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ENGLISH ONLY*

The Secretary of the Expert Committee on Malaria has the honour to communicate hereunder the following digest prepared by the Malaria Section of a first report on

THE ILARO EXPERIMENTAL VECTOR SPECIES ERADICATION SCHEME
BY RESIDUAL INSECTICIDE SPRAYING
(First Progress Report)

kindly transmitted by

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The report summarizes the basic survey data obtained during the first half of 1949 by Dr. L.J. Bruce-Chwatt, Senior Malariologist, Mr. J.Y. Brown, M.C.O., Mr. R.A. Fitzjohn, M.C.O. and Mr. I.A. Balogun, Senior Sanitary Inspector.

1. RATIONALE OF THE SCHEME

The purpose of the Ilaro Experimental Mosquito Eradication Scheme is to organize and to carry out a project suggested in 1948 by the World Health Organization's Expert Committee on Malaria namely a "species eradication in the absence of natural barriers" (Bull WHO vol 1, p 249).

Whether the residual spraying of human habitations alone will be adequate to eradicate the two most important West African malaria vectors in a mixed semi-urban African community is not known. Neither is it known if house spraying must be supplemented by residual spraying of the periphery and to what extent the spraying of this periphery will prevent a reinfestation of the treated zone. There is a lack of sufficient data from West Africa and the Ilaro scheme is really a pilot control scheme with the aim to evolve the most economic method of applying insecticides under the local conditions prevailing.

* For reasons of economy, no translation made in French

The reasons for choosing Ilaro for an experimental species eradication scheme are as follows:-

- (1) Ilaro is geographically within the Nigerian rain-forest zone which is notoriously hyperendemic.
- (2) It is a typical southern town, fair-sized and yet not too large for collection and evaluation of results. Its population of some 8,000 Africans is fairly homogeneous, not transient and of amiable disposition.
- (3) As it will be shown later, malaria in Ilaro is just above the level of hyperendemicity with pronounced seasonal endemic waves.
- (4) The main vectors of malaria are A. gambiae and A. funestus.
- (5) Ilaro is only 1-1/2 hours drive from Lagos and yet in spite of this short distance from Lagos, it is off the main North-South commercial road and not subjected to the usual migratory population trends.
- (6) The Town Council of Ilaro is efficient and co-operative, the schools are numerous and the population as a whole progressive and eager to benefit from modern trend in social medicine.
- (7) It is hoped that the new Rural Centre will become the local headquarters of the Experimental Mosquito Eradication and will provide facilities otherwise unobtainable in a small town. A close co-operation with the new Medical Field Unit stationed at Ilaro is aimed at, particularly as far as the undesirability of any chemotherapeutic interference with the natural course of malaria is concerned.

2. DESCRIPTION OF THE AREA

The altitude of the area varies between 200 and 400 feet above the sea level. The country is undulating, with wide valleys forming shallow beds of several small rivers flowing south towards the sea.

The area of which Ilaro is the centre is situated within the "Dry High Forest Zone" of the Forest Region and Derived Savannah vegetation belt (former Guinea High Forest). This is the typical western end of the Nigerian forest belt showing an intensive degradation due to shifting cultivation.

Climatically the area is within the 40 - 60 ins. mark of the annual rainfall distributed over some 90 rainy days in a year. In April the rains set in gradually to reach their maximum in June and July. There is then a distinct falling off in August, after which a second peak is reached in October to drop away again to a minimum in January; little precipitation from December to February.

The mean daily maximum temperature is 87° F, mean daily minimum 72° F. Average humidity is over 80 per cent throughout the year, with the exception of the period January-February when it may drop to 65-70 per cent.

The township of Ilaro, some 45 miles north-west of Lagos, is the main town and the administrative headquarters of the Egbado Division within the Abeokuta Province, Nigeria. The Ilaro subdivision covers an area of approximately 170 square miles and had in 1936 a population of some 15,000 people with a density of 84.5 persons per square mile.

The town is situated on a low hill about 300 feet above the mean sea level and some 50 - 100 feet above the surrounding area, which is crossed, West, South and East, by three streams all tributaries of the Edun river. Near the town there are extensive banana and cocoa plantations which are intersected by muddy shallow streams, tributaries of the Eleyo river. These streams are covered with a thick undergrowth of shrubs and creepers. Some of the surrounding country is forested and parts of the forestry reserve are the site of an extensive timber industry. The town is a sprawling conglomeration of some 1,500 houses most of which are constructed of reinforced mud and clay with corrugated iron or thatched palm leaf roofs.

The present population figure is not known but it is estimated to be about 9,000. No vital records whatever are available at Ilaro.

No anti-anopheline mosquito control is carried out.

3. MALARIA SURVEY

(i) Three surveys carried out between March 1949 and October 1949 have revealed that the amount of malaria in Ilaro is at the lower level of hyperendemicity with a pronounced endemic wave, that starts shortly after the beginning of the rainy season and lasts for at least 4 months. Spleen rates in the 1 - 10 age group of the child population were found to be 60.3 per cent in March 1949, 54.1 per cent in June 1949 and 74.3 per cent by the end of September 1949, with a corresponding increase of the average enlarged spleen from 1.5 in March 1949 to 1.83 in September. Crude parasite rates in the same group of child population have increased from 57.8 per cent in March, to 58.0 per cent in June and to 76.5 per cent in October.

In the adults the spleen rate rose from 8.7 per cent in March to 19.0 per cent in September. The corresponding parasite rates have increased from 13.0 per cent to 25.0 per cent.

The foregoing figures show that although malaria in Ilaro is on the hyperendemic level the population is not absolutely immune to it and shows a marked subclinical epidemic wave during the second half of the rainy season.

(ii) The clinical picture of malaria in school children is that of a relatively mild affection easily yielding even to an inadequate treatment.

(iii) P. falciparum is the main parasite species followed by P. malariae the incidence of which varies between 8 and 12 per cent. The gametocyte rate of P. falciparum is relatively low and varies between 8.0 and 12.0 per cent in the child population. P. vivax was seen as an exceptional occurrence.

4. ENTOMOLOGICAL INVESTIGATION

Collection of adults was carried out first in March and April 1949 and then during the period June to August 1949. 13 capture stations were selected within the township area.

The density per capture station room shows a very marked seasonal peak during the rainy season particularly for the former. It seems that A. funestus is the main vector throughout the year, while A. gambiae has a seasonal importance. The mean sporozoite rate of both vectors is about 6 per cent with A. gambiae having always a higher infectivity rate than A. funestus.

Breeding places of A. funestus are numerous and well defined along small streams. A. gambiae foci are irregularly distributed. A. hargreavesi is also present but so far could not be incriminated as a vector.

5. ORGANIZATION OF THE SCHEME

Ilaro is an experiment in local eradication of A. gambiae and A. funestus by residual spraying of human habitations.

As Ilaro forms a very concentrated densely inhabited zone within an uninhabited forest, all isolated dwellings within 3 miles of the perimeter of the town will be treated with BHC. The supposed day sheltering places in the forest will not be treated since this would make the task extremely difficult and the cost absolutely prohibitive.

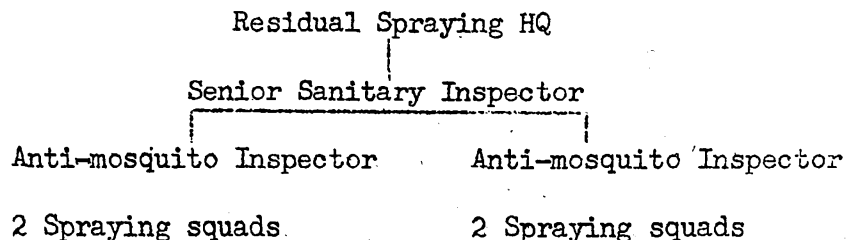
It is not proposed to carry out any larviciding in the first phase of the project. Larviciding methods will be used only if residual spraying in itself proves ineffective.

The insecticide to be used for the scheme is benzene-hexachloride (Gammexane) exclusively, at a dosage of 10 mgm per square foot. The formulation of the BHC compound that seems to meet the requirements is the gammexane dispersible powder P. 520 containing 6.5 per cent active gamma isomer of benzene-hexachloride. The walls of the houses at Ilaro are of porous materials - clay or rough brick. The sprayers to be used give approximately 1 gallon to 1,000 square feet. To obtain a mean coverage of 10 mgm per foot of pure gamma isomer the working concentration will be 150 gm per 1,000 square feet per 1 gallon or about 5 oz of P. 520 to one gallon of water.

The persistence of satisfactory toxicity of P. 520 in a community depends on the ratio of treated houses to untreated ones, on the thoroughness of the application, and (to a smaller degree) on the dosage. With the dosage of about 10 mgm/square foot the satisfactory toxicity of P. 520 residue should persist for at least 3 months.

Ilaro has a total of about 8,000 rooms with a mean sprayable surface of 800 square feet per room. The total sprayable surface of 6,400,000 square feet will need a coverage (at 4.6 oz per 1,000 square feet) of 16-1/4 cwts per one spraying with P.520. The cost of P. 520 from ICI is £4. 10. 5d per one 56-lb drum or 1/7-3/8 per lb. Therefore the cost of insecticide for one spraying of Ilaro will be about £150. Four sprayings will require 65 cwts at a cost of £600 per annum.

The scheme of the staff distribution is shown below:



A spraying squad will be composed of four labourers (2 sprayers and 2 carriers) and one foreman in charge of the squad. At the rate of 6 houses

per squad per day and with 26 working days in a month four squads can spray 520 houses in a month and the whole of Ilaro can easily be dealt with in three months. At the end of the three months the squads will recommence the spraying of houses that were sprayed at the beginning of one spraying period.

The most suitable equipment to be used for residual spraying of Ilaro is either the Kent Colonial Sprayer (stirrup pump pattern) or the Eclipse "Super Triumph" Bucket Sprayer with a 15 feet hose and an angle bent lime-washing nozzle. These sprayers are simple, robust, easy to handle and to repair and not expensive. (£3 each). Each spraying squad will need constantly 2 sprayers with another 2 sprayers readily available if necessity arises. The total number of sprayers necessary for Ilaro is 16. The cost of this equipment and of some smaller items will be about £300.

6. EVALUATION OF EFFECTS OF THE EXPERIMENTAL RESIDUAL SPRAYING SCHEME AT ILARO

The effects of the scheme will be judged by two standards: entomological and malarimetrical.

(i) Entomological records

Great importance is attached to the organization and supervision of efficient adult capture teams which will be the main yardstick of results of residual spraying before, during, and after its commencement. The proposed organization of adult capture teams is as follows. 40 capture stations will be set up within the township area. A capture station is a typical permanent or semi-permanent house not sprayed by gammexane where at fixed days of the week a trained mosquito collector captures all adult mosquitoes sheltering during the early hours of the morning.

Mosquito collecting will be carried out by the "spray-floor sheet" technique based on collection from a room on a standard size sheet of all mosquitoes knocked down by 0.2 per cent pyrethrum/kerosene spray (plus 2 per cent sesame oil). This technique is more reliable, and less time consuming than hand catching. It has the slight drawback of making the dissection of mosquitoes for oöcysts impossible and the dissection for sporozoites more difficult. The collection of adult mosquitoes in Ilaro will be carried out by two teams. Each team will consist of one mosquito collector and one mosquito boy - similarly to the routine used in Lagos. One team should be able to deal with 4 capture stations a day (at 2 rooms each) or with 20 stations a week. The collection will be carried out once a week in each station

- (c) Parasite rate and density survey on the same sample of the population.
- (d) Infectivity rate of dissected anopheles.
- (e) Other indices calculated from the above (Infective Density Index etc)..

7. COSTS

Total estimated costs per annum (including insecticide, equipment, staff and contingencies) £1,725 (= \$4,830.00).