

Field trial of Sumithion (O.M.S. 43) in the Mamasani area, Southern Iran, August-December, 1972

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ABSTRACT.

The aim of this trial was to determine the toxic effect OMS-43 on operators and inhabitants and to evaluate the effectiveness of this insecticide for the control of adult anopheline mosquitoes.

One round of spraying was implemented in August, 1972, at the peak of activity of *A. stephensi*, and this lasted for 30 successive days.

This study showed that: (a) the use of Sumithion under local conditions (subtropics, hot and dry season) is safe for residents, but its toxic effect on operators with limited precautionary measures should be considered further and (b) Sumithion is an effective insecticide against anopheline mosquitoes and controlled *A. stephensi* under the conditions of this experiment for more than two months.

RÉSUMÉ.

Le but de ce travail était de déterminer la toxicité de l'OMS-43 pour la main-d'œuvre de pulvérisation et d'évaluer son effet dans la lutte contre les anophèles adultes en Iran.

Un cycle d'aspersions fut exécuté en août 1972, au pic d'activité d'*A. stephensi*.

L'étude a montré que: l'utilisation du Sumithion (OMS-43: Fenitrothion) est sans danger pour les habitants dans les conditions locales (saison chaude et sèche subtropicale) mais l'effet toxique sur la main-d'œuvre est à prendre en considération; le Sumithion est un insecticide efficace contre les anophèles adultes et contrôle *A. stephensi* pendant plus de deux mois dans les conditions de l'expérience.

INTRODUCTION.

Due to the development of resistance of *A. stephensi*, the main malaria vector of southern Iran, to chlorinated hydrocarbon insecticides (Mofidi *et al.*, 1962), Malathion is in use at the present time for malaria control in this area. This program may be faced with serious obstacles in the near future, and there is thus a vital need for a safe and effective insecticide which could be used as a substitute for Malathion. A large-scale field trial of Sumithion (OMS-43) at stage VI was carried out in the Mamasani area in southern Iran, from August to December, 1972, by the School of Public Health and Institute of Public Health Research in collaboration with MEO of Iran and the Sumitomo Chemical Co., Ltd., Japan.

OBJECTIVES.

The main objective of this trial was to determine:

1. the safety of the material in regard to spraymen and inhabitants under operating conditions;
2. the toxic effects of the insecticide on domestic animals and poultry; and
3. the impact of insecticide treatment on the overall local anopheline population, especially on *A. stephensi*.

BACKGROUND INFORMATION.

A. stephensi, the main vector of the area, developed resistance to DDT in 1957 and to Dieldrin in 1960. Malá-

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thion at the rate of 2 gm/sq m has been applied since 1968. The secondary vectors such as *A. d'thali*, *A. superpictus* and *A. fluviatilis* with relatively exophilic and exophagic habits are active in the area. Malaria transmission usually occurs during 8 months (April-December) of the year, with the peak from mid-August to mid-October.

The main larval breeding places are rice fields, canals and river banks. Due to rice season cultivation activity in July and the consequent extension of breeding sites, a remarkable increase in anopheline density has been observed in the area.

MATERIALS AND METHODS.

AREA : A vast plain northwest of Kazeroun, which is almost entirely surrounded by mountains, was selected and 57 villages with a population of 11,445 were sprayed at a rate of 2 gm Sumithion sq m (99.6 % of temporary shelters and 96.1 % of permanent dwellings in the area were sprayed). The spraying operation lasted for 30 consecutive days in 1972 and two teams consisting of 20 spraymen, 2 mixers, 4 foremen and 2 team leaders were engaged in this operation. The operators were under systematic and closed clinical observation and cholinesterase determination (tintometric method) during the operation as well as, in some cases, two months after it.

The following entomological measures were conducted in five representative villages in the OMS-43 sprayed area and in two villages in the comparison area treated with Malathion:

1. pyrethrum spray collection at ten-day intervals at 8 fixed capture stations in each village;
2. floor sheet collection—the number of dead mosquitoes found on sheets spread overnight on the floors of six sprayed shelters was counted at 10-day intervals;
3. window trap collection—a total of 20 exit traps were installed, four window traps per village;
4. shelter pit collections—20 artificial pits were examined at 10-day intervals in sprayed villages;
5. night-biting collections on human and animal bait carried out at 10-day intervals in sprayed villages;
6. vector age determination—Detinova's method carried out in sprayed villages;
7. larval density—collected in sprayed villages;
8. biological evaluation on various surfaces of sprayed houses at 30-minute exposure with lab-bred *A. stephensi* was carried out at weekly intervals; about 600 mosquitoes were tested each time on sorbent and non-sorbent surfaces;
9. susceptibility tests using the WHO technique with DDT, Malathion and Fenitrothion were carried out on *A. stephensi*.

RESULTS AND DISCUSSION.

A. TOXICOLOGICAL STUDY.

In spite of the rigid instructions given to the spraymen to follow the necessary precautions, there were 42 cases of clinical symptoms. In some individuals several relapses occurred during the operation. No complaints or cholinesterase depression was observed during the first 2-week exposure.

The majority of cases were mild and short, recovery resulted after washing and rest (2-3 hours), and most cases returned to work on the same day.

The main clinical symptoms were headache, giddiness, nausea and abdominal cramps; some workers felt weakness. Diarrhoea was reported among two cases and was treated with Enterovioform (Ciba).

A drop in whole blood ChE was seen among both mixers accompanied by clinical symptoms. One of the mixers left his job when his ChE was depressed to 12.5. Out of 20 spraymen, 8 showed depression of ChE, in some cases with clinical symptoms. After Atropine was injected and rest prescribed, recovery resulted. Among the 4 foremen (except one) and 2 team leaders, ChE depression was not significant (fig. 1).

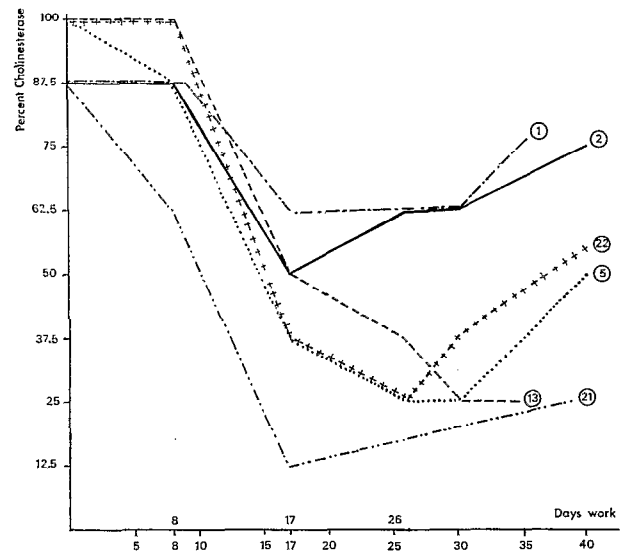


FIG. 1. — Whole blood cholinesterase depression among 2 mixers (Ser. Nos. 21, 22) and 4 spraymen (Ser. Nos 1, 2, 5, 13) during spraying period.

Clinical investigation and laboratory tests among 925 inhabitants of 5 villages, carried out 24 hours after insecticide application, showed only 15 cases with light symptoms. No significant change in ChE level was observed.

FIELD TRIAL OF SUMITHION (O.M.S.-43) IN THE MAMASANI AREA

TABLE 1. — Summary of entomological evaluation of OMS-43 on *A. stephensi* in 5 treated villages, Mamasani, 1972.

Month	Days after Spraying	Indoor Resting den/hut	% Gravid, 1/2 grav.	Outdoor Collection den/pit	Floor Sheet (# dead)	Exit Trap % mortality	# /Bait/Night		Parous Rate	Bio-Assay	
							Man	Animal		Sorbent Walls	Non-Sor. (wood)
May . . .	prespray	0	—	—	—	—	—	—	—		
	»	0.05	0	0	—	—	—	—	—		
June . . .	»	0.8	9.4	0.1	—	—	—	—	—		
	»	1	20	0.5	—	—	—	2.3	—		
July . . .	»	8.7	52.8	2.3	—	—	4.3	9.3	62.4		
	»	352.9	50.5	4.6	0	56	38.4	213	54.1		
Aug. . . .	3	2.9	9.2	21.8	37	100	14.9	27.1	9.8	96.9 %	100 %
	10	11.4	6.4	8.6	18	100	16.6	24.1			
	20	3.5	0.7	13.8	9	100	2	3.8			
Sept. . . .	30	4.2	14.3	3.6	0	—	2.1	4.7	3.5	83.1	100
	40	0.2	0	6.5	1	—	0.2	0.3			
	50	0	0	0.05	0	—	0.1	0			
Oct. . . .	60	0.07	0	0.15	0	—	0	0		40.0	93.9
	70	0	0	0	0	—	0	0.17			
	80	0	0	0.15	0	—	0	0.5			
Nov. . . .	90	0	0	0	0	—	0	0		19.4	84.1
	100	0	0	0	0	—	0	0			

TABLE 2. — Summary of entomological studies of effect of Malathion on *A. stephensi* in two comparison villages, Mamasani, Iran, 1972.

Month	Days after Spraying	Indoor Collection den./hut	% Gravid and 1/2 Gravid	Bio-Assay	
				Sorbent mud walls	Non-Sor. wood
May	pre-spray	0	—		
	»	0	—		
June	»	0.1	20 %		
	»	2.2	65.7		
July	»	10.9	55		
	»	675.7			
Aug.	»	847.6	33.8		
	»	997.6	37.9		
	5	42.6	10.5	47.5	100
Sept.	15	9.3	26.2	57.8	100
	25	7.5	30.9	48.4	96.6
	35	6.1	41.8	41.8	92
Oct.	45	4.2	42.5	32.4	89
	55	18.1	47.3	33	84
	65	19.8	47.7	23.5	83.3
Nov.	75	4.1	—	24.5	88
	85	0.06	—	18	45.4
	95	0	—	11.7	39.6

This study showed that the consumption of Sumithion under local conditions (sub-tropics, hot dry season) was safe for residents, but its toxic effect on operators should be considered and further toxicological investigation with restricted safety measures which can be used under tropical conditions are required.

B. ENTOMOLOGICAL STUDY.

— Pyrethrum spray catches showed a remarkable reduction in the indoor resting density of *A. stephensi*, i.e. from 352.9 per shelter before application of insecticide to 2.9, 11.4, 3.5, 4.2, 0.2 and zero afterwards (August-September). The number of empty, blood-fed, half gravid and gravid females was 1167 (8.3 %), 5820 (41.2 %), 5339 (37.8 %) and 1972 (12.7 %) respectively before application, and 3 days after spraying these rates changed to 98 (82.4 %), 10 (8.4 %), 10 (8.4 %), 1 (0.8 %) respectively (tabl. 1). In the two comparison villages sprayed with Malathion, the density decreased from 997.6 per shelter before spraying to 42.6, 9.3, 7.5, 6.1, 4.2, 18.1 and 19.8 in August-October (tabl. 2).

— Exit trap observations indicated 100 % mortality within a 24-hour recovery period. Among the collected mosquitoes no higher stages of blood digestion were seen (tabl. 1).

— The man-biting rate for *A. stephensi* was reduced during the course of collection, i.e. from 38.4 per bait per night before application to between zero and 16.6 per bait per night after spraying (tabl. 1).

In spite of a remarkable decline in *A. stephensi* biting indices, the animal-biting rate of *A. d'thali* during the same period of time was considerable, due to the relatively exophagic and exophilic habits of this species.

— Ovary dissections revealed a drop of parous rate from 54.1 % and 62.4 % to between 3.5 % and 9.8 % after insecticide application (tabl. 1).

— Bio-assay tests showed a mortality rate of 72.6 % on mud walls up to 40 days after spraying; this dropped to 8 % after 100 days. On non-sorbent surfaces (wood, rush mats), more than 67 % mortality was observed up to 100 days after spraying (tabl. 1).

In the tests with one-hour exposure, 74.5 % and 96 % mortality was observed on mud walls and wood respectively after 88 days insecticide application, and 44.8 % and 74 % after 104 days.

— Susceptibility tests using the WHO technique were carried out with regard to 0.1 % and 1 % Fenitrothion (OMS-43) concentrations. The range of mortality after half-an-hour exposure followed by a 24-hour recovery period was observed to be between 0.0 % to 2.9 % and 99.2 % to 100 % respectively, and with one-hour exposure between 0.7 % to 5.8 % and 100 % respectively.

The mortality rate with 0.5 %, 3.2 % and 5 % Mala-

thion with one-hour exposure was 2.1 % to 19.2 %, 93.6 % to 99.3 %, and 100 % respectively.

In the case of 4 % DDT concentration with one and four hours exposure, the mortality rate was 0.0 % to 1 % and 8.9 % to 12.9 % respectively.

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