United Nations

WORLD HEALTH ORGANIZATION

Nations Unies

ORGANISATION MONDIALE DE LA SANTE

MALARIA CONFERENCE FOR THE WESTERN PACIFIC AND SOUTH EAST ASIA REGIONS

Taipei, 15-27 November 1954

WHO/Mal/114
Taipei Conf./13
16 September 1954

ORIGINAL: ENGLISH

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

THE CONTROL OF ANOPHELES LEUCOSPHYRUS

by

J. McARTHUR

(Item 1.2 of the Provisional Agenda)

In this paper I would like first to give a brief summary of past work, in order to make intelligible the recommendations I wish to offer.

In 1938 I first went to Borneo under the North Borneo Government, and at that time little was known regarding Borneo malaria and its vectors, and much of the information was incorrect.

It was held, for example, that the chief vector of malaria in Borneo was Anopheles maculatus, and measures were being carried out, by oiling and other activities in towns generally, and by the preservation of jungle shade for A. maculatus control in particular.

My initial work found that areas in Borneo appeared to be either intensely malarious, or else very healthy, and that there were few areas of low endemicity. This suggested that there was some definite factor which decided the transmission of malaria which, if discovered, might be used as a means of ridding the land of the disease.

It was next found that A. maculatus, claimed to be the chief vector, was almost certainly harmless, and that areas which had much A. maculatus breeding were healthy, while areas which were A. maculatus-free were intensely malarious.

This suggested that the sums of money previously spent on A. maculatus control were being wasted, and may in some instances - as was proved later - have been simply preserving and encouraging the malaria they were intended to control.

It was finally shown that the chief vector of malaria in the interior and in many parts of the coast was Anopheles leucosphyrus; and a study of the habits of this insect not only explained the peculiar malaria situation, but suggested a means of control which might prove valuable yet simple.

It was found first that A. leucosphyrus was a very elusive insect, and that it had been overlooked as of any importance because it did not rest in the houses, and fed generally after midnight, so that the people were unaware of the very existence of mosquitos even where it was responsible for a spleen rate of 100 per cent.

Next it was found to breed in springs and seepages under jungle shade, often in such dense jungle that this had to be cut away in order to expose breeding. For this reason it had often been missed in surveys, and its distribution was much more widespread than had previously been supposed.

The fact that this mosquito bred under shade and not in the open, suggested this as the likely reason why towns and cultivated areas, having been cleared of jungle, were healthy, and why their environs, still under the shade of secondary jungle, were malarious.

This belief was strengthened by the fact that certain areas, under jungle some years previously, and then highly malarious, were found on later examination after clearing and cultivation, to be malaria-free.

It was also strengthened by the fact that large estates, cleared of jungle and under cultivation, were healthy at their centres, but were increasingly malarious toward the periphery, where jungle shade was complete.

This suggested that eradication of the vector might be achieved by the clearing of jungle shade over seepages in the hills, and its replacement if possible by native cultivation or grazing for cattle.

Experiments carried out just before the war, involving the clearing of jungle for a small radius around seepages, resulted in the immediate disappearance of the vector, and its replacement by other - harmless - mosquitos.

Unfortunately the war put an end to these experiments, but following the war it was possible to re-establish the work, and in 1948 an experiment on a larger scale was begun.

In this experiment, an area of about ten square miles was selected, in which A. leucosphyrus bred widely, and in which the spleen rate had been over 80 per cent. for at least 15 years.

In this area, the springs and seepages were defined, and the jungle was cleared sufficiently to admit sunlight.

It was found, as a result, that there was an immediate 95 per cent. reduction of vector breeding, which was maintained during the subsequent three years without significant further work.

It was found that the cattle came in to graze, and the natives came in to cultivate, and that the clearing and its effects were much more permanent than had been expected.

It was found that there was a significant fall in malaria, from 85 per cent. spleen rate before clearing, to 55 per cent. within one year, and to 50 and 45 per cent. during the subsequent two years.

It was found that malaria transmission had not completely ceased, as infections were still found in young babies; and it was felt possible that these infections might be due to the infiltration of infected mosquitos from surrounding highly malarious villages.

It seemed that here we had a valuable means of malaria eradication, based on a knowledge of the vector and its habits; eradication which might be remarkably permanent, could be carried out by the people themselves under supervision, by a measure which encouraged the development of the country and improved the agriculture and food supplies of the people; a means of eradication not dependent on outside sources of supply, and therefore unaffected by possible wars or other catastrophes.

The hope that complete and permanent eradication might be possible based on this method received encouragement from the fact that complete and permanent eradication appeared to have resulted unintentionally in every town, cultivated area and large estate where clearing had been carried out in a place which had been previously intensely malarious.

Two things remained to be studied.

The first was to discover whether this selective jungle clearance and cultivation, if extended to a wider area, would, by eliminating the infiltration of infected mosquitos from surrounding areas, result in the complete eradication of malaria transmission.

The second was to discover whether some more economical means of jungle clearance might be introduced which would be a further contribution to the solution of Borneo's malaria problem.

It was consequently proposed to establish a campaign on a wider scale, preferably in an area of greater economic importance, and possibly with better transport facilities than had been available in the earlier experiments.

At the same time studies were planned on the application of other means of control to this problem, under the Colonial Development and Welfare Scheme.

As a parallel piece of work, experiments were begun by the World Health Organization in Sarawak, on the spraying of residual insecticides as a possible means of malaria eradication.

It had been my hope that it might have been possible to carry out in this way two parallel campaigns, one in either North Borneo or perhaps preferably Brunei, by selective jungle clearance and cultivation based on my previous work; and another by spraying of residual insecticides in houses in Sarawak, in order to make a careful comparison of the costs and relative effectiveness of the two methods.

Unfortunately at this point it was decided that my own work should cease, although the Sarawak Experiment continued; and it has not been possible to carry out the further experiments which had been planned.

This paper is an earnest plea to the authorities concerned to re-establish this work which, having beem carried out for fifteen years, would appear to have been within a year or two of final success, and which may offer a means of eradication of value not only to Borneo but to a large part of the East.

The method advocated is simple:

Since A. leucosphyrus breeds chiefly in springs and seepages in hill ravines, its breeding places can be fairly accurately defined by following every stream to its source.

When breeding is discovered, clearing can be carried out by hand; but it is likely that other means will prove quicker, more effective and more economical.

Among other methods considered have been such means as mechanical clearing, flame-throwers, explosives, and so on; but the most promising method appears to be the application of selective herbicides.

Selective herbicides are substances which, when applied to vegetation, inhibit the growth of certain plant species without damaging others. Good examples are 2,4-dichlorophenoxyacetic acid and methylchlorophenoxyacetic acid, which are used widely for the control of weeds in cereal crops, pastures and lawns.

These compounds are formulated in a number of different ways as sodium salts, amine salts (which are much more stable in water) and as esters which may be applied as emulsions or in oil solutions when required as arboricides.

For this particular work it should be possible to find the ideal compound which would inhibit the growth of Borneo secondary jungle shade, while at the same time permitting the growth of grass for cattle, or of native crops.

In other parts of the world it has been found that one spraying of vegetation with a herbicide is sufficient for five years; and it is suggested that such a result in Borneo might be followed by cultivation which would render application of further herbicide unnecessary.

In this connexion it is pointed out that clearing for A. leucosphyrus control exposes the best soil for cultivation; soil which is composed of humus, and which is moist and sheltered. The clearing is not sufficient to encourage soil erosion, and it leaves undisturbed the jungle on the shoulders of the hills which can continue to act as a sponge for the retention of moisture.

It is suggested that, in areas where malaria is carried by A. leucosphyrus in Borneo and elsewhere in South East Asia, malaria eradication might be effectively carried out by small teams consisting of one man trained in A. leucosphyrus surveys, accompanied by one or two coolies equipped with knapsack sprayers, who would explore every stream from mouth to source, systematically spraying jungle with herbicide wherever vector breeding is discovered, thereby not only preventing vector breeding, but creating valuable areas for cultivation.

It is not possible at present without experiment to state dogmatically what herbicides would be of value for the clearance of different types of Borneo shade-producing vegetation, but trial requires to be made of several different substances.

These selective herbicides are now made in several countries and formulated by many different firms in those countries. As indicated above they can be prepared as sodium or amine salts or as esters, and applied in aqueous solution, oil in water emulsion form or as oil solutions depending upon the kind of vegetation it is desired to control and the degree of selectivity it is necessary to maintain. They can be applied from knapsack sprayers or small power-driven machines.

Costs do not appear to be high. For general work, spraying one acre - representing perhaps up to ten breeding places - appears likely to cost about £1 or £2, and this may prove sufficient for years.

It is suggested that the work should consist firstly of small-scale experiments to determine the ideal compound and the ideal method of application; and finally of a large-scale campaign against A. leucosphyrus, based on previous experience, but utilizing the newly-gained experience of selective herbicides.

The costs should not be great. It is work based on observed fact, and believed to be full of promise. The experience is available, and if successful the results would prove a contribution to anti-malaria methods, and to the prosperity as well as to the health, not only of Borneo but to other parts of South East Asia.

This paper is an earnest plea for the re-establishment of this work, either in North Borneo or Brunei or both, as a parallel to the experimental residual spraying programme being carried out in Sarawak.

Fig. 1

MAP OF THE AREA OF WHO OPERATIONS
ZONE DES OPÉRATIONS DE L'OMS