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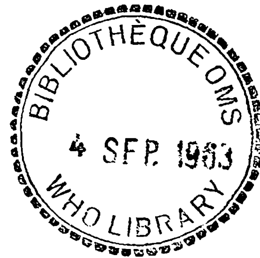

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REMARKS ON THE ERADICATION OF MALARIA
IN INTER-TROPICAL AFRICA

by

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Study of the antimalaria operations undertaken in certain French-speaking countries in the West of Africa, and in particular Senegal, Upper Volta, Dahomey, Togo and Cameroon, and comparison of these operations with the campaign conducted in the east of the continent, in the Island of Madagascar, reveal the following situation.

In these countries the residual insecticide-spraying operations resulted in rapid and marked regression of malaria as shown in the lowering of spleen and parasite rates and the reduction of the number of observed clinical cases.

In some regions where chemoprophylaxis has been combined with the insecticide-spraying operations, the regression of malaria has generally been more marked and more rapid.

Nevertheless, in both cases, a limit has been reached at which, in spite of repeated efforts, malaria has persisted to a degree which would be sufficient to cause a dangerous rise in incidence if the operations were stopped.

In two regions, however - the forest region of Cameroon and more especially the area of Yaoundé, and the high plateau of Madagascar - the regression of malaria has been much more spectacular than in the other regions of the African continent under consideration and than in the coastal region of Madagascar itself.

In the localities mentioned the rates fell so low that it was permissible for a time to believe that eradication had been achieved and, in fact, this might have been so if infection from the outside and small, not-easily-detected, residual foci had not reanimated the malaria which was becoming extinct.

However this may be, it is essential today to draw the appropriate lessons from these observations and to attempt to determine why in most of the African region studied it has not been possible to eliminate malaria beyond a certain level - a level very rapidly achieved but still too high to make eradication possible in present conditions, whereas in the Cameroon forest and on the Madagascar plateau it has been practically accomplished.

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All these countries, in spite of the differences between them and in some cases of the differences between regions in one and the same country, have certain conditions in common of which the two most important from the point of view of malaria are under-development and the presence of A. gambiae as the principal vector.

Sufficient emphasis can never be laid on the factor of under-development and the complicated problems it raises. Moreover, it has to be remembered that while malaria is often to a large extent responsible for under-development, the disease is in turn aggravated by under-development so that in the less-favoured countries more extensive means must be employed to combat it.

The shortage of qualified national personnel makes it necessary to provide personnel under technical assistance or co-operation programmes. This key staff, numerically insufficient for the tasks to be accomplished, frequently has to be content with dealing with the most urgent problems pending the training of an adequate quantity of national personnel, not so much to take over from them as, in the first place, to make it possible to intensify the activities already undertaken and to commence new ones, with particular emphasis on development of the health service infra-structure and on control of the major endemic diseases.

It is thus understandable that certain antimalaria campaigns were not adequately prepared and conducted at the outset. As a rule, the errors or deficiencies were rapidly discerned and an effort has been made to remedy them so that results have improved, although they have never been as good as had been hoped because many obstacles

inherent in the under-developed conditions hinder the progress of the operations. Among these obstacles the scattering of the populations and their way of life, added to the precariousness of communication routes, are by no means the least.

How in these conditions can total coverage be obtained and at the cost of how much effort? It has to be remembered that problems are created by the type of walls used in the people's dwellings and their frequent renewal; these factors, added to the climatic difficulties, influence the residual effect of the insecticide and make repeated spraying operations necessary.

It seems clear, therefore, that when eradication campaigns are undertaken in these countries a large margin of security must be left in the calculation of the necessary personnel, means of transport, material and insecticides.

The same applies with regard to the time allowed for the preparation of the campaign and to the duration of the operations. It is important also to know whether, by means of bilateral or possibly international assistance, the country will be in a position to conduct the campaign and bear its cost up to the last phase, particularly if outside financial aid is to be gradually reduced.

Here we come to another aspect of the difficulties encountered in the under-developed countries.

A problem cannot be solved merely by placing means and modern techniques or financial aid at their disposal. Certain administrative and political requirements must be met if progress is to be possible and enduring. Even supposing that a government is willing to undertake an eradication campaign and continue it to the end, there can be no guarantee of success until the country has achieved a certain economic and social level which will ensure the mass support and collaboration of the population in the campaign.

The second point which the countries of the African region have in common, that is, the presence of A. gambiae, raises an entirely different problem: here it is a question of the eradication technique adopted in the region.

Among the important African vectors of malaria, A. gambiae is the most difficult to overcome. Its capacity to bite both outside and inside dwellings raises the question as to whether house-spraying alone is sufficient to interrupt transmission, particularly in areas where the inhabitants spend part of the night out-of-doors or sleep in the fields during the harvest season.

Furthermore, owing to the frequently observed and fairly rapidly developing resistance to chlorinated insecticides other than DDT, this latter is now practically the only product used in the antimalaria operations in Africa. However, its irritant effect on the anophelines means that a large number of these go outside the houses to rest after having taken their blood meal inside the houses, instead of remaining on the inside treated walls for long enough to absorb a lethal dose of insecticide. In the regions where A. gambiae is the principal vector, this represents a defect in the systematic imagocide measures which aim at eradicating the disease by the interruption of transmission through contact insecticides.

In fact, this method reduces the intensity of transmission but does not interrupt it. In order to achieve eradication it will doubtless be necessary to use simultaneously other methods such as, for example, the reduction of the parasite reservoir by means of chemotherapy. However, while it seems unlikely that the insecticides currently used today can alone achieve eradication in the countries in question, it has to be remembered that the present synthetic antimalarial drugs are still too difficult to handle in mass campaigns for general use.

It would therefore perhaps be advisable, before undertaking large-scale eradication operations in tropical Africa, to find other insecticides which are not toxic to man and not irritant to mosquitos, and new drugs which can be taken less frequently and which will be more active against the various types of blood parasite.

Why is it that on the high plateau of Madagascar and in the forest region of Cameroon, where A. gambiae is also the vector, much more favourable results have been observed than in other regions where the same methods have been used? In Cameroon, whether in the campaign in the South, the Yaoundé pilot zone, or in the Northern campaign, the method used has been that of house-spraying. In Madagascar,

for the whole campaign, a system of distribution of antimalarial drugs to the entire child population of the island was adopted side-by-side with the insecticide spraying. Why then in both of these countries are there differences in the results from one region to another?

The first answer to this question that springs to mind is an entomological one.

When *A. gambiae* followed man subsequent to the latter inhabiting the uplands of Madagascar at an average altitude of 1200 metres, it was no longer in its natural habitat. In fact, as in the case of *A. funestus*, *A. gambiae* arrived long after man in the plateau region, which was until then free from malaria At Tananarive they still talk of the time when to exile a man to the coast was to send him to certain death, whereas later, when malaria appeared among the people with no natural immunity in the upland regions, it caused deadly epidemics there.

On the other hand, it seems that at 1200 metres, where the climate is very different from that of the coast, *A. gambiae* (as well as *A. funestus*) maintains an unstable biological balance and is therefore more sensitive to the action of the insecticides. One thing is certain: *A. funestus*, which is much more vulnerable on account of its endophily, has been entirely eradicated above 1000 metres, whereas below that altitude it continues to play a role in transmission. Although *A. gambiae* has not been eradicated at higher altitudes, its power of transmission has been reduced and most of the specimens captured have a zoophilic tendency.

In addition to the biology of the vectors, it should also be noted that on the Madagascar uplands the inhabitants shut themselves inside the houses overnight: they no longer stay outside and, in order to feed, the anopheles must penetrate into the dwellings.

In the South Cameroon region where a pilot zone was established, *A. gambiae* accompanies man in the forest and in the restricted space of the clearings coexists with him; a very much more precarious existence than in its native savannah. This means that it is much more easily affected by the insecticides. On the other hand, if the clearings are sufficiently large, the anopheles find again the conditions of life that are present in the savannah, and become much more difficult to eliminate.

In view of the gradual extension of these clearings and also because of a natural phenomenon (the regular progression of the savannah each year from the North to the South), it may be that in the fairly near future the ecological conditions in the Yaoundé pilot zone will be modified so as to favour the vectors. In that case, the control method which has so far been found satisfactory will have to be reconsidered.

Although the biology of the vectors, and particularly that of A. gambiae, may provide a partial explanation of some of the satisfactory results observed in the uplands of Madagascar and in the Cameroon forest, other favourable circumstances have also intervened.

When comparing the operations carried out in the different regions of Madagascar, it is noted that there are much greater facilities on the plateau than in the coastal regions.

The aim was not eradication but control, but owing to the more numerous access routes on the plateau it was possible to avoid long rounds on foot and to reach or approach nearly all the dwellings by truck and therefore to ensure almost total coverage with insecticides. In addition, the denser network of rural health services, out-patient clinics and maternity centres and centres for the distribution of chloroquine (Nivaquine) made it possible to treat a greater number of patients and to apply chemoprophylaxis to more children. If, in addition, it is remembered that malaria is seasonal owing to the altitude and resulting climate, that the inhabitants' living conditions are on the whole better on the plateau than on the coast, and that school attendance is higher, it is understandable that the malaria control campaign achieved a high degree of success in the upland regions.

In order to achieve eradication, an effort must be made today to eliminate the residual foci in the least accessible sectors and to develop an effective system of surveillance so as to prevent a fresh malaria offensive from these foci or from the coastal regions which are still all infected to a varying degree.

In Cameroon, in the Yaoundé pilot zone, relatively extensive means were used in the house-to-house spraying operations in order to obtain total insecticide coverage. These means and the operational facilities in the pilot zone made the work there easier

and more effective than in the zones covered by the campaign proper. There, also, the health infra-structure is stronger and the campaign in the South - which in fact was conducted for the purpose - protected the pilot zone from infection from without.

It was therefore demonstrated that in a forest region in Cameroon spraying operations could interrupt transmission - or at least everything seemed to indicate this. When the spraying operations were suspended, however, the system of surveillance applied in the pilot zone led to the discovery that malaria had rapidly reappeared, that clinical cases were more and more numerous and that A. gambiae, sometimes infected, was present in several villages.

The pilot zone of Yaoundé is considered at the present time to be in the consolidation phase but the limited size of the zone and the fact that it is no longer protected by the Southern campaign (where work has been suspended) make the success of the operation doubtful unless it can be resumed on a much larger scale and with the appropriate control and surveillance facilities.

Although in the light of this experience it may be possible to envisage eradication in a forest region, the same hope cannot yet be entertained with regard to the savannah regions, because the campaign in North Cameroon was a failure.

In the Sudan area also, in spite of the personnel and material available, the pilot zone of Bobo-Dioulasso, in Upper Volta, failed - although before its discontinuance it had provided valuable information. After having used the insecticides alone and then combined with chemoprophylaxis in certain sectors, or chemoprophylaxis alone, it was concluded that with the present weapons it was impossible to eradicate the disease in the zone and in regions of which it was typical.

Nevertheless, certain reservations should be made with regard to this conclusion: the smallness of the zone as compared with the vast malaria-infected areas surrounding it, the even smaller sectors within the zone, the movements of the inhabitants, and even of the vectors, may have had an influence on the results observed.

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After so much work, most of it undertaken at a time when there was still no talk of eradicating malaria - work which has been going on already in some countries for more than 10 years - the impression today is that it is in the African region that eradication of malaria will be most difficult, take the longest time to achieve and be most expensive.

Except in a few zones which are privileged owing to the climate or to the habits of the people or to the biology of the vector or to some other favourable factor, eradication in the tropical regions of the African continent as a whole seems still to be far away. Also, in spite of the desire of some countries to see eradication campaigns undertaken on their territory, it is for the present advisable and reasonable to postpone such campaigns and to prepare the countries in question by pre-eradication campaigns during which measures for the control of malaria may possibly be applied.

Supposing that the technical problems concerning the interruption of transmission and the reduction of the parasite reservoir, that is to say, problems relating to the insecticides and antimalarial drugs, were solved. Supposing, again, that with the intervention of technical assistance national malaria eradication services were set up on a sufficiently solid basis, and adequately equipped so that there would be no need to fear an operational set-back. Even if these necessary conditions were fulfilled, they are not of themselves sufficient to ensure that an eradication campaign will be brought to completion in an under-developed region as long as the countries composing such regions are not materially and psychologically organized to support the campaign and maintain the results achieved.

The real purpose of pre-eradication, understood in its widest sense, should be the creation of the necessary moral and material conditions in a group of countries forming a geographical and climatical whole without reference to political frontiers, and the bringing of such countries to the level of maturity necessary for the joint implementation of large-scale, inter-country eradication programmes which will enable them, after the attack phase, to set a time-limit to the consolidation phase and to reach the maintenance phase as rapidly as possible.

It would, in fact, be premature to launch an eradication campaign, in isolation, in a country which would then be in advance of its neighbours. In the absence of easily-watched natural frontiers, the consolidation phase would risk being prolonged unacceptably and the maintenance phase could not really commence until the neighbouring countries had also reached that phase.

This does not mean that, pending the propitious moment for launching an eradication campaign, nothing should be done to control malaria.

The development of the health infra-structure as provided for in the pre-eradication projects (that being one only of the aspects of development of the country) should in principle increase the number of treated patients. However, in some regions there may be considerable infant mortality from malaria, thus making it necessary to apply not only curative but also preventive measures.

The question might thus arise in certain countries as to whether, instead of continuing the necessarily long and costly setting-up of health centres, it would not be preferable to devote part of the available funds to applying chemoprophylaxis to the greatest possible number of children as regularly as possible, or to necessary and beneficial sanitary measures in suburban areas where such measures would contribute to the protection of large and particularly vulnerable population groups.

The problem is not a simple one, and when resources are limited it is often difficult to make a choice between the different measures proposed and to evaluate the results to be obtained from them respectively over a more or less prolonged period.

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These few remarks, which are based on observations made in connexion with various antimalaria activities on the continent of Africa and in Madagascar, lead to the conclusion that, on the whole, tropical Africa is not ready for eradication and should still today confine itself to pre-eradication programmes during which in some cases it might be necessary to give priority to activities intended to control malaria either through imagocide or antilarval measures or through the reduction of the parasite reservoir.

The eradication of malaria is the ultimate goal but it can only be attained by a great deal of work and by the expenditure of much time and money. However, if efforts and resources are pooled, if activities are co-ordinated within each country and as between the different countries in a malaria region, if the more favoured countries and the international organizations co-operate, it should be possible by joint action to shorten the length of eradication campaigns and to reduce their cost.

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