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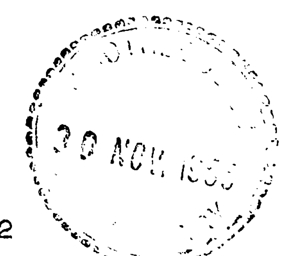

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The Chief of the Malaria Section
has the honour to communicate hereunder the
following note:

PRESENT SITUATION IN REGARD TO MALARIA CONTROL IN MADAGASCAR

by

Dr G. JONCOUR
"Direction des Services Sanitaires et Médicaux de Madagascar"

Malaria control began to develop along new lines in Madagascar at the end of 1949, under the direction of "Médecin-Général" JEANSOTTE, and at the instigation of "Médecin-Colonel" BERNARD, Director of the Madagascar Malaria Control Service. Our intention here is to demonstrate how this control has developed, to give an account of the position with regard to malaria endemicity as it is in 1955, and to consider the prospects for the future.

The principles adopted in 1949 with regard to malaria control are still in force, unchanged, in 1955. They are based on the following:

(1) spraying of residual insecticides inside all dwellings and their dependencies over the whole territory;

(2) chemoprophylaxis applied to the whole of the child population of the island;

(3) adoption of larval control measures principally in the large populated centres.

I. CONTROL BY IMAGOCIDES

Over the years, administrative changes - often important ones - have been introduced into this work.

During 1949, 1950 and 1951 the Central Malarial Control Service was directly responsible for the operations. It had house-spraying teams, trained by it, operating under its direct control. These teams, paid by the metropolitan authorities, acted primarily as demonstration units.

At the present time, the provincial and municipal authorities are responsible for the carrying out of the malaria control operations, and for their financing.

Insecticide spraying is effected in two ways:

- either by large, motorized provincial teams under the direction of competent team-chiefs, or

- by local, district teams, composed of 2-3 men who go on foot from village to village.

Each method has its advantages and disadvantages. In both cases efficacy depends upon the conscientiousness of the personnel and on the possibilities of frequent control by the local medical authorities.

Two insecticide products are used in 1955:

(1) DDT 75% wettable powder;

(2) 20% active product emulsion comprising -

Technical DDT	10%
Octochlordiphenyl	7%
BHC, gamma isomer	3%
	20%

The spraying apparatus used is the Galeazzi pre-pressurized sprayer.

Spraying is effected once a year, except in one province where it is still carried out twice yearly. The cost of the operations and the inconvenience caused

by spraying quickly led to the decision to make the operation a yearly one since, in our opinion, it is far better to carry out spraying effectively once a year, with the collaboration of the population, than to spray twice in conditions which mean that 30-40% of the dwellings - and always the same ones - are missed. It is unfortunate that the residual effect of the emulsion is not greater: the maximum seems to be 7-9 months, and while this is sufficient for the high plateaus in Madagascar where the transmission period only lasts five months (which is perhaps the reason why we have had such good results), it is hardly adequate for the coastal and forest zones where transmission continues throughout the year. In these regions, where results are less good, products like Actidrine - which appear to have a longer residual effect - will be tried out at the end of the year in some demonstration areas.

Spraying began in 1950 and in that year 220,000 dwellings were treated.

In 1954, the operations were as follows: 1,280,000 houses sprayed with 307,000 litres of 20% DDT emulsion (164 tons of 75% DDT, 36 tons of 50% DDT).

The treating of this number of houses means that a bit less than 4,000,000 inhabitants were protected.

II. CHEMOPROPHYLAXIS

In 1949 also, a large-scale programme of malaria chemoprophylaxis, and the regulations for its application, were established.

"Médecin-Colonel" Bernard, organizer of the anti-malaria campaign, by means of residual, contact insecticide, was of the opinion that a combination of the two methods would be most likely to provide results which would be sufficiently enduring and spectacular to persuade the population to co-operate voluntarily in such a large-scale project - co-operation without which it was useless to imagine that success (in any case only to be obtained over a lengthy period) could be achieved.

Chemoprophylaxis was, in fact, the method of choice of the directors of the Malaria Control Service before 1949. It had been principally confined to urban zones, in association with somewhat erratic larval control measures.

Chemoprophylaxis in Madagascar was finally regulated by Circular 7/SS of 1 June 1949. According to these regulations, all children from the day of their birth up to the time of leaving school (about 13 years, except for those taking higher studies) are to receive free, weekly distributions of Nivaquine (chloroquine).

The distributions for children of 0-6 years take place in dispensaries, "Gouttes de Lait" (free milk centres), and Red Cross centres. All such units are known as "Pre-School Distribution Centres".

The dosage is as follows:

0-1 year .half an 0,10 tablet
1-3 years . . . . one 0.10 tablet
3-6 years . . . . one and a half 0.10 tablets

In the schools (School Centres) distribution is at the rate of two 0.10 g tablets of Nivaquine per pupil and per week up to the age of 13 years. Over this age, schoolchildren receive three 0.10 g tablets per week.

In 1955, School Centres number 2,375.

The inspection carried out by the Malaria Control Service (Dr GOULESQUE) showed that there was unequal distribution of the Nivaquine among first-age-group infants, often as a result of carelessness on the part of the distributors. Since it is difficult to dissolve broken-up Nivaquine tablets, the firm of Specia kindly agreed to prepare sachets of Nivaquine powder. The contents of a sachet, dissolved in 1 litre of water, gives 0.050 g of Nivaquine per soupspoon. The Nivaquine dissolves immediately. These sachets will gradually replace the tablets in the Pre-School Centres. Finally, it was necessary that the Pre-School Centres for the distribution of Nivaquine be so distributed that all population groups might reach them regularly without covering too great a distance (5 km maximum). The co-operation of the chief medical officers of the Medical Districts was obtained in this connexion.

When a first census of these Centres was taken in 1952, they numbered 1,738; in 1955 there are 3,175 Centres.

In some provinces the maximum has been reached. Distribution centres are still too scattered in a few distant localities, difficult of access. The Central Malaria Control Service proposes, therefore, to advise the opening of other centres - the more so since we observe that it is in these localities that patches of endemicity like those which existed before 1949 are still to be found.

The Pre-School and School Centres together deal with about 760,000 children. Attendance varies around 70-80%.

It is somewhat difficult to assess the yearly part played by chemoprophylaxis, since 1949, in the campaign against malaria. Nevertheless, it should be remembered that the children constituted the principal reservoir of the virus and paid the highest price in malaria. In our opinion, the drop in infant mortality resulting from a sharp fall in the number of P. falciparum cases should be placed to the credit of chemoprophylaxis.

VAUCEL, in an article which appeared in May 1953 entitled "Rôle et intérêt des nouveaux médicaments synthétiques antipaludiques dans la prophylaxie du Paludisme" (Role and importance of the new synthesized antimalarial drugs in prophylaxis of malaria) emphasizes that the efficacy of the synthesized drugs in chemical, suppressive prophylaxis is generally recognized. In mass prophylaxis the administration of weekly doses of Nivaquine is very effective among partially immune populations. Moreover, adequate prolongation of preventive doses of a chemical prophylactic agent often prevents the appearance of malaria and is often as valuable as causal prophylaxis. The author stresses, however, that above all it is important to extend this protection and not to limit it to non-immune elements in the non-indigenous population - and in the indigenous population, the non-immune element is the child.

In Madagascar, thanks to the work of the Pre-School Centres, the most vulnerable children are protected and no resistance to Nivaquine has ever been observed in the island.

III. ANTILARVAL CAMPAIGN

In Madagascar, this method is only adopted in the towns where there is a municipal hygiene office, and where a health agent is available. It is a question mainly of general hygiene methods which are a useful complement to the control of the adult mosquito in the urban centres. We would mention also the role played by Gambusia in the antilarval campaign: it destroys anopheline larvae in waters where the breeding-places are not accessible to small-scale antilarval measures. Gambusia is protected: an Order prohibits fishing or sale of it throughout the territory.

INCIDENCE OF MALARIA

We will now attempt to assess the 1955 situation in regard to malaria, and to this end let us examine the means at the disposal of the Malaria Control Service.

Malaria endemicity is studied each year on the basis of documents which the Service receives from the chief medical officers of Mobile Hygiene Teams (Groupes mobiles d'Hygiène) and from the chief medical officers of the Medical Districts. These reports are established according to technical directives issued by the Central Malaria Control Service, controlled in the field by the chief medical officer of the Service.

Study of malaria endemicity comprises:

(1) establishment of the spleen rate in children of 2-10 years, per canton and per district;

(2) taking of blood samples for the establishment of:

parasite rate in infants of 0-1 year;
endemic parasite rate in children of 2-10 years.

These blood samples are sent for examination to the Haematological Laboratory attached to the Central Service. In 1954, 101,250 haematological tests were carried out;

(3) despatch of samples of anopheles (larvae and adults) to the Entomological Laboratory of the Central Service. These identifications make it possible to keep up to date the map showing localization of anopheline populations.

The study covers the regions which cannot be visited by mobile teams during the year and it is made, on the basis of a uniform plan, by malaria control health agents[1] (subordinate personnel trained by the Service) under the direct control of the chief medical officers of the Medical Districts and under the technical supervision of the chief medical officer of the Malaria Control Service.

Finally, all health centres and units are required to submit monthly reports on malaria and this makes it possible to obtain an overall picture of the morbidity situation at any moment.

Before 1949 malaria was hyperendemic in most parts of Madagascar, with a few mesoendemic and holoendemic patches.

Of the 80 districts, malaria was holoendemic in 11, hyperendemic in 42 and mesoendemic in 27 (see annexed map). Eighty per cent. of parasite carriers were under 15 years of age; 95 per cent. of gametocyte carriers were under 15 years of age.

In addition to the particular aggressivity of *P. vivax*, it was observed that there was very rarely any association between the parasites; that distribution of plasmodia was more in relation to season than to geographical factors; that *P. vivax* and *P. falciparum* were of equal importance, and that *P. malariae* was rare.

A. funestus appeared to be the chief vector on the high plateaus (50 per cent. of captures); it was definitely anthropophilic. The other anophelines showed a marked ubiquity.

No very thorough study of the anopheline population in the coastal regions appears to have been made before 1949.

In 1955, of the 80 districts, 30 are mesoendemic, 50 hypoendemic (see annexed map).

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[1] See Annex

Of the 30 mesoendemic districts, 17 have spleen rates ranging from 10 per cent. to 20 per cent.; 13 from 20 per cent. to 35 per cent.

The ideal method would be to give a haematological picture of each district, but this is a practical impossibility due to the fact that we have no data on the situation prior to 1949. We have, however, at our disposal a few particulars covering geographical regions.

In the high plateaus and in particular the Province of Tananarive, parasite rates of 25 to 35 per cent. were found. In Tananarive, 23 per cent. of the blood tests gave positive results, but we have no information as to the population group concerned.

In 1955, of 3,348 samples taken from children of 2-10 years, six were found to be positive, i.e. a parasite rate of 0.18 per cent.

In the high plateaus districts of Fianarantsoa Province, 1,639 specimens were examined and there was no positive reaction, i.e. a parasite rate of 0 per cent.

In the Ambatondrazaka district, which was seriously affected by malaria before 1949, the spleen rate has fallen in 1955 to 2.7, and of 5,561 specimens from children of 0-15 years, six were found positive for _P. falciparum_, i.e. a parasite rate of 0.10 per cent.

In 1954, the gametocyte rate in the high plateaus was 0 and during nine months of 1955 no gametocyte was found. SAUTET's "recession rate", which Dr GOULESQUE sought to establish in 1954 in various parts of the island, was 0 on the high plateaus (Provinces of Tananarive and Fianarantsoa) and this has been maintained.

These excellent statistics are confirmed by the rarity of cases of malaria microscopically ascertained, notified by the district medical authorities.

In the south of the island, where there was less malaria before 1949, the situation is satisfactory. In 1955, among 9,797 specimens taken from children of 2-10 years, 52 showed falciparum schizonts and 1 falciparum gametocytes.

<u>In the east coastal districts</u>, below Tamatave, there has been a considerable drop in the parasite rate, but it is still on an average 3 to 4 per cent., with a gametocyte rate of 0.5 per cent. and a recession rate of 12 to 15 per cent. <u>Vivax</u> and <u>malariae</u> are both found in this region, but in extremely small proportions (22 <u>malariae</u>, 12 <u>vivax</u>, out of 512 positive specimens in a batch of 14,000 examined).

In the coastal area above Tamatave where the spleen rates are higher, the parasite rates are lower: 94 positives (falciparum schizonts) out of 10,000 specimens examined, with 6 showing falciparum gametocytes; average parasite rate 0.9 per cent.; gametocyte rate 0.06 per cent.; recession rate 6 per cent. These figures are only of value because they refer to identical geographical and climatic regions. It is true that if we take into account Sautet's recession rate, evolutive malaria may still be said to exist in these districts.

<u>In the west coastal districts</u> the situation is better.

Below Maintirano (town situated on the west coast on a level with Tamatave) 10,000 specimens were examined in 1955 and gave 67 positive (falciparum schizonts), with 4 showing falciparum gametocytes.

This gives an overall parasite rate of. . . . . 0.66 per cent.
" gametocyte rate of . . . . 0.04 per cent.
" recession rate (Sautet) . . . . . 6 per cent.

Above Maintirano, where 11,400 specimens were examined, 68 gave positive reaction (falciparum schizonts), with 8 showing falciparum gametocytes.

This gives a parasite rate of . . . . 0.6 per cent.
a gametocyte rate of . . . . 0.07 per cent.
a recession rate of . . . . 11 per cent.

Although it will be noted that the parasite and gametocyte rates are very much lower, the drop in the recession rate as compared with the East Coast is relatively slight. For purposes of comparison, it is interesting to note the figures given by LAVERGNE in a report on the general characteristics of malaria endemicity in Madagascar, 1948: "Coastal regions east and west, stable endemicity, with fairly constant annual cycle and parasite rate of 10 to 25 per cent.".

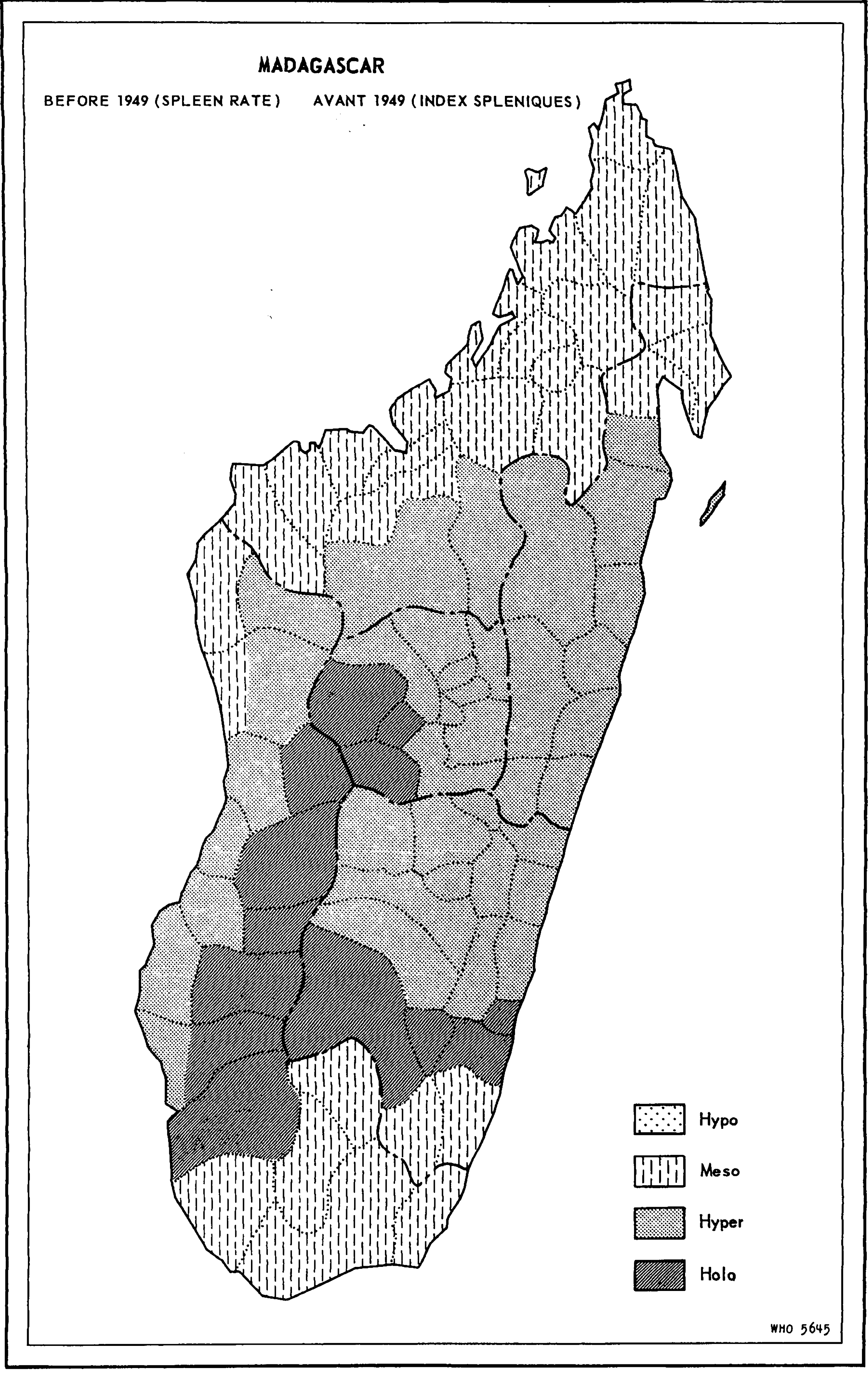
The rapid drop in general parasite rates has no doubt been due to the regularity with which chemoprophylaxis has been applied. It should be pointed out that most of the controls carried out are on children who have been treated with Nivaquine. For this reason, the recession rate (Sautet), and the parasite rate in infants of 0-1 year which we are at present seeking to establish in all cantons, will give us in the near future some very much more reliable information on the transmission situation. There are now very few pilot zones in Madagascar. In 1955, however, the Mobile Team surveyed the Isandra valley in the south Midongy district, which is very difficult of access as there is no road. In this valley there had never been any spraying of insecticide or distribution of Nivaquine. Examination of children of 2-10 years revealed a spleen rate of 72 per cent. and a parasite rate of 30 per cent. (falciparum and malariae).

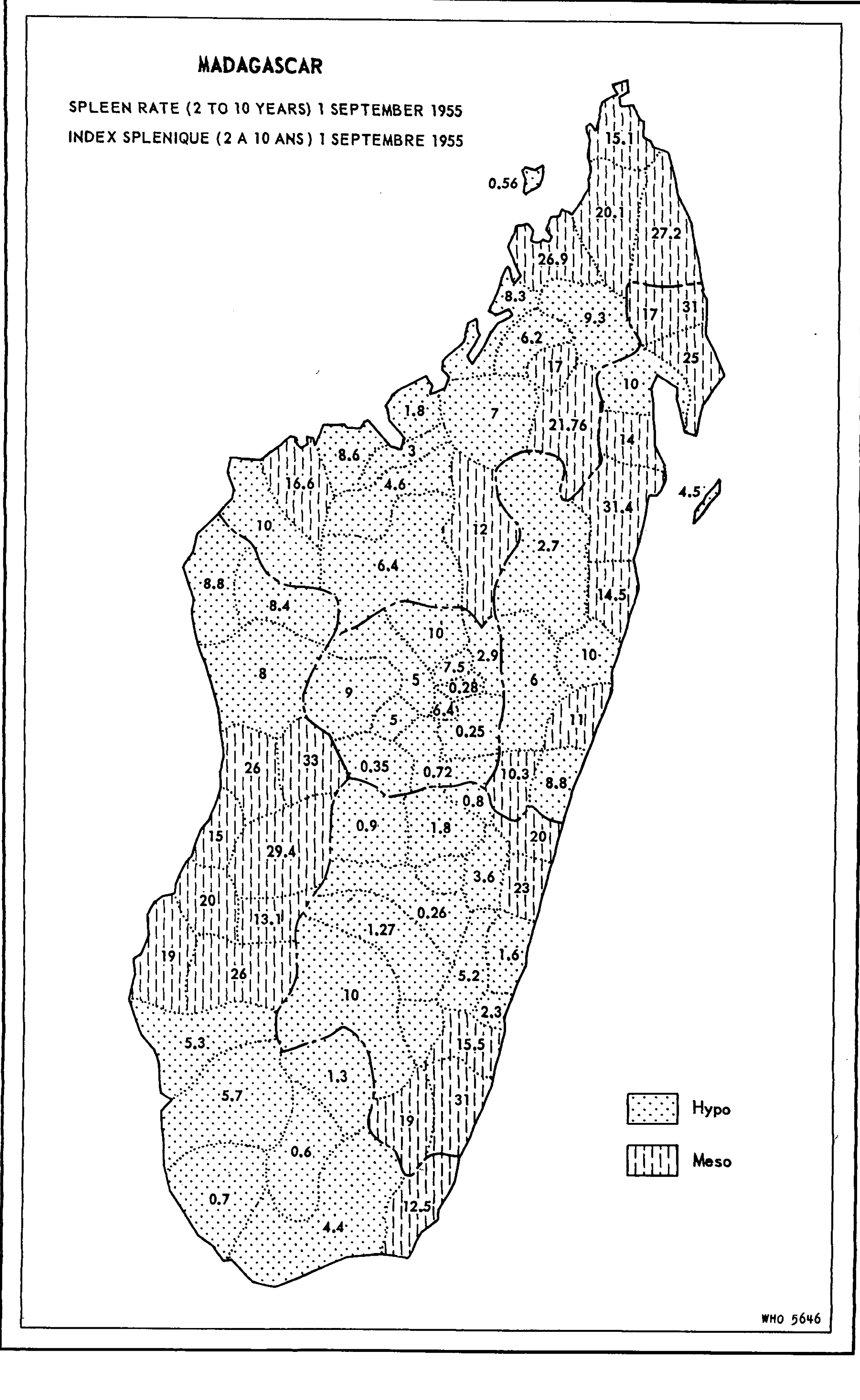
ANOPHELISM

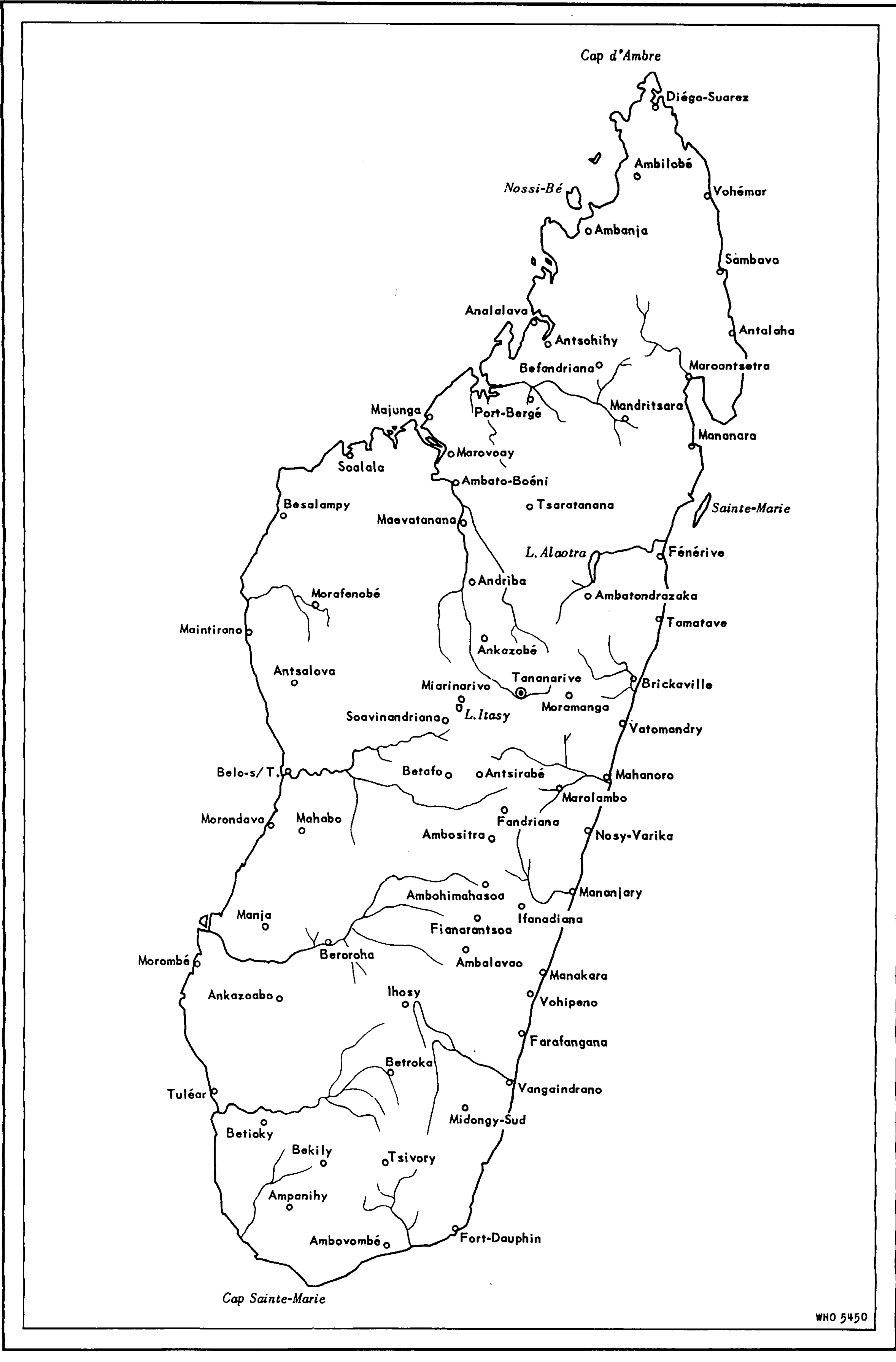
It is difficult to assess anopheles density in a country with many different micro-climates. On the whole the pullulation of anopheles has decreased. On the high plateaus, for example, A. funestus has disappeared. It is true, of course, that the climatic conditions in those regions were not favourable to the species and that, being strictly endophilic, it must have been considerably affected by the spraying of insecticides. A. gambiae has been very much reduced and it is now found only in animal sheds and outbuildings. In the coastal areas, A. funestus is less and less observed, but the same cannot be said of A. gambiae, whose behaviour everywhere seems to have changed; it is exophilic and exophagic and it persists in the forest and coastal areas where active transmission appears to continue.

VITAL STATISTICS

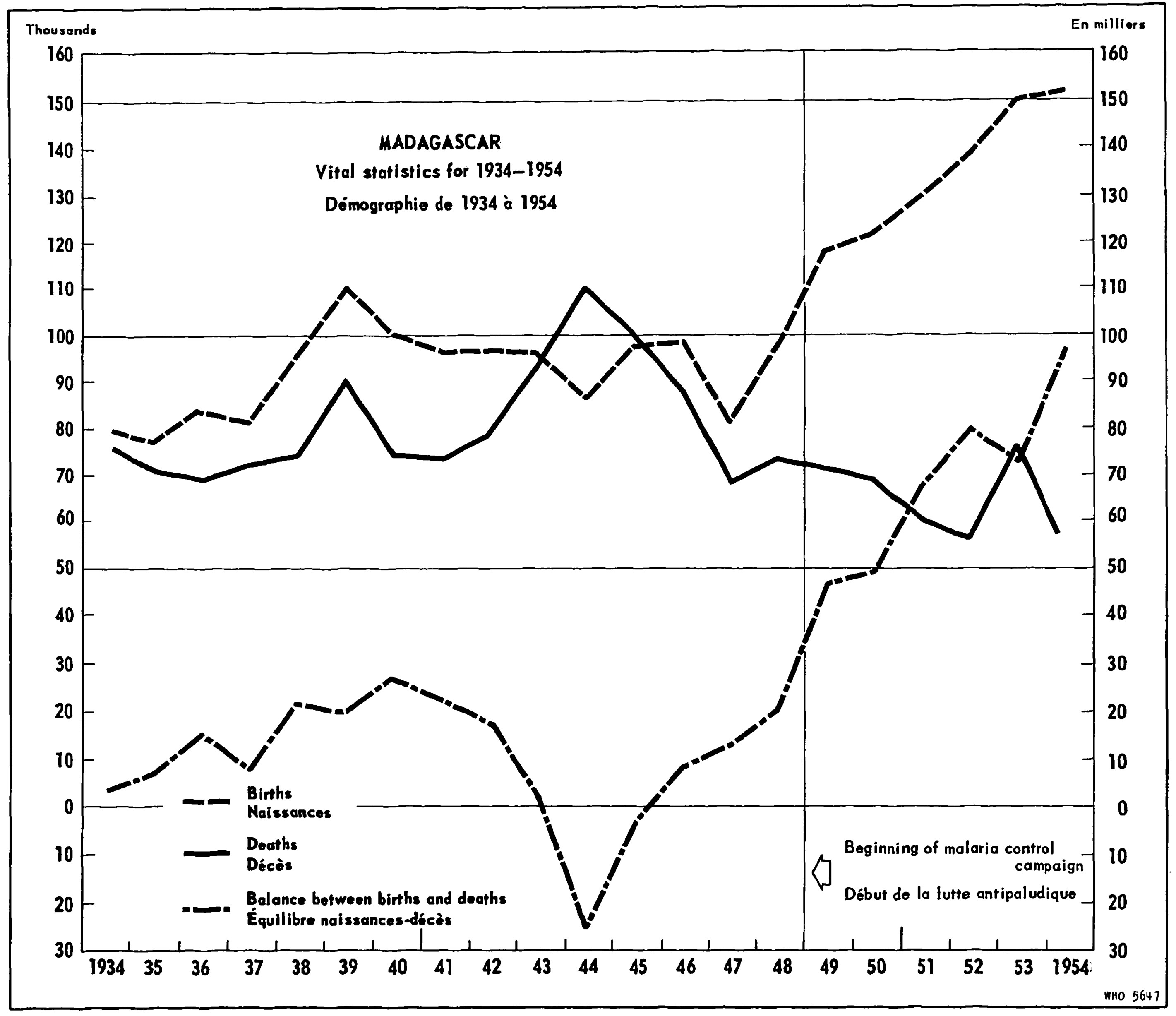
Conclusions based on evaluation of spleen, or even parasite, rates may be open to criticism. Demographic statistics, however, are beyond question and in this field it must be admitted that there has been a progressive and constant preponderance of births since the commencement of malaria control.


MADAGASCAR
BEFORE 1949 (SPLEEN RATE)
AVANT 1949 (INDEX SPLENIQUES)
Hypo
Meso
Hyper
Holo
WHO 5645


MADAGASCAR
SPLEEN RATE (2 TO 10 YEARS) 1 SEPTEMBER 1955
INDEX SPLENIQUE (2 A 10 ANS) 1 SEPTEMBRE 1955
15.1
0.56
20.1
27.2
26.9
8.3
9.3
17
31
6.2
25
17
10
1.8
7
21.76
14
8.6
3
16.6
4.6
4.5
31.4
10
12
2.7
6.4
8.8
8.4
14.5
10
10
2.9
7.5
8
5
0.28
6
9
6.4
5
0.25
11
26
33
0.35
0.72
10.3
8.8
0.8
0.9
1.8
20
15
29.4
3.6
23
20
0.26
13.1
1.27
19
1.6
26
5.2
10
2.3
5.3
15.5
1.3
5.7
31
Hypo
19
0.6
Meso
0.7
12.5
4.4
WHO 5646



Cap d'Ambre
Diégo-Suarez
Ambilobé
Vohémar
Nossi-Bé
Ambanja
Sambava
Analalava
Antalaha
Antsohihy
Befandriana
Maroantsetra
Majunga
Port-Bergé
Mandritsara
Mananara
Soalala
Marovoay
Ambato-Boéni
Sainte-Marie
Besalampy
Tsaratanana
Maevatanana
L. Alaotra
Fénérive
Andriba
Morafenobé
Ambatondrazaka
Tamatave
Maintirano
Ankazobé
Antsalova
Tananarive
Brickaville
Miarinarivo
Moramanga
Soavinandriana
L. Itasy
Vatomandry
Belo-s/T.
Betafo
Antsirabé
Mahanoro
Marolambo
Morondava
Mahabo
Fandriana
Ambositra
Nosy-Varika
Ambohimahasoa
Mananjary
Manja
Ifanadiana
Fianarantsoa
Morombé
Beroroha
Ambalavao
Manakara
Ankazoabo
Ihosy
Vohipeno
Farafangana
Betroka
Vangaindrano
Tuléar
Midongy-Sud
Betioky
Bekily
Tsivory
Ampanihy
Ambovombé
Fort-Dauphin
Cap Sainte-Marie
WHO 5450


MADAGASCAR
Vital statistics for 1934–1954
Démographie de 1934 à 1954
Thousands
En milliers
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
10
20
30
1934
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
1954
Births
Naissances
Deaths
Décès
Balance between births and deaths
Équilibre naissances-décès
Beginning of malaria control campaign
Début de la lutte antipaludique
WHO 5647

In 1948 a beginning was made with chemoprophylaxis, and sometimes with insecticide spraying, in a few large centres.

In 1949 the antimalaria campaign began to be extended to the whole of the island.

We feel that the chart attached hereto makes any statistical comment superfluous.

PROSPECTS

On the high plateaus the following may be envisaged:

(1) establishment of a system of supervision and closer contact between the Malaria Control Service and the Medical Districts and Hospitals in order that strict attention may be paid to the diagnosis of malaria. Diagnostic conclusions must not be arrived at too easily: in the majority of cases, only persons who have been shown by haematological test to be carrying blood parasites should be confirmed as suffering from malaria;

(2) selection of strictly controlled pilot zones where insecticide spraying and chemoprophylaxis can be interrupted.

In the coastal regions, malaria endemicity should be studied over smaller areas (districts, cantons) and a more exact haematological picture should be established on the basis of the study of two categories of child population, i.e. 0-1 year and 2-10 years - possibly in different seasons. We believe also that a more thorough study of the behaviour of *A. gambiae* in these regions would be useful.

All these factors may call for modifications in the details of the malaria control campaign, such as the use of insecticides with a longer residual effect (Dieldrin), for example, or a more extended chemoprophylaxis.

ANNEX

TRAINING AND ROLE IN MADAGASCAR OF AUXILIARY PERSONNEL ATTACHED TO THE MALARIA CONTROL SERVICE: "MALARIA CONTROL HEALTH AGENTS"

Malaria control health agents are specialized technicians who have been trained by the Central Malaria Control Service. They are competitively recruited from among members of the indigenous population between 17 and 24 years of age and holding the "Second Degré" (first part of secondary education) school certificate.

Successful candidates are admitted to the "School for Malaria Control Health Agents" where they take a six months' course, which includes theoretical and practical training, principally in malariology. The School premises being within those of the Central Malaria Control Service, students have every facility for participating in the activities of the entomological and haematological laboratories. Malariological field surveys complete the practical training. At the end of their studies students sit for a final examination and those who are successful are appointed as probationary health agents and assigned to posts. At the end of a year's probation they are confirmed in their posts or not, as the case may be.

Their function is to act as specialized assistants to the chief medical officers attached to the Mobile Teams and to the chief medical officers of the Medical Districts. Their salaries are covered by the budgets of the services employing them.

The Mobile Teams and the chief medical officers of the Medical Districts carry out malaria surveys, and it is particularly interesting to note the activities of malaria control health agents in these two Services.

The Mobile Team being polyvalent, the malaria control health agent acts as the chief medical officer's deputy in so far as malaria is concerned (spleenometry; taking of blood specimens from the child population and seeing that they are despatched to the Malaria Control Service; taking and examining blood specimens from adults and persons attending the rural dispensaries run by the Mobile Team). This health agent is also responsible for making a brief entomological survey of the region being visited by the

Team, and for sending specimens of adults and larvae to the Central Malaria Service Entomological Laboratory or to the "Laboratoire d'Entomologie de la Recherche Scientifique".

The District Medical Service health agent's role is more important, and above all it calls for more initiative. Following precise instructions given to him by the Malaria Control Service through its district medical officer, he carries out malariological and entomological surveys in the cantons which the Mobile Team has been unable to survey during the year. He takes blood samples and sees that they are forwarded to the Central Laboratory. Under the direct authority of the district medical officer, he supervises the pre-school and school chemoprophylaxis Centres responsible for weekly distributions of Nivaquine. In some circumstances he may act as supervisor of DDT-spraying teams. He draws up a monthly report on his work, for submission to the chief medical officer of the Central Malaria Control Service, who is thus informed of everything that goes on with regard to malaria in the medical district concerned.

Health agents are not yet attached to all medical districts but it is hoped to achieve this in the near future.

In some regions it will soon only be a question of surveillance and of assignment of specialized health agents to limited areas over which they will be able to exercise effective control. In our opinion, the problem is one of detection of isolated cases of malaria and the adoption of emergency measures to prevent renewed contamination of districts in which transmission has been interrupted.