United Nations

WORLD HEALTH
ORGANIZATION

MALARIA CONFERENCE FOR THE WESTERN
PACIFIC AND SOUTH-EAST ASIA REGIONS

Taipei, 15-27 November 1954

a 60555

Nations Unies

ORGANISATION MONDIALE
DE LA SANTE

WHO/Mal/106
Taipei Conf./5
20 August 1954

ORIGINAL: FRENCH

The Secretary of the Expert Committee on Malaria
has the honour to communicate hereunder
the following note:

THE USE OF ANTIMALARIAL DRUGS AS ADJUVANTS TO
DDT IN MALARIA CONTROL IN VIET-NAM

by

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(Item 2.1 of the Provisional Agenda)

THE CHARACTERISTICS OF MALARIA IN VIET-NAM

In Viet-Nam there are two types of malaria:

1. Coast malaria, transmitted by species of anopheles breeding in brackish water, i.e. A. sundaicus, A. sinensis and A. subpictus. This is essentially malaria of the season or epidemic type, varying from one year to another in intensity and localization.

2. Malaria of the stable, hyperendemic type, transmitted by anopheles of the Myzomyia group, the most important of which, A. minimus, acts as major vector in the whole of Viet-Nam. This type is, by definition, the malaria of the highland and intermediate regions whose unhealthy character has long been recognized.

This special distribution of malaria has important ethnographic and demographic consequences.

The Viet-Namese race, which is very prolific but particularly sensitive to malaria, disappears as soon as one enters the highland regions, giving way to indigenous races which are more resistant despite an extremely high infant mortality rate. These races are of Chinese origin in north Viet-Nam and of Indonesian or Malayo-Polynesian origin in central and south Viet-Nam.

Formerly, penetration into this hinterland and its economic development was only possible thanks to costly sanitation work (drainage and oil treatment)

or to strictly controlled chemoprophylaxis, but it may be said that the problem of malaria prevention in the rural districts remained untouched.

THE USE OF RESIDUAL INSECTICIDES

Consequently we commenced in 1948 a series of experiments in an attempt to find out what could be achieved by the use of residual insecticides, as concerns both protecting the indigenous population and facilitating the settlement of groups of workers and the development of still unexploited regions.

The author resumed and extended these experiments from 1951-53 in his capacity as chief of the malaria control team placed by WHO at the disposal of the Government of Viet-Nam.

THE SOUTHERN HIGHLAND REGIONS ("PAYS MONTAGNARDS DU SUD") (THE DEMONSTRATION ZONE)

We selected as demonstration zone the area known as the southern highland regions (SHR), which was well known thanks to previous surveys by the Pasteur Institute, and whose economic possibilities were shown by the existence of tea, coffee, tung tree and rubber plant plantations.

The SHR are situated 300 km north-west of Saigon on the last foothills of the Annamese chain. Apart from the summer centre of Dalat there are four provinces: Kontum, Pleiku, Banmethuot and Djiring, with a total area of 57,000 sq. km and a population of 500,000.

All this territory, except for those parts situated above 1,000 m, belongs to the hyperendemic or holoendemic malaria area.

The spleen-rates of the children are constantly above 60 per cent. and few seasonal variations are seen.

Although the transmission of malaria is practically constant there, nevertheless two more pronounced thrusts of the infection can be detected at the beginning and above all at the end of the rainy season, the maximum infection rate occurring in general at the end of the year.

The villages, which on the whole are small and rather far apart, consist of huts built on piles and covered with straw, the walls and flooring being made of plaited bamboo.

In most cases the huts are communal, being occupied by several families.

Cooking is carried on inside the huts, whose internal walls and ceiling are thus covered with a layer of soot and smoke.

The furnishing is rudimentary: it includes a few mats, benches and, almost always, glazed earthenware jars used to keep the grain from the harvest and to make rice alcohol.

The principal activity of the inhabitants is rice growing.

This is generally carried on in forest clearings. However, irrigated rice fields are found in certain regions.

The populations of these villages are relatively stable. There is no true nomadism, but during the sowing and harvesting seasons part of the inhabitants leave the village and go to the fields or "rays" where they live in temporary shelters.

INITIAL EXPERIMENTS AND METHOD USED

On commencing our experiments in 1948 we were confronted with the need of obtaining results as rapidly as possible, both to gain the confidence of the inhabitants themselves and to obtain from the responsible authorities the necessary resources for the development and extension of the campaign.

Thus, although we intended to study the use of contact insecticides we had at the same time to employ chemoprophylaxis, a method of proven efficacy which was already in routine use in the plantations and public works undertakings of the SHR.

Furthermore, although it is true that it brings transmission to a stop, spraying could have no effect on already existing infections, which in certain villages extended to almost all the child population, with infant mortality rates of the order of 3-400 per thousand.

A rapid improvement in the state of health of patients was a propaganda feature which we could not neglect.

For this reason we instituted in each province a demonstration sector including only a limited number of villages, for a comparative study of:

- the action of DDT spraying used alone;

- combined DDT spraying and chemotherapy.

DDT spraying was carried out at the outset with a 5 per cent. kerosene solution of technical DDT and subsequently using 50 per cent. and then 75 per cent. wettable powder in a dosage of 2 g per m^2.

In principle, the villages were sprayed twice yearly.

Chemotherapy in the form used by us, consisted in the weekly distribution of drugs, carried out on the same day each week and strictly checked by roll call.

In view of the very considerable tolerance of adults to malarial infection, we intentionally limited chemotherapy to young children and pregnant women.

After having used mepacrine (quinacrine) at first, we subsequently made almost exclusive use of chloroquine (nivaquine).

THE FIRST RESULTS (1948-50)

The findings during the first series of experiments, carried out from 1948 to 1950 may be summarized as follows:

Under the special conditions of our experiment, which took place among primitive peoples highly infected with malaria and constantly undernourished, we found that the action of DDT employed alone shows itself only very gradually.

The higher the spleen-rates at the outset, the slower the improvement is to appear. On the average, one to two years are necessary to bring about an appreciable fall in the spleen-rate. It is probable that this interval corresponds to the time necessary for spontaneous recovery from infection acquired before the sprayings.

Chemoprophylaxis makes it possible to obtain a rapid fall in the endemic indices (parasite and spleen rates). Its action, however, is only temporary and incomplete. As soon as medication is interrupted, the infection-rate climbs very rapidly again and returns to its initial value.

On the other hand, we felt that the combination of chemoprophylaxis and DDT spraying was a particularly valuable method, in view of its simultaneous action on the reservoir of virus and on transmission.

We may cite as an example of the results obtained during these initial experiments, the case of the villages in the canton of Dak-Lieng (Banmethuot) and the village of Plei Tongia (Kontum).

Thus we found that in Dak-Lieng the action of DDT appeared only very gradually. After four years' spraying the spleen-rate was still above 20 per cent. (Table I)

At Plei Tongia, under the combined effect of chemotherapy and spraying, the change was much more rapid.

A year after the commencement of prophylaxis, the situation could be considered as stabilized and, despite the cessation of all medication, the spleen-rates remained at a practically negligible level. (Table II)

It would be easy to give further examples, details of which were included in our end-of-campaign report in 1953.

THE DEVELOPMENT OF OUR PROPHYLAXIS CAMPAIGN (1951-1953)

When in 1951 we were able to return to these trials, under the auspices of WHO with the valuable assistance of the American Economic Mission, and extend preventive measures to all the mountain villages, it became clear that weekly chemoprophylaxis, in the form we had employed at the outset, was inapplicable as a collective prophylactic method in the rural areas.

We were consequently led to consider simplified treatment schedules, modifying either the length of the treatment or the dosage and the periodicity of distribution.

ACCELERATED INTENSIVE TREATMENT

There seemed to be two methods suitable for rapidly reducing the reservoir of virus while waiting for the DDT sprayings to exert their full effect. These methods were as follows:

- a radical treatment, using massive doses administered either as a single dose or over the course of one or two days;
- a treatment with sub-massive doses spread over a longer period, involving, as previously, periodic distribution of drugs, but reduced to the minimum possible time.

Our experience shows that the latter method is the one that gives the better results.

In the initial stage we limited the duration of the weekly distributions of chloroquine to six months.

This method, applied in the two villages of B. Drai Hling and B. Dok, gave fully satisfactory results. A year after the cessation of treatment, the improvement still persisted and the rates were in the neighbourhood of 20 per cent. (Table III)

Subsequently we reduced the duration of treatment to two months by employing sub-massive doses of chloroquine and distributing the drug every fortnight only.

This schedule, which was tried out in several districts, gave excellent results.

The dosage used during these experiments was as follows (chloroquine):

0 - 1 year . . . . 0.15 g

1 - 4 years . . . . 0.30 g

4 - 12 " . . . . 0.45 g

12 years and over . . . . 0.60 g

We may give as example a number of villages in the province of Kontum, treated comparatively either by DDT spraying alone or by spraying combined with chemotherapy. The change in the indices in these two groups of villages is particularly enlightening. (Table IV)

Reference may also be made to a group of 11 villages in the Banmethuot region sprayed on the same dates, but only some of which were subjected to chemoprohpylaxis. (Table V)

THE NEW ANTIMALARIAL DRUGS

In a third series of experiments we returned to our trials of radical treatment using the new antimalarials, pyrimethamine and amodiaquine.

Pyrimethamine

We selected three neighbouring villages situated in comparable physiographic conditions where the infection-rates at the outset were particularly high, the spleen-rates ranging from 68 to 80 per cent. and the parasite-rates from 47 to 55 per cent.

Our intention was to eliminate the infection with pyrimethamine and then to stop transmission by means of spraying either with DDT or with Dieldrin.

The experiment was arranged as follows:

Village	Population treated	Periodicity of treatment	Number of distributions	Insecticide used
B. Buor	Children	Weekly	14	DDT
B. Ea Po	Children and adults	Weekly	14	DDT
B. Nui	Children	Fortnightly	7	Dieldrin

The pyrimethamine doses used were 50 mg for the adults and older children and 25 mg for children under four years of age.

In all three villages the change in the rates followed exactly the same course as in the case of the village of B. Buor, which we give as example. (Table VI)

These results show:

- the extremely rapid action of pyrimethamine on the parasites in the blood;

- the equally rapid action of the medication on splenomegaly;

- the practically equal effectiveness of weekly and fortnightly medication;

- the uselessness of extending the treatment to the whole population, since the adults represent only a negligible fraction of the reservoir of virus.

In the village of B. Ea Po, the parasite rates were 61.9 per cent. among children and 8 per cent. among adults at the outset and treatment of the whole population in no way altered the trend in the rates as a whole.

However, despite the immediate and spectacular results, a rapid increase in the infection-rate was observed as soon as treatment ceased.

It may be concluded therefrom that pyrimethamine in the doses used has not a radical action on the infection.

On the other hand, new trials carried out in the Pleiku region using double the dose of pyrimethamine, i.e. 100 mg and 50 mg respectively according to the age of the children, gave much more interesting results. As with the experiments made with chloroquine, this treatment was limited to two months

and comprised only five fortnightly distributions of the drug.

Unfortunately it was not possible for us to determine the parasite-rates before commencing treatment, but the change in the spleen-rates alone is sufficiently eloquent:

Village	No. of Children	Spleen-rates			
		Before treatment	At the end of treatment	After 3 months	After 8 months
P. Brel	96	91.6	83.9	31.4	31.0
P. Khum	76	75.0	54.8	38.2	31.0

In May 1953, more than eight months after the treatment had ceased, the spleen-rates were stabilized and the parasite-rates remained negative in both villages.

In this increased dosage, the action of pyrimethamine was much more complete and lasting than in the initial experiments.

Amodiaquine

This was tried out in two villages in the Djiring region, namely Djirlagne and Kala, where no improvement had been obrerved although they had been subjected for more than a year to DDT spraying.

In the first experiment we used a relatively prolonged treatment.

One village received 13 fortnightly distributions of amodiaquine and the other 16, the doses being 3 tablets (0.60 g) for adults and children above 10, and one half tablet for younger children. (Table VII)

As in the case of pyrimethamine, it was found that the treatment had an immediate effect on the blood infection rate.

In one month the percentage of children with parasites in the blood fell from 62 per cent. to 3.7 per cent.

The action on splenomegaly was also very distinct. In two months the spleen-rate fell from 67.6 per cent. to 36 per cent. At the end of the treatment it was only 13 per cent.

Five months after ceasing the medication, the rates were still in the neighbourhood of 10 per cent.

In January 1954 the situation was stabilized and the parasite-rate was only 9 per cent.

We also tried accelerated intensive treatment with amodiaquine, similar to that carried out with chloroquine and pyrimethamine.

Five distributions of amodiaquine were made in two months, between July and September, to three villages in the region of Pleiku, namely P. Hland, P. Phung and P. Dal. A distinct improvement was obtained. (Table VIII)

To summarize, these two new antimalarials, pyrimethamine and amodiaquine, represent an appreciable advance on earlier drugs of the 4-amino quinoline series and even on chloroquine.

Their greater aggressiveness and more complete action make it possible to use them in high doses for short-term treatment and with distribution at long intervals, which schedule seems to us to give the best results as regards elimination of the reservoir of virus in hyperendemic or holoendemic malarial regions.

SUMMARY AND CONCLUSIONS

Experiments extending over more than four years have shown that in the southern highland regions of Viet-Nam, an area where holoendemic malaria is particularly serious, the effect of DDT spraying reveals itself only very gradually so that it is advantageous to facilitate its action by decreasing the reservoir of virus through the use of antimalarial drugs.

This slowness in the action of DDT is due in part to the fact that the regions concerned are under-developed, the population being in a constant state of malnutrition, but other factors are also involved.

One of the most important is the temporary nomadism of the village dwellers during seasonal work in the fields.

In the course of one of our surveys we found that the parasite-rate among children remaining in a village treated with DDT was only 4.7 per cent. whereas it reached 80 per cent. among children returning from the harvest.

Another point worthy of mention is that this nomadism deprives the parasite-rate among infants, regarded as a test for the cessation of transmission, of much of its significance, for it is precisely the youngest children who accompany their mothers whenever they go to the fields.

In the stabilized villages this rate falls very rapidly to zero and the infrequent cases of infection observed may be considered as accidental.

Housing conditions also play an important part.

The native huts, with their walls covered with soot and smoke, represent poor shelters for adult anopheles.

It is very difficult, as has again been shown by the recent research carried out by A. Goulioura s, to capture specimens of A. minimus in these huts and it is probable that this anopheles, although known to be anthropophilic, should not be considered as a strictly domestic species in Viet-Nam.

DDT nonetheless constitutes, in the present state of our knowledge, the essential weapon for malaria control in rural surroundings.

Thus, following our initial experiments, we definitely gave up continuous chemoprophylaxis, whose disadvantages are well known and remain the same whatever the drug used.

We have replaced it by intensive, short-term treatments.

The treatment schedule which we have developed - a fortnightly treatment extending over a few weeks only - seems to give satisfaction.

In this way it is possible, with a team of trained assistants provided with suitable means of transport, to treat a large number of villages simultaneously, the exact number clearly depending on local conditions and ease of communication.

Among the present antimalarials, chloroquine, and above all pyrimethamine and amodiaquine, represent the drugs of choice.

In conclusion, we would repeat that this treatment is justified only in regions seriously affected by malaria, with primitive populations whose living and nutritional conditions are particularly precarious.

On the whole, this treatment has enabled us to speed up the improvement in health conditions by one to two years and has had a particularly important moral effect in all the villages.

TABLEAU I
TABLE I

SECTEUR DE BANMETHUOT SECTOR OF BANMETHUOT CANTON DE DAK LIENG (Darlac) DISTRICT OF DAK LIENG (Darlac)	Pulvérisations Spraying W.D.P.	
	Pétrole : 5 %	P.M. : 75 %
	Janvier/January 1949	Octobre/October 1951
	Octobre/October 1949	Avril/April 1952
	Avril/April 1950	Septembre/September 1952
	Juin/June 1951	

DATES	Indice splénique Spleen Rate	Rate moyenne Average Spleen	Indice splénométrique Splenometric Index	Indice plasmodique Parasite Rate	Indice gamétique Gametocyte Rate
Janvier/January 1949	76	-	-	-	-
Juillet/July 1949	61	-	-	-	-
Octobre/October 1949	54	3	157	-	-
Avril/April 1950	-	-	-	39	8
Juillet/July 1950	42	2,5	106	29	4,2
Février/February 1951	37	2,6	98	-	-
Mars/March 1952	30	2,5	77	14,5	0,9
Août/August 1952	25	2,5	64	7,1	5,3
Février/February 1953	21	2,4	52	6,2	1,2

TABLEAU II
TABLE II

SECTEUR DE KONTUM SECTOR OF KONTUM Village de Pl. Tongia Village of " " Chimioprophylaxie hebdomadaire Weekly chemoprophylaxis Quinacrine puis Chloroquine Arrêt : juillet 1952 Discontinuation : July 1952	Pulvérisations Spraying			
	Décembre December	1948	Janvier January	1952
	Décembre December	1949	Août August	1952
	Juillet July	1950	Février February	1953
	Mars March	1951		

DATES		Indice splénique Spleen Rate	Rate moyenne Average Spleen	Indice splénométrique Splenometric Index
Juin/June	1948	85,9	2,83	243
Février/February	1949	73,6	2,23	164
Mai/May	1949	38,2	2,38	90
Décembre/December	1949	27,6	2,62	72
Juin/June	1950	15,5	2,10	33
Octobre/October	1951	9,5	2,14	20
Avril/April	1952	9,2	2	18
Août/August	1952	2,5	2	5
Mai/May	1953	3,1	2,3	7
Septembre/September	1953	1,7	2	3,4

TABLEAU III

TABLE III

SECTEUR DE BANMETHUOT SECTOR OF BANMETHUOT Buon-Drai Hling B.H. Dok Population : 435	ARALEN	Pulvérisations Spraying	
	du 23-10-51 au 14-4-52 from 23-10-51 to 14-4-52	Juillet / July 1951 Novembre / November 1951 Avril / April 1952	Septembre / September 1952 Février / February 1953

DATES		Indice splénique Spleen Rate	Rate moyenne Average Spleen	Indice splénométrique Splenometric Index	Indice plasmodique Parasite Rate	Indice gamétique Gametocyte Rate
Juin/June	1951	76,1	2,8	213	-	-
Octobre/October	1951	-	-	-	51,6	7,6
Novembre/November	1951	34,7	2,4	83	-	-
Janvier/January	1952	-	-	-	7,9	0,9
Mars/March	1952	-	-	-	2,9	0
Avril/April	1952	9,4	2,1	19	-	-
Juin/June	1952	-	-	-	2,7	0
Juillet/July	1952	-	-	-	5,4	1,1
Septembre/September	1952	-	-	-	7	1
Novembre/November	1952	-	-	-	19	5,9
Décembre/December	1952	21,1	2,1	44	-	-
Janvier/January	1953	-	-	-	18,9	8,1
Avril/April	1953	-	-	-	12,7	2,7
Mai/May	1953	21,9	2,4	52	11,9	4,6

TABLEAU IV

TABLE IV

SECTEUR DE KONTUM SECTOR OF KONTUM	Villages de (Pl. Klec " of (Pl. Mun (Pl. Loc (Pl. Tower		
	Indice splénique Spleen Rate	Rate moyenne Average Spleen	Indice splénométrique Splenometric Index
Février/February 1952	95,1	2,34	222
Août/August 1952	82,8	2,9	240
Mars/March 1953	75,2	2,8	210
Septembre/September 1953	70,3	2,7	189
	D. D. T. SEUL " ONLY		
SECTEUR DE KONTUM SECTOR OF KONTUM	Villages de (Pl. Kon Hongo/Kotu " of (Pl. Groi		
	Indice splénique Spleen Rate	Rate moyenne Average Spleen	Indice splénométrique Splenometric Index
Février/February 1952	90,8	2,6	236
Août/August 1952	40,1	2,1	84
Mars/March 1953	37,3	2,3	85
Septembre/September 1953	26,4	2,1	55
	D. D. T. + CHIMIOPROPHYLAXIE CHEMOPROPHYLAXIS		

TABLEAU V
TABLE V

SECTEUR DE BANMETHUOT SECTOR OF BANMETHUOT B. Kgr Prong II, B. Kbu, B. Cu Molin, B. Ea Kao Population : 780	Pulvérisations Spraying	
	Juillet July 1951 Avril April 1952 Février February 1953	Novembre November 1951 Septembre September 1952

DATES		Indice splénique Spleen Rate	Rate moyenne Average Spleen	Indice splénomé-trique Splenome-tric Index	Indice plasmodi-que Parasite Rate	Indice gamétique Gametocyte Rate
Juin/June	1951	73,4	4	220	-	-
Septembre/September	1951	69	2,6	179	-	-
Janvier/January	1952	74,8	2,9	217	-	-
Février/February	1952	59,3	2,3	136	31,9	6,1
Mai/May	1952	-	-	-	29,5	4,5
Septembre/September	1952	-	-	-	19,4	3,3
Novembre/November	1952	-	-	-	32,9	12,3
Décembre/December	1952	38,7	2,5	96	-	-
Janvier/January	1953	-	-	-	27,3	11,4
Avril/April	1953	41	-	-	16,4	2,7
Mai/May	1953	41,7	2,7	112	-	-

TABLEAU V (suite)

TABLE V (continued)

<table>
<tr><td rowspan="4">SECTEUR DE BANMETHUOT
SECTOR OF BANMETHUOT

B. Hma, B. Ea Ktur,
B. Hjung, B. Tur,
B. Mblot, B. Ea Ana,
B. Ea Tuor

Population : 1.790</td><td rowspan="4">NIVAQUINE
(bimensuelle)
(fortnightly)
du 5.5 au 30.6 1952
from 5.5 to 30.6 1952</td><td colspan="4">Pulvérisations
Spraying</td></tr>
<tr><td>Juillet
July</td><td>1951</td><td>Novembre
November</td><td>1951</td></tr>
<tr><td>Avril
April</td><td>1952</td><td>Septembre
September</td><td>1952</td></tr>
<tr><td>Février
February</td><td>1953</td><td></td><td></td></tr>
</table>

DATES		Indice splénique Spleen Rate	Rate moyenne Average Spleen	Indice splénométrique Splenometric Index	Indice plasmodique Parasite Rate	Indice gamétique Gametocyte Rate
Juin/June	1951	76,5	2,9	222	-	-
Septembre/September	1951	71,1	2,5	178	-	-
Février/February	1952	56,5	2,6	147	-	-
Mai/May	1952	42,6	2,4	102	28,3	4,1
Août/August	1952	27,7	2,3	64	4	0
Septembre/September	1952	-	-	-	3,6	0,6
Novembre/November	1952	-	-	-	9,2	2,5
Janvier/January	1953	27,3	2,3	63	10,6	0,3
Avril/April	1953	-	-	-	7	1,5
		21,5	2,2	47	-	-

TABLEAU VI
TABLE VI

SECTEUR DE DARLAC SECTOR OF DARLAC	PYRIMETHAMINE		Pulvérisations Spraying
Buon Buor Population : 225	du 19.4 1952 au 19.7 1952 from 19.4 1952 to 19.7 1952	14 distributions hebdomadaires weekly	D.D.T. 13.7.52 15.12.52 6.53
	du 24.4 1953 au 6.6 1953 from 24.4 1953 to 6.6 1953	4 distributions bimensuelles fortnightly	

DATES		Indice splénique Spleen Rate	Rate moyenne Average Spleen	Indice splénométrique Splenometric Index	Indice plasmodique Parasite Rate	Indice gamétique Gametocyte Rate
11 Mars/March	1952	-	-	-	48	2,6
19 Avril/April	1952	81,3	2,9	234	-	-
3 Mai/May	1952	69,8	2,6	181	16,2	1,3
17 Mai/May	1952	52	2,5	130	-	-
31 Mai/May	1952	-	-	-	12,3	1,2
7 Juin/June	1952	56	2,5	140	-	-
14 Juin/June	1952	-	-	-	6,2	0
28 Juin/June	1952	49,3	2,5	123	2,5	0
19 Juillet/July	1952	44	2,3	101	2,5	0
26 Août/August	1952	47,3	2,4	115	12,3	2,7
20 Septembre/September	1952	54,9	2,6	145	-	-
22 Septembre/September	1952	-	-	-	25,9	5,2
20 Novembre/November	1952	56,2	2,7	153	-	-
29 Novembre/November	1952	-	-	-	20,9	9,8
29 Janvier/January	1953	78,3	2,7	216	28,2	8,9
25 Avril/April	1953	59,5	2,7	161	20,2	2,5
9 Mai/May	1953	-	-	-	0	0
27 Mai/May	1953	32,9	2,2	72	0	0
20 Juin/June	1953	25,3	2,2	57	0	0

TABLEAU VII
TABLE VII

SECTEUR DE DJIRING SECTOR OF DJIRING	AMODIAQUINE	Pulvérisations Spraying
Villages : Djirlagne et Kala Population : 413.	Djirlagne (bimensuelle) (fortnightly) du 3.7 au 25.12.52 from 3.7 to 25.12.52 13 distributions Kala du 25.7 au 25.12.52 from 25.7 to 25.12.52 16 distributions	Octobre / October 1951 Avril / April 1952 Janvier / January 1953 Septembre / September 1953

DATES		Indice splénique Spleen Rate	Rate moyenne Average Spleen	Indice splénométrique Splenometric Index	Indice plasmodique Parasite Rate	Indice gamétique Gametocyte Rate
Septembre/September	1951	-	-	-	70	20
Octobre/October	1951	50	2,9	145	-	-
Décembre/December	1951	68,7	1,5	103	55	15
Avril/April	1952	62,5	2,4	149	61,5	21,4
Juillet/July	1952	67,6	2,5	169	62,2	9,7
Août/August	1952	-	-	-	3,7	0,9
Septembre/September	1952	36	2,1	75	0	0
Novembre/November	1952	-	-	-	1,5	0,7
Décembre/December	1952	13,2	2,1	48	-	-
Janvier/January	1953	-	-	-	10	1
Mars/March	1953	11	2	22	9,1	2,3
Mai/May	1953	12,6	2	25	6	3
Mars/March	1954	-	-	-	9	2

TABLEAU VIII
TABLE VIII

SECTEUR DE PLEIKU SECTOR OF PLEIKU Plei Ya Hlang Plei Phung Plei Dal Population : 560	AMODIAQUINE	Pulvérisations Spraying
	du 16 juin au 9 septembre 1952 from 16 June to 9 September 1952	Juillet/July 1952 Septembre/September 1952 Janvier/January 1953 Juillet/July 1953

DATES	Indice splénique Spleen Rate	Rate moyenne Average Spleen	Indice splénométrique Splenometric Index	Indice plasmodique Parasite Rate	Indice gamétique Gametocyte Rate
Juin/June 1952	83,4	3,2	267	-	0
Août/August 1952	76,2	3,1	236	12	-
Septembre/September 1952	72,5	3	217	13,4	2,9
Novembre/November 1952	64,3	2,6	167	0,8	0
Décembre/December 1952	58,8	2,4	141	0	0
Janvier/January 1953	-	-	-	2	0
Mars/March 1953	-	-	-	0	0
Mai/May 1953	37,6	2,1	79	0,9	0
Septembre/September 1953	-	-	-	2,6	0,9
Janvier/January 1954	-	-	-	4,3	0