft samples (50 rafts each) taken before and after treatment indicated that all dilutions were either ovicidal or killed first instar larvae on hatching as none of the post-treatment egg samples brought into the laboratory survived. The majority of the pre-treatment egg samples survived and were reared through to adults. These applications also killed most of the other insect life present in the pond, including various dipterous larvae, water beetles and back swimmers.

Two days after treatment first instar larvae began hatching in all treated pools, indicating short residual activity. It is felt that these came from egg rafts deposited some time after treatment. Population levels of all stages remained rather high in surrounding untreated water furnishing a continuing source for reinfestation of the treated pools.

This preliminary work appeared to indicate that DDVP has considerable promise in mosquito control operations.

Tests in California by other workers (3) have indicated that DDVP has given excellent results against all immature stages of mosquitoes in pastures and clear water. In contaminated waters the results were not quite so good.

DDVP at 0.1 p.p.m. has been reported (3) as highly effective against mosquito larvae and pupae and in about the same category as Thiodan, ET-14 and phosdrin.

DDVP is less toxic to warm bloods than most of the other very effective materials. It is very effective against all stages of mosquitoes at relatively high dilutions. Its short residual activity would be an advantage in many situations. In short, DDVP is a very promising new material for the control of mosquitoes.

References Cited

1. Yearbook, California Mosquito Control Association, Inc., 1956.

2. MATTSON, A. M., SPILLANE, J. T., and PEARCE, G. W. Journal of Agr. Food Chem. 3(4):319–321, 1955.

3. ISAAK, L. W. Twenty-Fifth Annual Conference, California Mosquito Control Association, Inc., San Jose, California, 1957.

The above papers conclude the *Proceedings* section of Volume 17 of *Mosquito News*. There were several papers which were not submitted to *Mosquito News* either because they were not originally intended for publication or because they were to be published elsewhere. Papers which are delayed because of the necessity for revision are ordinarily published in the Articles section in a later issue.

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Sixty per cent of the people in the state of Utah are now living within the boundaries of organized mosquito abatement districts.

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