

FIELD TRIALS OF SUMITHION (OMS-43) AND MALATHION RESIDUAL SPRAYS FOR CONTROL OF *ANOPHELES STEPHENSI MYSORENSIS* IN THE MAMASANI AREA, SOUTHERN IRAN, 1974¹

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ABSTRACT. To evaluate the effectiveness of sumithion (OMS-43) for the control of *Anopheles stephensi mysorensis* Sweet and Rao the main malaria vector in the south of Iran, an extensive field trial (area-scale) was carried out in the Mamasani area, in 1974.

One round of syringing was implemented in July 1974, at the beginning of *A. stephensi* activity. The effectiveness of sumithion was evaluated by indoor pyrethrum spray, floor sheet, exit

window trap, outdoor night-biting collections, vector age determination of female mosquitoes and biological evaluation.

On the basis of the results obtained, it was concluded that sumithion is an effective insecticide against anopheline mosquitoes. The control of *A. stephensi* under conditions of this experiment lasted for about 2 months, but its toxic effect on operators under local conditions (sub-tropics, hot dry season) should be considered.

INTRODUCTION. Due to the resistance of *Anopheles stephensi mysorensis* Sweet and Rao, the main vector of malaria in southern Iran, first to DDT in 1957 and then to dieldrin in 1961, residual house spraying was discontinued from 1961 until 1967. Thereafter, several promising compounds for the control of mosquitoes have been evaluated, and malathion was found to be a readily available and somewhat convenient insecticide for use in the malaria eradication program.

Malathion house spraying, 50% w.d.p. 2 g/m², has been implemented since 1968. However, the frequent application of malathion may lead to resistance in the future, and therefore a substitute insecticide is needed to replace malathion if and when the necessity arises. Sumithion (OMS-43²) is a new insecticide which was evaluated in southern Iran by Eshghy et al. (1972). Another operational field trial of OMS-43 was implemented with a comparison area under malathion house

spraying for the control of *A. stephensi* in the same locality in Mamasani in 1974 (see map).

MATERIAL AND METHOD

AREA OF OPERATION. The study area is located on the southern slopes of the Zagros Mountains and has a sub-tropical climate. The summer is long and hot with maximum temperatures over 40° C. The winter is moderate and the temperature rarely drops below zero. The relative humidity is usually about 30–50%. Most dwellings (90%) are constructed of unbaked mud bricks and some are built with thatch roofs and mud brick walls (10%).

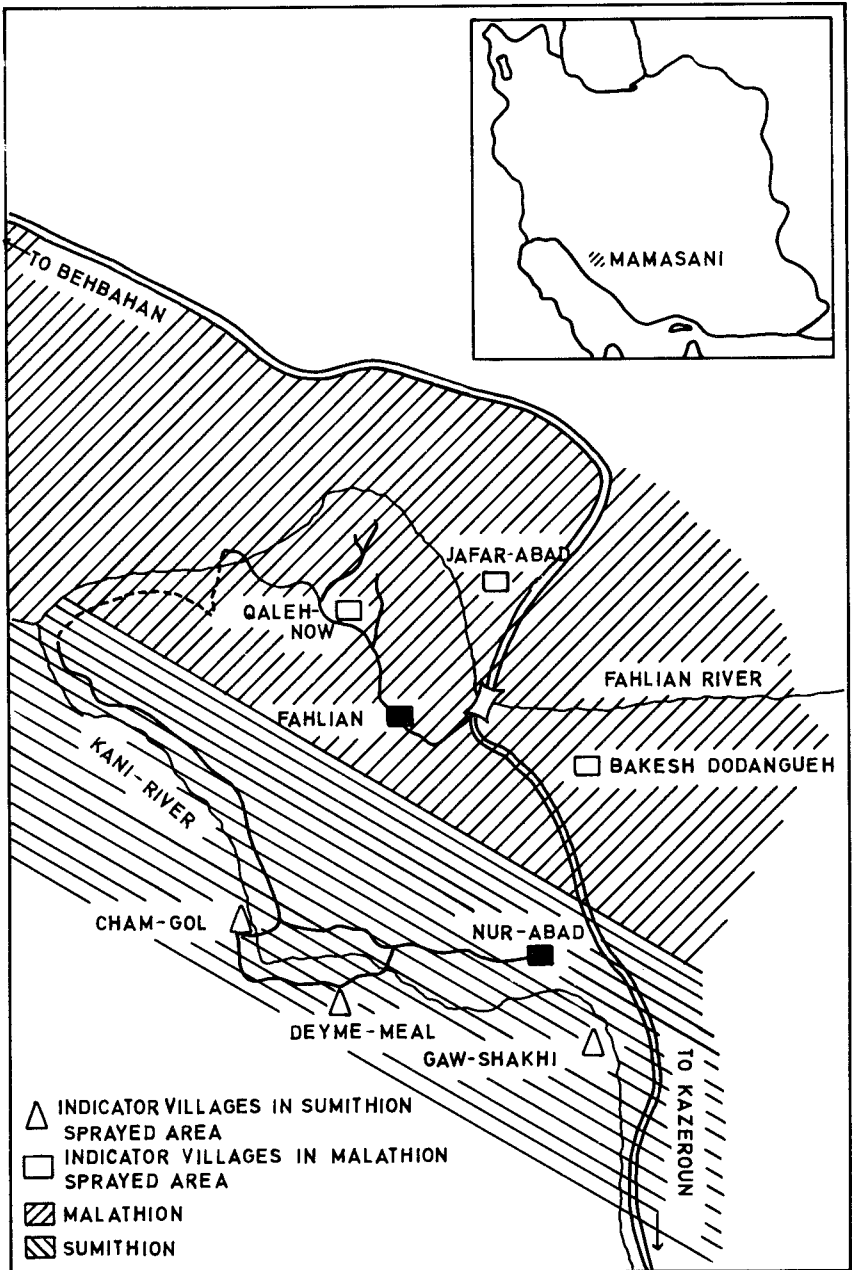
Secondary vectors such as *Anopheles dthali* Patton, *A. superpictus* Grassi and *A. fluviatilis* James, with relatively exophilic and exophagic habits, are active in this area. Malaria transmission usually occurs during 7 months of the year (April–November) with a peak from mid-August to mid-October. The main larval breeding places are rice fields, canals and river banks. Due to seasonal rice cultivation in July and the provision of vast breeding places, an increase in anopheline density occurs every year in this area.

One round of spraying with OMS-43

¹This study was jointly carried out by the School of Public Health and Institute of Public Health Research of the University of Teheran, and the Malaria Eradication Organization of the Ministry of Health.

²O,O-dimethyl O-(3-methyl-4-nitrophenyl) phosphorothionate.

MAP SHOWING OPERATIONAL AREA TREATED WITH SUMITHION (OMS -43) AND MALATHION MAMASANI, SOUTHERN IRAN



Map showing operational area treated with sumithion (OMS-43) and malathion Mamasani, Southern Iran.

40% w.d.p. 2 g/m² (technical) was carried out in 57 villages with a population of 12,210 people from 4 July to 7 August, 1974. Two rounds of spraying with malathion, 50% w.d.p. 2 g/m², were implemented from 1-31 July and from 25 August to 4 September, 1974, in the comparisons area. During the first round of spraying, 26 villages with 7,289 people, and during the second round of spraying, 23 villages with 6,774 inhabitants, were under spraying operations.

METHOD OF ENTOMOLOGICAL EVALUATION. In each of the OMS-43- and malathion-treated areas, three representative villages were chosen for entomological evaluation. The studies were carried out at 10-day intervals. The following measures were conducted in both OMS-43- and malathion-treated areas:

1. Pyrethrum spray collection—at 8 fixed capture stations in each indicator village;
2. Window trap collection—a total of 24 exit traps were installed, 4 window traps per village;
3. Floor sheet collection—the number of dead mosquitoes found on 2 sheets spread overnight on the floor was counted in each indicator village;
4. Shelter pit collection—24 artificial pits were examined in both OMS-43 and malathion indicator villages, 4 shelter pits per village;
5. Night-biting collections—on human and animal bait;
6. Vector age determination—Detinova's method (1962) carried out in sprayed villages;
7. Larval density—determined in sprayed villages;
8. Biological evaluation—on sorbent and non-sorbent surfaces of sprayed houses at 30-min exposure with laboratory reared *A. stephensi*; also bio-assay of the airborne effect on OMS-43 sprayed on the interiors of houses and bio-assay with continuous exposure for 70%, 90% and 100% knocked-down mosquitoes;

9. Susceptibility tests using the WHO technique with DDT and malathion were conducted.

RESULTS AND DISCUSSION

The residual spraying of OMS-43 resulted in a considerable decline in the population of *A. stephensi*, as compared with malathion, by routine observation (Figs. 1-8).

Morning resting densities were measured from 7 a.m. to 9 a.m. The mosquitoes were grouped by species, sex and abdominal condition. Pyrethrum spray collections of *A. stephensi* from houses in the OMS-43 index area totalled 2,626 over the 50-day period prior to spraying of this insecticide. The number of half-gravid and gravid females were 1,383 (52.6%).

During July-October, after the OMS-43 application, only 50 (5.1%) females were found to be gravid and half-gravid in pyrethrum spray collections. The maximum density for *A. stephensi* in 3 indicator villages was 48.5 per shelter before spraying, and then ranged between 0.1-11.4 per shelter after the OMS-43 application.

In three comparison villages before spraying with malathion, the maximum indoor resting density was 122.8 per shelter in June. After the first round of malathion spraying, the density was between 4.7-512.2 per shelter during July-August, 1974. During the second round of treatment, the densities ranged between 0.8-43.9 per shelter.

The main larval breeding places of *A. stephensi* are rice fields. Due to seasonal rice cultivation activity in June-July, and the consequent extension of larval breeding place surfaces, a remarkable increase was observed in the adult anopheline population in both OMS-43 and malathion treated villages.

During the 2 months after spraying with OMS-43, a total of 73 females of *A. stephensi* and 112 *A. thali* were col-

FIG.1
ANOPHELINE INDOOR DENSITY IN SUMITHION
(OMS-43) TREATED VILLAGES-MAMASANI,
IRAN, 1974

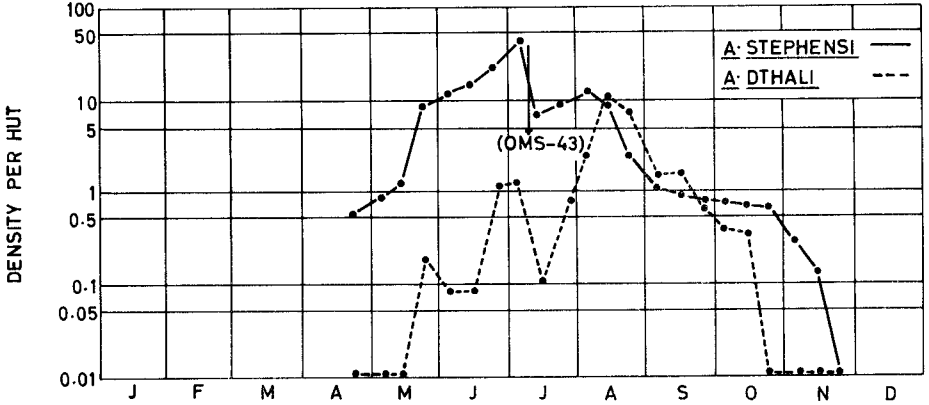


FIG.2
ANOPHELINE INDOOR DENSITY IN MALATHION
TREATED VILLAGES-MAMASANI,
IRAN, 1974

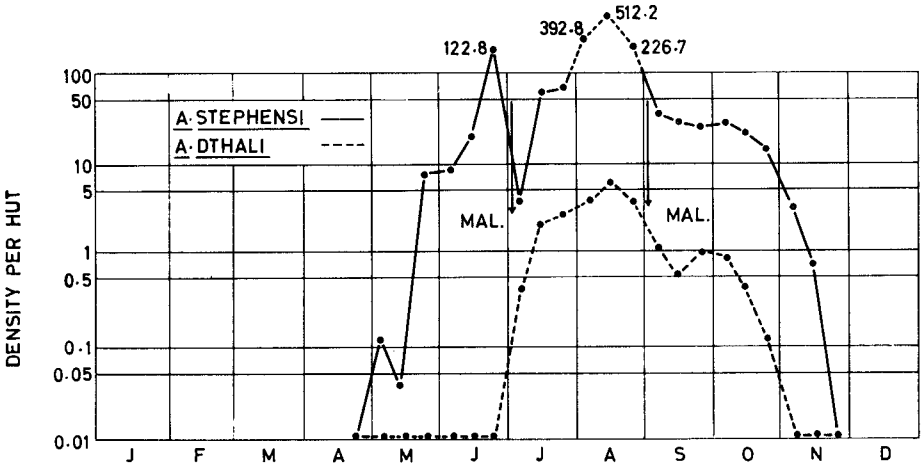


FIG. 3
SHELTER PIT COLLECTIONS OF ANOPHELINES IN
SUMITHION (OMS-43) TREATED VILLAGES - MAMASANI
IRAN, 1974

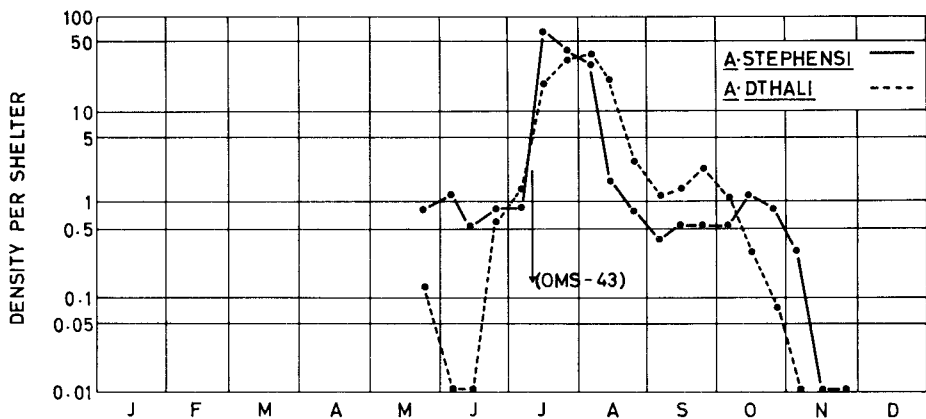


FIG. 4
SHELTER PIT COLLECTIONS OF ANOPHELINES IN
MALATHION TREATED VILLAGES-MAMASANI,
IRAN, 1974

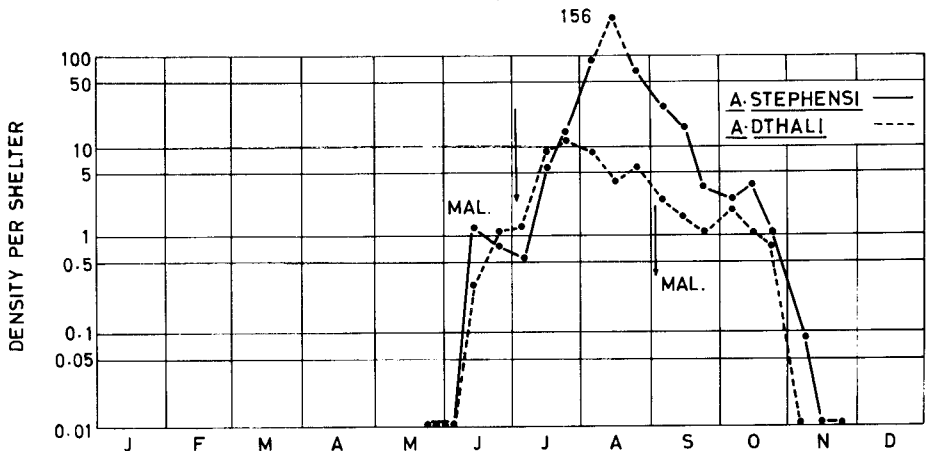


FIG. 5
NIGHT BITING CATCHES ON HUMAN BAIT IN
SUMITHION (OMS-43) TREATED VILLAGES - MAMASANI,
IRAN, 1974

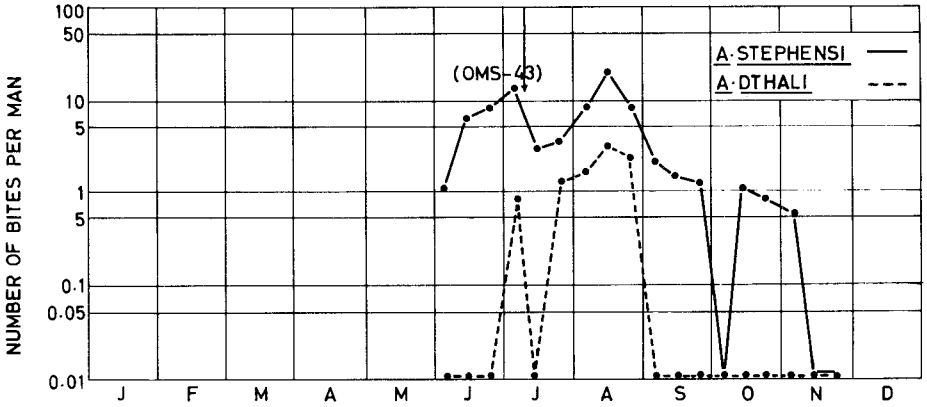


FIG. 6
NIGHT BITING CATCHES ON HUMAN BAIT IN
MALATHION TREATED VILLAGES - MAMASANI,
IRAN, 1974

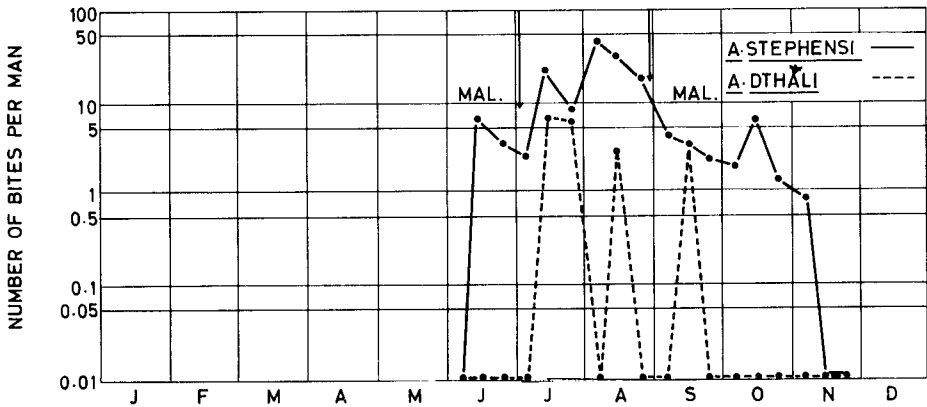


FIG. 7
NIGHT BITING CATCHES ON ANIMAL BAIT IN
SUMITHION (OMS-43) TREATED VILLAGES-MAMASANI,
IRAN, 1974

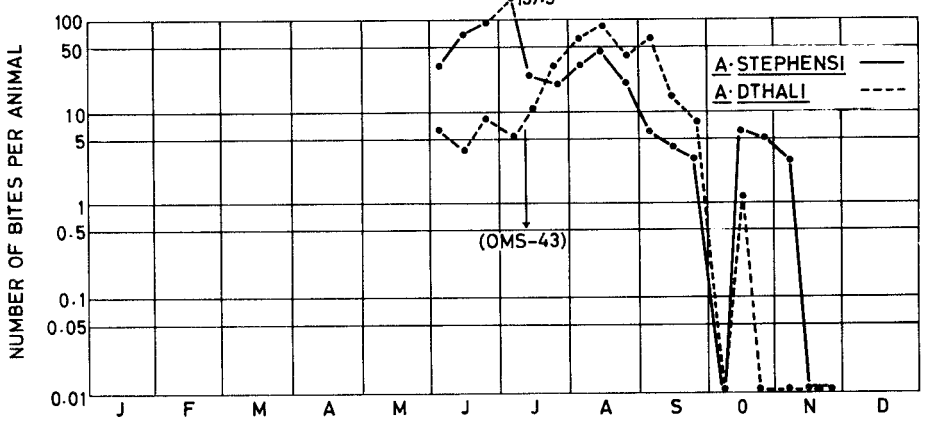
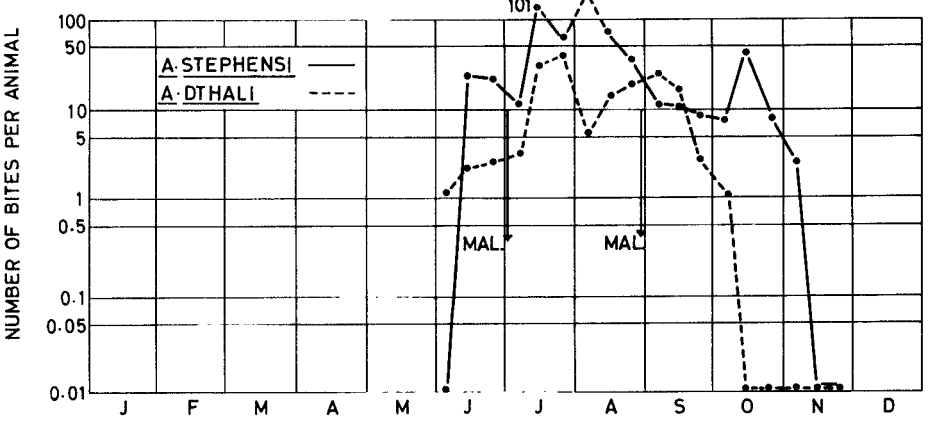


FIG. 8
NIGHT BITING CATCHES ON ANIMAL BAIT IN
MALATHION TREATED VILLAGES-MAMASANI,
IRAN, 1974



lected on sheets spread overnight on the floors. The finding of dead mosquitoes on floor sheets indicates that OMS-43 insecticidal contact was lethal to these mosquitoes. A similar mortality was observed in the malathion-treated area.

Exit trap collection prior to OMS-43 application resulted in a total of 46 *A. stephensi* females, 52.2% of which were gravid and half-gravid. After spraying, 64 *A. stephensi* were collected in traps during a 30-day period. All captured mosquitoes were blood-fed and empty and the mortality rate was 100% after a 24-hour holding period.

Before malathion spraying, 80 *A. stephensi* were collected in exit traps in the comparison area during a one-month period, with a survival rate of 92.5%; 21.3% were gravid and half-gravid females. After the first round of malathion application, a total of 754 *A. stephensi* were collected during two months; 0.3% were gravid and half-gravid. After the second round of spraying, a total of 237 *A. stephensi*, with 2.9% gravid and half-gravid, were collected. The mortality rate was between 46.2-100% on the first round, and between 26.6-100% on the second round of operation.

Shelter pit surveys for *A. stephensi* showed an average density range between 0.2 and 67.2 per pit in the OMS-43 treated villages for the period July-November, 1974. In comparison, in the malathion treated area, the average density per shelter pit during the first and second rounds of spraying ranged from 0.6 to 156 and 0.1 to 23.6 respectively during the same months.

Night-biting collections of *A. stephensi* during the pre-spray period ranged from 1 to 14.7 per night-bait on man and 30 to 137.5 on animals in the OMS-43 area and from 0 to 5.7 per night-bait on man and 0 to 21 on animals in the malathion area. During the 5 months after OMS-43 spray application, the number per bait per night on man ranged from 0 to 19.2 on man and 0 to 46.5 on animals. In the malathion-treated area, it was from 2.5

to 44.5 on man and from 13.5 to 120 on animals during the first round. Observations were made outdoors as well as indoors on the prevailing human resting and sleeping habits.

The results of ovary dissections on 220 *A. stephensi* collected from indoor resting sites showed a parous rate ranging between 55 and 58.5% before OMS-43 application. During the 75 days after OMS-43 spray application, of 416 dissected, the parous rate ranged between 8.5-16%. In the pre-malathion spray period, 220 *A. stephensi* were dissected and the parous rate ranged between 47.3 and 57.6%. After the first round of malathion operation, a total of 610 *A. stephensi* were dissected and the parous rate ranged between 8.5 and 16%.

Bio-assay tests on OMS-43 insecticidal residue on surfaces was conducted according to the recommendation of WHO (1970). The results of biological evaluation of OMS-43 within a 30-min exposure period showed a mortality rate of about 65.3% on mud walls up to 45 days after spraying. However, by 135 days, it had dropped to 8%. Wood bio-assay gave more than 70% mortality up to 95 days after spraying. Bio-assay mortalities on mud surfaces sprayed with malathion were 63.5% after 35 days on the first round of spraying. On non-sorbent wood surfaces, at 55 days after spraying the 24-hr mortality was 96.5%.

Observations of the air-borne killing effect of OMS-43 were made in the interiors of houses. A total of 6 cages of 25 blood-fed *A. stephensi* each were used in each test, of which 4 were installed in 4 sprayed rooms and 2 kept as controls. The time of exposure was 6 hours from 7 a.m. to 1 p.m. and the holding time was 24 hours. The type of cage used in these tests was a cylindrical screen cage, 10 x 16 cm in size, which was hung at 50 cm distance from the wall and ceiling in treated houses. One hundred percent kill occurred 45 days post-treatment, and 80% 85 days after spraying.

A study was made of the time required

for the "knockdown" of *A. stephensi* on OMS-43 treated mud walls using a prolonged bio-assay technique. Five days after spraying, an exposure time of 29, 38 and 43 minutes to mud walls was required to cause the "knockdown" of 70%, 90% and 100% respectively in the bio-assay cones. At 135 days after spraying, 335, 420 and 438 minutes were required for the "knockdown" of 70%, 90% and 100% respectively.

Susceptibility tests using the WHO (1970) technique were carried out with 0.5%, 3.2% and 5% malathion concentrations. The range of mortality after 1-hr exposure followed by a 24-hr recovery period was observed to be between 7.1-14.8%, 100% and 100% respectively. In the case of 4% DDT and 4% dieldrin concentrations with 4 hours exposure, the mortality rate was 32.9-39.3% and 32.6-45.1% respectively.

Considering the results obtained, sumithion (OMS-43) is more effective as compared with malathion against some anopheline mosquitoes, and it gave control of *A. stephensi* under the conditions of this experiment for more than 2 months. However, the toxic effect of this insecti-

cide on operators under local conditions should be considered.

ACKNOWLEDGMENT

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