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The Secretary of the Expert Committee on Malaria
has the honour to present
the following report on

MALARIA CONTROL IN MADAGASCAR

by

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at Tananarive

Since 1949, the Madagascar Malaria Control Service has adopted new methods whereby it directs its attack against adult anopheles by means of contact insecticides.

The spraying with DDT of interiors of habitations should, by itself, be sufficient to break the cycle of transmission of malaria and to protect individuals.

We are, therefore, now concentrating our efforts on the application of this method of control.

Nevertheless, pending its application to the whole of the territory of Madagascar, we have considered it advisable to distribute Nivaquine weekly and free of charge to all Malagasy children from the time of birth until they leave school. These children are, in fact, the chief victims of malaria and they constitute the principal reservoir of the disease.

This practice is not a departure from our main intention, but the installation of insecticide spraying appliances throughout the whole of Madagascar (228,682 sq. miles) will take some considerable time.

The chemoprophylaxis which is applied to the whole of the infantile population of the island must, therefore, be considered as an emergency measure during the transitional period, the length of which will vary from region to region, and as a stage in the advance towards control by contact insecticides.

For the satisfactory carrying-out of our work, the Planning Budget placed 60,000,000 FAC. Frs. at our disposal in 1949, 90,000,000 in 1950, while 120,000,000 are allocated for 1951. This represents a total of 270,000,000 FAC. Frs. or 540,000,000 French Frs. for the first three years. These credits are employed entirely for malaria control by means of contact insecticides.

The cost of the infantile chemoprophylaxis is met by a special credit of 30,000,000 FAC. Frs. voted each year by the Representative Assembly of Madagascar.

The contact insecticide anti-malaria campaign commenced at Tananarive on 19 September 1949.

At that time, it was only possible to provide six teams. This number has progressively increased and today there are twenty-five teams; in 1951 the number will be increased to thirty.

Each team consists of a European foreman and six natives, and is transported by lorry and supplied with six sprayers. We use the Italian "GALEAZZI" compression sprayer

The foreman drives the lorry himself. He is responsible for the organization and supervision of the operations. He warns occupiers of habitations which are to be treated on the next day by delivering a printed notice indicating the steps to be taken, so that the operation may be carried out in the most effective manner. The foreman is also responsible for the maintenance in good working condition of the team's lorry and sprayers. He furnishes a weekly report in which he states which buildings have been treated and the amount of DDT used.

The spraying is done by five men; the sixth prepares the solution, refills the sprayers and records the habitations treated.

At the present time the 25 teams are distributed as follows:

Tananarive Sector	.....	6
Lake Alaotra Sector	.....	4
Tamatave Sector	.....	4
Sainte-Marie Sector	.....	1
Diego-Suarez Sector	.....	4
Nossi-Bé Sector	.....	2
Majunga Sector	.....	4

i.e. 10 teams on the plateaux and 15 on the coast.

This year, it is our intention to treat the greatest possible number of localities in the northern half of the island, keeping within the 22nd Parallel.

In 1951, we shall pass to the southern sector.

As insecticides we use DDT 20% concentrate, which is an emulsion containing 5% DDT, 10% Octachlor and 5% Gammexane (manufactured by the "Société des Insecticides Américains", Grenoble) and GEIGY 50% wettable powder.

We also propose to use a DDT 20% - Octachlor 30% wettable powder. Before using, we add sufficient water to give an emulsion containing 5% active ingredient and a wettable powder containing 2.5% of it. These are the highest concentrations for effective spraying.

We have received 5 tons of pure DDT powder supplied by the GEIGY firm. This DDT, which it is intended to mix with fuel oil, together with some Triton X100, will be sprayed on the marshy areas around the communities previously treated by "House spraying". The helicopter which will carry out this spraying has just arrived at Tananarive.

Table I gives the total work carried out by the Malaria Control service as teams have been formed and put into service in the different sectors.

On addition, the figures from the different sectors up to September 1950 show that during this first year, we treated 165,000 habitations, comprising 574,000 rooms, using 96 tons of 20% emulsion and 20 tons of 50% wettable powder.

More than a million inhabitants have benefited from the operations and the dwellings of more than 250,000 of them have already been given two sprayings.

These figures, even if we are subsequently able to improve on them, demonstrate that the Malaria Control service alone will be unable to carry out the annual spraying necessary to ensure protection against malaria in the whole of the territory.

We shall treat a certain number of regions successively each year and if our task is to be properly carried out, it is essential that the zones treated by us shall serve as demonstration areas. In carrying out our prophylactic work, we must not lose sight of the necessity for social education. We must make this method of prevention known so that later, under our direction and control, it can be carried out by the various communities on their own initiative.

Already at Tananarive, the Municipal Office of Hygiene has made itself responsible for the second spraying campaign; a third is under way. Tamatave, Diégo-Suarez and Antsirabe are organizing similar operations.

More important still, the Province of Tananarive which, apart from the capital, has 600,000 inhabitants, will be able to carry out its own preventive measures from 1951, at the request of the rural population who want to see control continued.

This example will certainly be followed by the other Provinces in due course.

It is still too soon to be able to judge the results of the campaign but the first indications are very favourable.

Firstly, we would remark that we received a very enthusiastic reception from the people of Madagascar. We enforced Decrees Nos. 268 and 269 of 16 November 1949 amending the provisions of the Sanitary Regulations and making spraying of habitations with insecticides obligatory. It was never found necessary to apply the relevant penalties; the rare recalcitrants quickly realized the advantages to be gained from our work and opened their doors to us.

In order to study the residual effect, we made a survey of 2,227 houses in Tananarive, where spraying dated from 4, 5 and 6 months. We found 2,133 dead mosquitoes as against 169 live ones. Among the latter there were only 18 anopheles: 6 funestus, 8 imerinensis, 3 squamosus, 1 gambiae.

These anopheles died in the laboratory during the night following their capture.

The medical entomology laboratory of the Scientific Research Department has, for its part, made some surveys, the results of which are shown in the annexed Table II.

The results justify the conclusion that the product employed was effective, since even after 8 months, the anopheles exposed for 15 minutes in a wall cage died in 24 hours.

Similarly, the results obtained in the field show that the spraying was correctly carried out by the teams.

In addition, the hematological laboratory of the Malaria Control service, which examines smears from the various population groups and from the municipal health units, recorded the following:

	<u>Slides examined</u>	<u>Positive slides</u>	<u>Percentage</u>
First half year 1945	29,167	6,675	22.88
" " " 1946	25,855	5,223	20.20
" " " 1947	25,555	4,775	18.66
" " " 1948	39,141	7,507	19.17
" " " 1949	43,588	2,861	6.56
" " " 1950	30,676	930	3.03

The first fall, observed in 1949, coincides with the introduction of Nivaquine in malaria prophylaxis, but the second can only be attributed to the insecticide sprayings.

In any case, it is interesting to note that the percentage of positive smears which, during recent years oscillated around 20%, suddenly fell to 6.5% in 1949 and to 3% in 1950.

Malaria is commencing to beat a retreat.

The best proof which a country can give of its state of health is a favourable demographic curve.

On this point, results obtained during the past two years in Madagascar surpass the most optimistic expectations.

While up to 1947, the demographic situation of the country remained practically stationary, since 1948 the increase in population has regularly doubled each year.

The annual excess of births over deaths is as follows:

10,978 in 1946

12,584 in 1947

21,651 in 1948

47,109 in 1949

(50,500 for the period 1 July 1949 - 30 June 1950)

The almost vertical rise of this curve makes comment unnecessary. But this advance is all the more remarkable in that the results of anti-malaria spraying, which commenced only in September 1949, have not yet clearly shown their effect in this graph.

These first results lead us to await with confidence the real test of the effectiveness of our campaign which, in the last analysis, will be revealed by the statistics furnished by the health services, as well as by the demographic curves, and which will very probably go far beyond malaria prophylaxis alone.

Tananarive, 16 September 1950.

Director of Malaria Control Service.

Signed: Dr. P. BERNARD
Médecin Colonel.

TABLE I

Dates	Localities	Working Days per team	Buildings treated	Rooms treated	DDT	
					Concentrate (litre)	Powder (kg)
10 Sept-10 Dec 1949	Tananarive-Ville (1st camp)	533	18,109	93,964	33,334	312.-
1 Jan-27 July 1950	Tananarive-Ville (2nd camp)	964	21,205	93,609	850	7,936.-
2 Jan-29 July 1950	Tananarive Province (1st camp)	1,260	69,843	233,779	11,859	8,070,850
31 July-1 Sept 1950	Tananarive Province (2nd camp)	137	7,072	25,767	9,373	56.-
6 Mar-9 Apr 1950	Antsirabe Sector	131	3,884	23,883	7,736	-
6 Feb-2 Sept 1950	Tamatave Sector	478	13,786	43,537	14,916	2,880,600
20 Mar-1 July 1950	Ile Sainte-Marie Sector	74 ¹ / ₂	5,169	7,100	4,975	-
14 Aug-9 Sept 1950	Amba tondrazaka Sector	24	3,604	11,426	2,105	-
9 Mar-26 Aug 1950	Diégo-Suarez Sector	274	19,843	31,005	6,723	1,634.-
10 May-2 Sept 1950	Nossi Bé-Ambanja Sector	93	3,084	9,684	4,426	-
		3,968 ¹ / ₂	165,599	573,754	96,297	20,889,450

TABLE II

		CULICIDAE			CONTACT 15 MINS	SURVIVAL TEST
		MALES	FEMALES			
1949	October 28	Spraying of laboratory walls with an emulsion (DJT 5% -Octachlor 10% Gammexane 5%) diluted with 4 parts of water so as to give about 1.70 grammes of active ingredient to the square metre.				
	November 16	2 <u>A.gambiae</u>	1 <u>A.gambiae</u>	9h.		
	18	1 <u>C.pipiens</u>	3 <u>A.gambiae</u>	8h.		
	-	1 <u>C.pipiens</u>		8h.		
	21	2 <u>A.gambiae</u>	4 <u>A.gambiae</u>	10h.		
	25	1 <u>A.gambiae</u>	4 <u>A.gambiae</u>	7h.		
	December 21		2 <u>A.gambiae</u>	9h.		
	22		4 <u>A.gambiae</u>	12h.		
	1950 January 12		5 <u>A.gambiae</u>	20h.		72h.
	February 6		3 <u>A.gambiae</u>	18h.		
	13		4 <u>A.gambiae</u>	24h.30		
	16		4 <u>A.gambiae</u>	25h.50		
	17	2 <u>C.pipiens</u>	2 <u>C.pipiens</u>			
	-		2 <u>A.gambiae</u>	23h.45		78h.
	March 16	3 <u>A.gambiae</u>	2 <u>A.gambiae</u>			55h.
	18		7 <u>A.gambiae</u>			
	6	3 <u>A.gambiae</u>	3 <u>A.gambiae</u>	26h.		
	8		2 <u>A.gambiae</u>	23h.		
	13	3 <u>A.gambiae</u>	3 <u>C.pipiens</u>	30h.		
	18	2 <u>A.gambiae</u>	2 <u>A.gambiae</u>	23h.30		
	26		4 <u>A.gambiae</u>			50h.
	June		2 <u>A.gambiae</u>	25h.		