

## MALATHION SUSCEPTIBILITY TEST OF *A. STEPHENSI* MYSORENSIS IN SOUTHERN IRAN<sup>1</sup>

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**ABSTRACT.** Southern Iran has been treated with malathion at the rate of 2 g/m<sup>2</sup>, 2-3 cycles per year, since 1964. In Chelow village, which is in a palm-growing area, malathion has been used only for controlling adults of anophelines, and there is no record of organo-phosphorous insecticides having been used for agricultural pest

control. Susceptibility tests carried out in this village showed that, after almost a decade of malathion application in dwellings, *Anopheles stephensi mysorensis* remains susceptible to malathion and the discriminating dosage that kills 100% of *A. stephensi mysorensis* is the same as it was in 1964 (3.2%).

**INTRODUCTION.** The main malaria vector in southern Iran is *Anopheles stephensi mysorensis*. This species developed resistance to DDT (Mofidi *et al.*, 1958) and subsequently to dieldrin in 1959 (Mofidi *et al.*, 1960). Since 1964, the Bandar Abbas area has been treated with malathion at the rate of 2 g/m<sup>2</sup>, 2-3 rounds per year (Manouchehri *et al.*, 1972), and up to the present time (April, 1974) 23 rounds of spraying with this insecticide have already been completed.

Resistance to organo-phosphorous and carbamate compounds has been observed in *A. albimanus* in South America (Georghiou, 1973; Pal, 1973). As the emergence of malathion resistance may have a reverse effect on malaria control in this area, the susceptibility level of *A. stephensi mysorensis* to malathion has been checked regularly by the Bandar Abbas Research Station.

**MATERIAL AND METHODS.** The method used in testing is that developed by the World Health Organization for evaluating the susceptibility of a field population of adult anophelines (WHO, 1963, 1970). Paper impregnated with malathion at concentrations of 0.4, 0.5, 0.8, 1.6, 3.2 and 5.0% was provided by W.H.O. For the controls, paper impregnated with Risella oil alone was used. The exposure time to

the impregnated paper lasted one hour, and after a 24-hour recovery period, a mortality count was made. During the holding period, the mosquitoes were held in paper cups and a pad of wet cotton wool was placed on the top of the cups. All observed mortalities were corrected by Abbott's formula when necessary (Abbott, 1925). LC50's were estimated by plotting the dosage mortality lines. The mosquitoes used were blood fed *A. stephensi mysorensis* which had been collected from human and animal shelters at Chelow village, Bandar Abbas, southern Iran.

**RESULTS.** The base-line data collected just prior to starting malathion spraying for the control of *A. stephensi mysorensis* in Chelow village showed that the discriminating dosage that killed 100% of this species was 3.2%. From October 1964, to April 1966, five rounds of malathion spraying at the rate of 2 g/m<sup>2</sup> were performed (Manouchehri *et al.*, 1966). From 1967, two rounds of malathion have been applied annually in March and August. (See Table I.)

During 1965-66, the density of *A. stephensi* was so low that we were not able to perform the adult susceptibility test. From October 1967, susceptibility tests have been checked regularly and have shown that this species is susceptible to malathion (Manouchehri *et al.*, 1970).

During 1971-72, paper impregnated with malathion at concentrations of 0.5 and 5.0% was used. The mosquitoes tested in December 1971, and March 1973, showed a tolerance to malathion and the

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TABLE I. Results of malathion susceptibility tests on *A. stephensi mysorensis* (1964-1974) in Chelow village, Bandar Abbas, southern Iran.

Date	Spraying cycle	Temp.		R.H. %*	Control	% Mortality after one-hour exposure, 24 hours recovery							
		Min.-max.				0.4%	0.5%	0.8%	1.6%	3.2%	5.0%	6.4%	
October 1964	.....	28-32		40-50	2.5 (186)	15.3 (183)	.....	46 (186)	98 (190)	100 (164)	.....	.....	100 (98)
November 1967	10 Mal.	20-31		77-78	1.2 (192)	.....	.....	45.6 (74)	98 (161)	100 (100)	.....	.....	.....
March 1969	11 Mal.	22-31		75-85	1.5 (192)	.....	.....	65.8 (94)	98.8 (85)	100 (73)	.....	.....	.....
April 1970	14 Mal.	25-28		60-70	0 (122)	31.5 (54)	.....	53.8 (62)	95 (79)	100 (69)	.....	.....	100 (14)
March 1971	17 Mal.	21-26		70-72	0 (96)	.....	0 (94)	.....	.....	.....	.....	.....	100 (100)
December 1971	19 Mal.	23-31		60-70	0 (170)	.....	0.6 (166)	.....	.....	.....	.....	.....	90 (195)
March 1973	20 Mal.	25-26		78-89	0 (112)	.....	1.8 (106)	.....	.....	90 (108)	.....	.....	91.5 (107)
April 1974	23 Mal.	27-32		69-75	0 (75)	.....	90 (75)	.....	.....	100 (75)	.....	.....	.....

\* R.H. = Relative humidity.

The figures in parentheses represent the number of mosquitoes tested. Before 1964, the area was sprayed with DDT and Dieldrin, 10 and 3 rounds, respectively.

percentage mortality observed was 90 and 91% respectively.

It has been reported by W.H.O. (unpublished, 1973) that "Some irregularities were suspected in the impregnation of test papers of organo-phosphorous and carbamate insecticides of October 1971 and February 1972 consignments," and the results of tests carried out with these papers in December 1971, and March 1972, are invalid and should be ignored.

**DISCUSSION.** Susceptibility tests carried out in Chelow village, which is in a palm-growing area where malathion is used only for controlling adult anophelines and where there is no record of the use of organo-phosphorous insecticides for agricultural pest control, showed that after almost ten years of malathion application at a rate of 2 g/m<sup>2</sup>, 2-3 rounds per year, *A. stephensi mysorensis* remains susceptible to malathion and adult susceptibility persists at the same level that it was in 1964.

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