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The Secretary of the Expert Committee on Malaria has the honour to communicate hereunder a paper by D.G. MER, Chief of the Antimalaria Service of the Government of Israel, Director, Malaria Research Station, Rosh Pina

MALARIA CONTROL IN THE STATE OF ISRAEL

The malaria incidence among the Jewish population in the Israel portion of Palestine consisting of old settlers and new immigrants was in

1945, 1207; 1946, 466; 1947, 226.

In this period the population remained more or less static at 600,000 inhabitants. In 1948 when the population increased to about 750,000 inhabitants there were 1,227 new cases, to which has to be added approximately 500 cases being of long latency vivax infections which only made themselves manifest during the spring of 1949 after the discontinuance of proguanil (paludrine) prophylaxis.

1945.⁽¹⁾ Anti-malaria work consisted in 1945 of the classic methods of control, being based on anti-larval campaigns, screening of houses, the use of nets and mosquito repellents. In highly malarious areas pyrethrum spray was used as an anti-imago measure and people were persuaded to stay indoors after dusk. The first experiments were made with DDT as a residual spray in this year.

1946. The use of DDT as a residual insecticide for spraying out buildings was begun in 1946 as an addition to the anti-larval work carried on from 1945. All Jewish and Arab villages were sprayed out in the hyper-endemic area of Huleh, where the vector is A. sacharovi. In other malarious areas all Jewish villages, and some Arab villages were also treated.

1947. The DDT residual spraying, additional to the anti-larval campaign, continued in 1947 as for 1946. Mechanical protection was now being relaxed and in malarious areas people were allowed to spend the evenings outside their dwellings. The year was a dry one and breeding places were then naturally reduced in number.

(1) Since 1945 anti-malaria work is carried out by the civilian authorities, while during 1942-44 the Army undertook it.

1948. In 1948 residual spraying continued in all Jewish and Arab villages, some of which owing to the political situation were in ruins or not inhabited. Many of the inhabitants - that is, old settlers and immigrants - spent nights outside dwellings in tents, dug-outs or in the open, no attention being paid to mechanical protection. Tents and dug-outs were residually sprayed with DDT, and mosquito repellents were used as a personal protection. The anti-larval work was reduced to oiling of breeding areas with DDT in kerosene, but unfortunately not all areas could be treated. Now for the first time proguanil was used as a suppressant on a large scale, but owing to the scarcity of supplies prophylaxis was started only after the appearance of the first cases of malaria in a given community. Up to October 1948 only about 50% of those to whom the suppressant was offered availed themselves of proguanil, and in some communities situated in the hyper-endemic area in which A. sacharovi was the vector prophylaxis was stopped in September as being superfluous. In other areas it was continued up to two months after the end of the transmission season. From October onwards, when an increased incidence of malaria was evident, proguanil prophylaxis was again enforced, the dosage being increased from 0.1 gm. bi-weekly to 0.2 gm., with approximately 80% of the population now making use of the prophylaxis.

The following are notes on the DDT residual spraying campaign. The walls and ceilings of buildings were sprayed with a 5% solution of DDT in kerosene, to which 0.5% of sesame oil was sometimes added, the rate of application being about 1 gm. of DDT technical grade per square metre superficial area treated. Spraying cycles were commenced in A. sacharovi areas for 1946 and 1947 as follows:-

First spraying cycle in February
Second " " " May
Third " " " September

In A. superpictus and sergentii areas for the same period the cycles were as follows:-

First spraying cycle in June or the end of May
Second " " " September

It was observed that in summer months the number of anophelines seemed to rise considerably in sprayed quarters two months after the last spraying, but during the colder winter months the residual toxic effects lasted for much longer.

In 1948 since the month of June spraying squads worked continuously, every building in malarious areas being treated each month or every four or six weeks. It was then found that the number of anophelines in catching stations was considerably reduced.

The average number of anophelines observed in catching stations was as follows:-

Hyper-endemic area Huleh. A. sacharovi

<u>Year</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sep.</u>	<u>Oct.</u>	<u>Nov.</u>
1945	352	1,445	792	152	125	84*	8*
1946	43	62	57	17	8	3	0

Area of high endemicity. A. superpictus and sergentii

<u>Year</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sep.</u>	<u>Oct.</u>	<u>Nov.</u>
1944	195	299	154	-	182	418	281
1945	348	571	273	-	272		52*
1946	42	5	10	-	23		11

*Experimental residual spraying was carried out in these months.

For 1947 and 1948 the numbers of anophelines observed in catching stations were even less than the numbers observed in 1946, however, no regular catches were made in 1948 but stations were regularly inspected from time to time. An essential difference in the anopheline behaviour of the areas in which A. superpictus and A. sergentii predominate was noticed in 1947 and 1948. In 1947 biting by anophelines out of doors was not at all noticeable but in 1948 repellents had to be used by people in order to protect themselves against bites out of doors. There was an overall reduction of malaria incidence in the two areas under consideration, the figures being as follows:-

Hyper-endemic area Huleh, where *A. sacharovi* predominates throughout the transmission season. Resident Jewish population approximately 3,000

New infections:	1945	186
	1946	37
	1947	56
	1948	56 (during this time prophylaxis was partially carried out by means of proguanil)

Area of high endemicity, *A. superpictus* being prevalent from June to September, with *A. sergentii* from September to November. Resident Jewish population approximately 10,000.

New infections:	1945	388
	1946	130
	1947	64
	1948	239 (proguanil prophylaxis commenced in October)

In this latter area the increased incidence occurred during the third and fourth quarter of the year. In addition, numerous cases of latent vivax malaria have appeared in the spring of 1949 after the stopping of suppressive proguanil treatment. Very few such cases were noted in the area where *A. sacharovi* is predominant.

Notes on anti-larval work

In the years 1945, 1946 and 1947 drainage and weeding of water surfaces proceeded. Anti-larval measures consisting of oiling, with kerosene only or kerosene DDT mixtures, were carried out. In 1948 very little anti-larval work was done at all, and where this was carried out only oiling took place. The impression has been formed that anti-larval work with DDT in kerosene 1 to 2.5% is very efficient and does away with the necessity of weeding, but must be repeated every second week during the summer months.

The breeding of *A. sacharovi* was considerably reduced as a consequence of residual spraying in buildings, but no such reduction of breeding density was observed in the case of either *A. superpictus* or *A. sergentii*.

Note on suppressive treatment by the use of proguanil

Suppressive treatment was given to approximately 60,000 subjects over different periods. The analysis is not yet fully completed but the impression is held that the following is a true reflection of the conclusions which will be reached.

Proguanil suppressive treatment is efficient only after regular dosing and by enforced distribution, so that the necessary supervision is laborious and expensive. It is thought that any epidemic of malaria could be stopped within two weeks with the distribution and consumption of adequate dosages of proguanil, providing that a dosage of 0.2 gm. twice weekly is taken, as it is considered that a dosage of 0.1 gm. twice weekly is not sufficient to prevent all cases of falciparum and to suppress all vivax infections. The dosage of 0.2 gm. paludrine twice a week is not sufficient to cure vivax infection even if prolonged for two months after infection has taken place. The above dosage causes in a large percentage of persons the appearance of very rare erythrocytes in the urine and an increase of myelocytes in the blood. The curative effect of paludrine in both vivax and falciparum infections is often very poor as compared with quinine or mepacrine taken with or without a combination of plasmocquine.

Note on Research work carried out

The malaria research station at Rosh-Pina took part in malaria training for the British Army from 1939 to 1941. As the staff joined the British Army in 1942 and served as malaria experts until 1946, no research work could be done at the station itself, but members on active service were instrumental in surveying practically the whole of the Middle East and parts of Bengal and Burma. In 1946 research could be commenced again and was split into various sections, as follows:-

Entomological Section:-

research on the effect of DDT residual spraying on malaria prevalent in hyper-endemic areas;
laboratory testing of various insecticides;
effect and relationship of naphta ingredients in its relationship to the insecticidal action of DDT formulations;

resistance of flies to DDT;

improvement of different types of larvacides containing DDT.

Parasitological Section:-

research into the malaria of bats.

Therapeutic Section:-

experimentations in proguanil prophylaxis.