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A VILLAGE SCALE TRIAL OF FENTHION (BAYTEX)
AS A RESIDUAL SPRAY IN NIGERIA

by

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INTRODUCTION

In 1960 the Insecticide Testing Unit of the World Health Organization carried out in Lagos, Nigeria, field trials with Fenthion (Baytex)³ and Malathion. Fenthion was applied at 2.9 g/m² in a village of mud-walled huts, and 1.6 g/m² in a fishing village constructed of palm mid-rib (Elliott & Barnes, 1961).⁴ In 1961 further trials were carried out with fenthion at a target concentration of 1.5 g/m² in a village of mud-huts. The entomological results of this trial are presented below. In addition, toxicological (Taylor, 1962)⁵ and chemical (Gratz & Dawson, 1962)⁶ studies were carried out and these are presented elsewhere.

DESCRIPTION OF TEST VILLAGE

The test village, Araromi, is 27 miles from Lagos, and consisted of 24 mud-walled huts, 15 with galvanized corrugated iron roofs and nine with thin thatch roofs. The undersides of the thatched roofs were sprayed, those of the corrugated iron roofs were not.

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³ "Fenthion" is the name designated for Bayer 29493, O,O-dimethyl-O-4-(methyl mercapto)-3-methyl phenylthiophosphate by the International Standards Organization.

⁴ Elliott, R., Barnes, J. M. (1961) WHO/Insecticides/125

⁵ Taylor, A. (1962) Bull. Wld Hlth Org. (in press)

⁶ Gratz, N. G. & Dawson, J. (1962) (in press)

Details of the spraying and examination of the deposits are presented in the previously mentioned paper (Gratz & Dawson). The over-all average initial deposit for the village based on 236 filter paper wall samples was 1.38 g/m^2 .

METHODS

Bio-assays

Bio-assays were carried out using three-day old blood-fed, female, insecticide susceptible Anopheles gambiae reared from an insectary colony in Lagos. The bio-assay tests were carried out in accordance with a previously described method,¹ an effort being made to use always at least 10 females per conical exposure chamber. Tests were begun five days after the spraying and carried out at one week intervals for 12 weeks and at two week intervals thereafter.

A 30 minute exposure was used for both control and test mosquitos until average mortalities fell below 60 per cent. at which time the exposure was doubled to 60 minutes; if subsequent mortalities were not above 60 per cent., the exposure was increased to 120 minutes. After exposure, mosquitos were transferred in the field to paper cups covered with sugar-water pads and returned to the laboratory to be held at 27°C until the reading of 24 hour mortalities. Generally for the 30-minute exposures, ten bio-assay exposure points were used for mud and seven points each for wood and raffia-palm mid-rib; on each of the substrata three points were fixed - and used in each subsequent test - and the remainder were chosen at random for each test.

Outlet window-traps

Twelve houses were selected from the 24 in the village and in each of them one room with a window was designated as a catching station. An outlet window trap fitted into a central 12 inch square hole of hard-board cut to the shape of the individual window was mounted in each of these at 6.00 p.m. one day a week and removed at 6.00 a.m. the following morning. Mosquitos were moved from the trap in the field and living mosquitos placed into net-covered paper cups and returned to the laboratory to determine 24 hour survival. The time from the

¹ WHO TWS (1960) No. 191: 50-53

village to the laboratory was 35 minutes and a piece of sugar-water soaked cotton was placed on each cup. Control mortalities were low but when they were above 10 per cent. Abbot's formula was applied.

Pyrethrum spray catches

Immediately following the removal of the window trap, the shutters of the catching-station room were closed and the space under the eaves outside the room sprayed from the outside with a small hand spray gun. While this was being done, white sheets were spread over the floor of the room, beds, cabinets, etc. and a mixture of one part of pyrethrum concentrate to 67 parts of kerosene space-sprayed with 75 strokes of the hand-sprayer. Fifteen minutes later all the mosquitos were collected off the floor sheets, and identified and counted for each station.

Assessment of fenthion residual deposits at bio-assay points

The amount of fenthion active material deposited on the various types of surfaces was chemically assessed on the same points or very near to the points where the bio-assay cones were placed. Three to four samples of each type of surface were taken 32, 53, 81, 102, 124 and 144 days after the spraying. The area scraped or washed was equal to that covered by the base of the bio-assay cone, i.e. 63.5 cm².

Samples of fenthion deposits on wooden doors, raffia-palm mid-rib or bamboo were taken by washing the surface of the wall with cotton wool wetted with a mixture of 1:1 chloroform-alcohol. The insecticide was then extracted from the cotton in the laboratory. The amount of fenthion found at all the above points is also included in Table I, Bio-assay results.

RESULTS AND DISCUSSION

Effect of spraying on natural mosquito population

The results of pyrethrum spray catches are presented in Table 2 for the sprayed village - Araromi - and for control village Adamo some two miles beyond it in Table 3. Unfortunately due to technical delays, the spraying took place

from 14 to 16 August when the normal mosquito population had begun to decline. However, following the application of the insecticide no mosquitos were taken in the pyrethrum spray catches in the treated village for seven weeks and following that mosquitos were at a level below that of the control village until November, 13 weeks after the spraying. Examination of the number of mosquitos in the window traps, Table 2 for Araromi and Table 3 for Adamo, show that one living Culex mosquito was found in a window trap on 6-IX, three weeks after the spraying, and thereafter one living mosquito was found in a window trap on 11 October, eight weeks after the spraying. In the control village of Adamo, there were consistent small numbers which, while they are higher than in the treated village, are of questionable significance.

However, some caution must be used in interpreting the reduced figures in the treated village as demonstrating an actual reduction in mosquito densities in the village as they may in reality represent a reduction in mosquitos entering treated huts, an observation which was made by Kuhlow (1960)¹ for DDT.

Bio-assays

The results of the bio-assays for different types of test surfaces are given in Table 1. Satisfactory mortalities, i.e. above 70 per cent. after a 30 minute exposure, was obtained on a rough inner mud wall surface up to 47 days after spraying; following this, loss of effectiveness was rapid and six days later only a 32 per cent. kill was obtained. One week later, at 67 days, a 60 minute exposure gave only 47 per cent. mortality and at 74 days a two-hour exposure gave only 60 per cent mortality; following an additional two-hour exposure after 81 days with a resulting 51 per cent. mortality, tests on mud surfaces ceased.

On wood surfaces satisfactory mortalities were obtained in bio-assays for at least 81 days. After a 60-minute exposure at 123 days gave only a 57 per cent. mortality, tests on wood were stopped.

¹ Kuhlow, F. (1961) WHO/Mal/310

On raffia-palm mid-ribs, mortalities were less consistent but were above 70 per cent. for 116 days. A 30-minute exposure at 123 days gave 57 per cent. and at 144 days after spraying, i.e. almost five months, a 60-minute exposure on this surface gave a 78 per cent. mortality after which tests were terminated.

These results are similar to those obtained in 1960 (Elliott & Barnes, 1961) who found that fenthion applied at an initial concentration of 1.57 g/m^2 in the Lagos area gave a bio-assay mortality of over 70 per cent. for more than four months on wood with one hour exposures, and for more than six months on raffia-palm mid-rib with a 30-minute exposure. Fenthion applied at a higher dosage - 2.92 g/m^2 gave 70 per cent. to 100 per cent. mortalities for over three months on mud following a 30-minute exposure.

Schoof et al. (1961)¹ tested fenthion and malathion at various concentrations in El Salvador and found them both ineffective at 0.5 g/m^2 but effective (70 per cent. to 100 per cent. kills) at 1.0 g/m^2 and 2 g/m^2 for 2-1/2 to three months - based on one hour exposures on wood, thatch and mud. Fenthion was superior to malathion on whitewashed and plastered surfaces. Thus while results on organic surfaces in Araromi were similar to these authors' work, the longevity of the insecticide on the mud was superior in El Salvador. The possible difference in types of mud with resulting variation in insecticide performance must, however, be considered.

Conclusions

Fenthion (Baytex or Bayer 29493) applied at a target dosage of 1.5 g/m^2 in a village near Lagos, Nigeria, gave an indication of controlling natural populations of mosquitos for about 10 weeks as demonstrated by comparison of window-trap and pyrethrum spray catches in the treated and control village.

Bio-assays with A. gambiae showed an effective (70 per cent. to 100 per cent.) kill, after half-hour exposures, for seven weeks on mud surfaces, for eleven weeks on wood surfaces, and for 16 weeks on raffia-palm mid-ribs.

¹ Schoof, H., Mathis W., & Austin, J. R. (1961) Bull. Wld Hlth Org. 24, 475

TABLE 1. PERCENTAGE MORTALITY OF 3-DAY OLD BLOOD-FED FEMALE
 ANOPHELES GAMBIAE EXPOSED TO VARIOUS SURFACES TREATED WITH BAYTEX
 40 PER CENT. W.D.P. IN ARAROMI, NIGERIA

Days After Spray- ing	Mud		Wood		Raffia-palm mid-rib	
	Surface Baytex ^{2a} gm/m ²	Percentage 24-hour ^b Mortality ^b	Surface Baytex ^{2c} gm/m ²	Percentage 24-hour ^b Mortality ^b	Surface Baytex ^{2c} gm/m ²	Percentage 24-hour ^b Mortality ^b
		30-min. Exp.		30-min. Exp.		30-min. Exp.
5	1.378 ^d	100	1.378 ^d	-	1.378 ^d	100
12		100		100		-
19		100		100		100
25		94		100		100
32	0.523	100	0.099	100	0.088	93
39		92		100		93
47		85		100		99
53	0.616	32	0.041	100	0.203	91
		60-min. Exp.				
60		47		98		86
67		11		92		88
		120-min. Exp.				
74		60		74		90
81	0.195 (0.5 mm scraping)	51	0.036	93	0.094	-
	0.300 (2-3 mm below ") (superficial)					
95				-		72
102	0.191 (0.5 mm scraping)		0.061	43	0.076	89
	0.232 (2-3 mm below ") (superficial)					
116				65		100
				60-min. Exp		
123				57		57
						60-min. Exp.
144					0.072	78

^a 2-3 mm scraping unless otherwise stated.

^b A mortality of 70 per cent. or above was considered an effective kill.

^c Obtained by superficial washing.

^d Initial deposit on filter papers affixed to wall surfaces.

TABLE 2. ARAROMI (BAYTEX-TREATED) PYRETHRUM SPRAY CATCHES
 TOTAL AND AVERAGE NUMBER OF MOSQUITOS/CATCHING STATION/WEEK

Date 1961	Total No. of Mosqs	No. of cst Used	Average per cst	Total No. of Anopheles	Average	Remarks
-	-	-	-	-	-	
-	-	-	-	-	-	
1.6	25	12	2.0	18	1.5	
8.6	29	11	2.6	9	0.8	
14.6	21	9	2.2	12	1.0	
21.6	51	12	4.2	37	3.0	
28.6	71	9	7.8	62	6.8	
5.7	73	9	8.1	66	7.3	
12.7	108	11	9.8	104	9.4	
19.7	134	11	12.1	129	11.7	
26.7	117	10	11.7	116	11.6	
2.8	114	11	10.3	110	10.0	
9.8	49	9	5.4	48	5.3	
16.8	0	10	0	0	0	Sprayed with Baytex
23.8	0	11	0	0	0	
30.8	0	9	0	0	0	
6.9	0	10	0	0	0	
13.9	0	11	0	0	0	
20.9	0	9	0	0	0	
27.9	0	12	0	0	0	
4.10	1	10	0.1	0	0	
11.10	0	12	0	0	0	
18.10	0	10	0	0	0	
25.10	(1) 3	11	0.2	(1) 1	0	() = Unsprayed Control House
1.11	0	11	0	0	0	
8.11	0	10	0	0	0	
15.11	5	12	0.4	1	0	
22.11	4	12	0.3	3	0.2	
29.11	-	-	-	-	-	
6.12	0	11	0	0	0	
13.12	1	10	0.1	0	0	
20.12	0	12	0	0	0	
27.12	-	-	-	-	-	
3.1.62	1	10	0.1	0	0	

TABLE 3. ADAMO (BAYTEX CONTROL) PYRETHRUM SPRAY CATCHES
TOTAL AND AVERAGE NUMBER OF MOSQUITOS/CATCHING STATION/WEEK

Date 1961	Total No. of Mosqs	No. of cst Used	Average per cst	Total No. of Anopheles	Average
19.5	15	12	1.2	11	0.9
23.5	12	12	1.0	2	0.1
2.6	21	11	1.9	6	0.5
7.6	25	11	2.2	12	1.0
-	-	-	-	-	-
-	-	-	-	-	-
27.6	67	12	5.5	47	3.9
4.7	61	12	5.0	42	3.6
11.7	93	12	7.7	67	5.6
18.7	81	11	7.3	61	5.5
25.7	60	11	5.4	51	4.5
1.8	43	12	3.5	30	2.5
8.8	29	12	2.4	19	1.5
15.8	14	12	1.1	13	1.0
22.8	13	12	1.0	12	1.0
29.8	6	6	1.0	3	0.5
5.9	6	12	0.5	0	0
12.9	8	11	0.7	2	0.1
19.9	6	10	0.6	2	0.2
26.9	5	11	0.4	1	0
-	-	-	-	-	-
10.10	2	12	0.1	1	0
17.10	0	9	0	0	0
24.10	6	10	0.6	3	0.3
31.10	12	10	1.2	7	0.7
7.11	4	11	0.3	3	0.2
14.11	4	9	0.3	1	0
21.11	8	11	0.7	5	0.4
28.11	5	11	0.4	1	0
5.12	4	11	0.3	2	0.1
12.12	0	12	0	0	0
19.12	5	11	0.5	1	0.0
26.12	-	-	-	-	-
2.1.62	2	10	0.2	0	0

TABLE 4. ARAROMI (BAYTEX-TREATED)
 AVERAGE NUMBER OF MOSQUITOS PER OUTLET WINDOW TRAP PER WEEK

Date 1961	Total No. of Mosqs	No. of cst Used	Average Mosqs per cst	Total No. of Anopheles	Average Anopheles per cst
28.6	29	11	2.6	8	0.1
5.7	20	11	1.8	5	0.5
12.7	35	12	2.9	3	0.3
19.7	16	10	1.6	5	0.5
26.7	27	11	2.5	16	1.5
2.8	47	12	3.9	30	2.5
9.8	35	12	2.9	9	0.8
	B A Y T E X	S P R A Y E D		B A Y T E X	S P R A Y E D
23.8	0	10	0	0	0
30.8	1	12	0.1	0	0
6.9	2	11	0.2	0	0
13.9	0	11	0	0	0
20.9	0	10	0	0	0
27.9	2 (1)	12	0.2	0	0
4.10	1 (1)	11	0.1	0	0
11.10	1 (1)	12	0.1	0	0
18.10	2 (1)	10	0.2	0	0
25.10	5	12	0.4	0	0
1.11	4 (2)	12	0.3	0	0
8.11	8	12	0.7	0	0
15.11	3	12	0.3	0	0
22.11	9 (2)	11	0.8	1	0.1
29.11	1 (1)	11	0.1	0	0
6.12	6	12	0.5	0	0
13.12	3	9	0.3	0	0
20.12	3	12	0.3	0	0

() = No. in control - unsprayed cst.

TABLE 5. ADAMO (BAYTEX CONTROL)
AVERAGE NUMBER OF MOSQUITOS PER OUTLET WINDOW TRAP PER WEEK

Date 1961	Total No. of Mosqs	No. of cst Used	Average Mosqs per cst	Total No. of Anopheles	Average Anopheles per cst
20.6	24	12	2.0	3	0.3
27.6	34	12	2.8	3	0.3
4.7	10	11	0.9	2	0.2
11.7	24	11	2.2	6	0.6
18.7	20	11	1.8	1	0.1
25.7	30	12	2.5	4	0.3
1.8	28	12	2.3	4	0.3
8.8	9	12	0.8	4	0.3
15.8	7	10	0.7	0	0
22.8	14	10	1.4	0	0
29.8	5	10	0.5	1	0.1
5.9	3	10	0.3	1	0
12.9	2	11	0.2	1	0.1
19.9	8	11	0.7	1	0.1
26.9	5	9	0.6	0	0
10.10	9	11	0.8	0	0
17.10	7	12	0.6	0	0
24.10	5	11	0.5	0	0
31.10	8	10	0.8	0	0
7.11	4	10	0.4	1	0.1
14.11	4	9	0.4	1	0.1
21.11	2	9	0.2	0	0
28.11	7	10	0.7	0	0
5.12	5	10	0.5	0	0
12.12	7	10	0.7	0	0
19.12	3	11	0.3	0	0

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