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DIELDRIN-RESISTANT ANOPHELES FLUVIATILIS IN EASTERN SAUDI ARABIA

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by

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In October 1958 during the peak malaria season in eastern Saudi Arabia, a follow-up study was begun on malaria cases reported in ARAMCO medical service establishments. The principal purpose of this study was to determine if dieldrin-resistant Anopheles pulcherrimus might possibly be involved in the transmission of malaria in the Qatif Oases where most of the malaria cases were occurring. Dieldrin was first used for malaria control in this area in 1955 and has been applied once annually ever since. Since 1955, A. stephensi, the principal vector in the eastern part of Saudi Arabia, had not been collected from village houses but A. pulcherrimus and A. coustani were more prevalent than they had been during the previous seven years when DDT had been used six times for malaria control.

This follow-up study was started before the autumn application of dieldrin had been made in 1958. Mosquito collections from the houses of malaria patients included A. stephensi, A. sergenti and A. fluviatilis as well as A. pulcherrimus and A. coustani. With the presence of three known vectors in these houses interest in A. pulcherrimus as a vector decreased. After a 0.5 g/m^2 deposit of dieldrin had been applied to the walls and ceilings of village dwellings and stables more mosquito collections were made. No A. stephensi were collected from sprayed surfaces but A. pulcherrimus, A. coustani and A. fluviatilis were found. Occasional specimens of A. sergenti were also collected. The mere presence of A. fluviatilis in these collections was unusual but the numbers and regularity of their appearance in collections was even more unusual because previous tests showed this species to be quite susceptible to dieldrin.

Insecticide resistance tests using both the Busvine-Nash technique and the WHO adult test kit were made with A. fluviatilis collected in three villages and one garden in the Qatif Oases. Mosquitos from another garden situated about 20 miles from the Qatif Oases were also tested. The villages of Jarudiyah, Hillat Muhaish and Umm Khuman and the Qatif Garden have been sprayed four times with dieldrin. The isolated garden of 'Ain al-Saih had never been sprayed in a malaria control programme up to the time of the test reported here. It has been sprayed since. Previous Busvine-Nash tests (1955-1958) with A. fluviatilis from three other gardens in the Qatif Oases showed it to be susceptible to DDT and to dieldrin. LC_{50}'s of DDT ranged from less than 0.5% to less than 2.0%. The LC_{50}'s of dieldrin were less than 0.05%.

Frequent collections have been made in these villages since the middle of December 1958. The number of A. fluviatilis in each day's catch was usually low but the catches were divided and tested over a range of at least two dieldrin concentrations and control papers. The results of individual tests over periods of up to a week were pooled and are shown in the table. Results of tests with A. stephensi from unsprayed 'Ain al-Saih are also included. LC_{50}'s were determined by the Litchfield-Wilcoxon method.

In earlier tests, LC_{50}'s of DDT and of dieldrin to A. fluviatilis from 'Ain al-Saih and other, sprayed, gardens were well within a normal range of susceptibility to both insecticides. The present tests show that no significant change has occurred in the 'Ain al-Saih strain. However, the strains of A. fluviatilis from three sprayed villages and one garden are all resistant to dieldrin with LC_{50}'s ranging from 1.15% to >4.0%, at which concentration the mortalities ranged from 28% to 46%. Compared to the 'Ain al-Saih strain these strains are from 25 to over 100 times more resistant to dieldrin. There is no indication that they are resistant to DDT.

Tests with these strains and strains from other villages and gardens are continuing.

MORTALITIES (PER CENT.) IN SUSCEPTIBILITY TESTS BY THE BUSVINE-NASH AND THE WHO METHODS
(Figures in brackets show numbers tested)

1. Anopheles fluviatilis - (a) Dieldrin

LOCALITY	DATE day, month, year	DAILY MEAN TEMP. RANGE OUT	IN	METHOD	0.025%	0.05%	0.1%	0.2%	0.4%	0.8%	1.6%	4.0%	CONTROLS	LC_{50}
Al-Jarudiyah	14-29.12.58*	58-70	75-78	BN			5 (7)	19(18)	20(20)	18(15)	78(10)		11 (19)	1.15%
"	4-7.1.59	61-62	75	BN					0 (6)	0 (6)	20 (5)		0 (10)	>>1.6%
"	28.2-4.3.59*	59	75	WHO					19(17)			40(15)	12 (17)	>4.0%
" (2-hr exposure)	7-10.3.59		75-79	WHO				10(10)	29(14)			31(26)	0 (23)	9.0%
Hillat Muhaish	11-13.1.59	59-64	75	BN				0 (6)	0 (8)	0 (4)	50 (2)		9 (11)	?
Umm Khuman	13.1-3.2.59	55-70	72-77	BN					3(30)	6(16)	15(26)	28(18)	9 (45)	>4.0%
"	21-25.2.59	51-60	72-75	WHO					6(17)			46(24)	0 (25)	>4.0%
Qatif Garden	29.1-2.2.59*		76-79	WHO				2(17)	39(29)	35(26)	45(26)		10 (29)	2.8%
'Ain al-Saih	24.12-10.1*	55-67	75-79	BN	36(13)	48(16)	76(15)	86(12)					16 (19)	0.043%

					(b) DDT							0.25%	0.5%	1.0%	2.0%	4.0%	CONTROLS	LC_{50}%
'Ain al-Saih	24.12-10.1*	55-67	75-79	BN	13(16)	100(8)	100(9)			7 (28)	>0.25,<0.5							
Umm Khuman	2-10.2.59*	54-70	75-77	WHO	17(21)	27(27)	91(26)	100(5)		14 (29)	0.58							
Qatif Garden	7-14.2.59*	58-70	75-77	WHO	63(29)	52(30)	91(29)			16 (31)	0.23							

2. Anopheles stephensi	(a) Dieldrin				0.025%	0.05%	0.1%	0.2%	0.4%		
'Ain al-Saih	24.12-10.1*	55-67	75-79	BN		21(66)	48(69)	89(73)		8 (86)	0.088

	(b) DDT				0.25%	0.5%	1.0%	2.0%	4.0%		
'Ain al-Saih	24.12-10.1*	55-67	75-79	BN	14(66)	41(73)	51(81)	80(68)	98(44)	14(102)	0.8

* Mortality corrected by Abbott's formula