EFFECTIVENESS OF DDVP AS A KILLING AGENT IN MOSQUITO KILLING JARS[1]

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ABSTRACT. Mosquito killing jars containing 20 percent DDVP as the killing agent proved effective in a field test conducted for 11 weeks. Controlled laboratory tests comparing five concentrations of DDVP to cyanide showed 20 and 25 percent DDVP to be as effective as cyanide in mosquito killing jars over an eight week period. After 20 weeks of use, all DDVP concentrations were more effective than cyanide based on the length of time necessary to kill 100 percent of the test mosquitoes.

INTRODUCTION

Mosquito light traps are operated generally in or near areas of human habitation or places often frequented. The use of cyanide in mosquito killing jars poses a problem in and around civilian facilities and military installations, due to the extreme toxicity of cyanide. At least two deaths have occurred in the military within the last six years through the ingestion of sodium cyanide. Because of these toxic properties, its use is forbidden by a safety regulation at Fort Leavenworth, Kansas, which houses the military disciplinary barracks. Restrictive regulation such as this necessitates the utilization of other chemical killing agents in mosquito killing jars.

McDonald *et al.* (1964) working in West Pakistan, compared potassium cyanide to DDVP resin in killing jars using a standard New Jersey light trap. Based on the number of insects caught, the test indicated little apparent difference in effectiveness of the two chemicals. Pennington (1967), compared cyanide to "Vapona" resin strips in killing jars used in a field test. He showed DDVP to be more effective than cyanide after 10 weeks of use based on the number of mosquitoes collected per type of killing jar.

The purpose of this experiment was to determine the feasibility of using a volatile and relatively safe insecticide, DDVP, in mosquito killing jars. Preliminary field and controlled laboratory tests were conducted.

MATERIALS AND METHODS

In the summer and fall of 1969, DDVP killing jars were used in conjunction with a mosquito attractant experiment utilizing light traps and various chemicals (Stryker and Young, 1970). The field test was conducted at Alabama Army Ammunition Plant, Childersburg, Alabama, and Charleston Army Depot, Charleston, South Carolina. The killing jars were made by diluting 43.65 percent DDVP emulsifiable concentrate (Stephenson Chemical Co., College Park, Ga.) with distilled water to a concentration of 20 percent. Orthopedic and dental modeling plaster (FSN 6510-203-7235) was added to the 20 percent solution until a thick slurry resulted. The slurry was poured into a pint polyethylene Mason type jar and allowed to harden. Six jars were made and used in the field from 27 July –14 October 1969. The mosquito traps used were 6-volt wet cell battery-operated miniature light traps (FSN 6545-089-3766) and standard New Jersey traps (FSN 3740-607-0337).

[1] Mention of a proprietary product does not imply endorsement by the U.S. Army. The opinions contained herein are those of the authors and should not be construed as official or reflecting the views of the Department of the Army.

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In the laboratory five concentrations of DDVP were compared to standard cyanide killing jars. The DDVP jars were made as described in the preparation of field test jars except that pint glass Mason jars were used so that mosquito mortality could be observed. The DDVP concentrations used were 5, 10, 15, 20 and 25 percent. The cyanide jars were made with 5 g of sodium cyanide covered by a small quantity of sawdust and 0.5 inch layer of plaster. Control jars contained only a 0.5 inch layer of plaster. Two replicates of each DDVP concentration, cyanide, and controls were used. The jars were aged for one week prior to testing. All jars remained unsealed and at room temperature (70–80° F) throughout the study.

Depending upon the available supply, weekly, 4–13 *Culex quinquefasciatus* Say male and female adults were aspirated from a laboratory colony into each killing jar and control jar. A screened lid was screwed onto each jar to prevent the mosquitoes from escaping. The time necessary to achieve 100 percent kill at each DDVP concentration and in the cyanide jars was recorded. Mosquitoes remained in the control jars for at least 30 minutes.

RESULTS AND DISCUSSION

FIELD TESTS. Because the mosquito population was insufficient at Childersburg to conduct the attractant experiment (preliminary experiment), the field study was conducted at Charleston where a larger mosquito population existed. Therefore, mosquito capture data are available only from Charleston during the period 11 September–13 October. The six original killing jars were used at both localities throughout the study.

Field tests showed that the DDVP killing jars remained effective for a minimum of 11 weeks when exposed to the environment. The number of mosquitoes captured per trapping period in each killing jar at Charleston is shown in Table 1. All mosquitoes were dead and in identifiable condition when removed from the jars for identification.

LABORATORY TESTS. When the DDVP killing jars were fabricated it was noted that the amount of DDVP emulsifiable concentrate used affected hardening of the plaster. Concentrations of 20 and 25 percent took considerably longer to harden. At these concentrations the plaster also became discolored (brownish).

The results of the laboratory test between the time necessary for DDVP and cyanide to achieve 100 percent kill of *C. quinquefasciatus* adults are summarized in Table 2. The data are based on an average of two replicates per test. Initially the cyanide jars acted more rapidly than all DDVP concentrations. On week one the time necessary for 100 percent kill in cyanide averaged 0.5 minute while the highest concentration of DDVP (25 percent) averaged 1.75. The time necessary

TABLE 1.—Mosquitoes caught in six 20 percent DDVP killing jars[1] at Charleston Army Depot, Charleston, South Carolina, from 11 September–13 October 1969[2]

Trap Period	Days in Period	Trap[3] Nights	DDVP Jar 1	2	3	4	5	6
1	6	35	4808	909	2441	10,436	2493	1464
2	9	49	15,984	2888	6109	12,154	7667	9864
3	3	14	2353	612	**	2219	588	1061
Total	18	98	23,145	4409	8640	24,809	10,748	12,389

[1] The jars were used for six weeks before being used at Charleston.
[2] Two types of light traps were used: Standard New Jersey light trap and 6-volt wet cell battery operated miniature light trap.
[3] A trap night is one trap operating for one night.
** Trap inoperable for entire period.

TABLE 2.—The average time[1] in minutes it takes to achieve 100 percent kill of *Culex quinquefasciatus* adults by DDVP and cyanide under laboratory conditions.[2]

Week	% DDVP Concentration					Cyanide (5 g)
	5	10	15	20	25	
1	3.25	2.75	2.13	1.88	1.75	0.50
2	3.00	2.75	1.75	1.38	1.25	0.63
3	2.25	1.88	1.88	1.75	1.63	2.25
5	3.25	1.88	1.88	1.75	1.63	1.88
7	2.88	2.50	2.50	2.00	2.00	1.75
8	3.88	2.88	2.88	1.88	1.88	1.75
9	2.75	2.63	2.63	2.63	1.88	4.63
11	3.25	3.50	2.75	2.63	2.25	5.50
14	3.25	3.75	2.75	2.38	2.25	7.75
17	3.38	3.00	2.75	2.63	2.13	8.25
20	3.50	3.38	2.88	2.75	2.13	10.75

[1] Two replicates of each DDVP concentration and cyanide were used.
[2] From 4–13 adult mosquitoes were used per replicate per test.

for 100 percent kill increased substantially as the DDVP concentration decreased. By week five all DDVP concentrations with the exception of 5 percent were killing in about the same time necessary for cyanide. From week eight to nine the cyanide increased from an average killing time of 1.75 to 4.63 minutes (one replicate took longer than 6 minutes to attain 100 percent kill).

The DDVP killing time for all concentrations did not appear to change substantially throughout the experiment, while the time necessary for cyanide to achieve 100 percent kill increased 21 fold from week one to termination of the experiment on week 20. The 5 percent DDVP which initially was seven times slower than cyanide was more than three times as rapid to achieve 100 percent kill on week 20.

Throughout the study there was no mortality among mosquitoes in the control jars which contained only plaster.

Based on both field and laboratory tests it can be concluded that DDVP is an adequate substitute for cyanide in mosquito killing jars.

Literature Cited

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