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The Secretary of the Expert Committee on Malaria has the honour to transmit hereunder a

REPORT ON MALARIA CONTROL IN SOUTHERN RHODESIA

by

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Since the occupation of the Colony of Southern Rhodesia in 1890, malaria and blackwater fever have been the most serious health problems interfering with development and the welfare of all the inhabitants.

In the early decades five per cent of European hospital admissions and 28 per cent of the registered deaths were on account of malaria and blackwater fever. The situation was aggravated by the scattered agricultural development and the peculiar pattern of gold mining development by means of small workings which meant that the advantages of aggregation into communities were not operative. Since the earliest days great faith has been reposed in quinine prophylaxis and the government made this drug freely available at all post offices at a cost of 3/9d per 100 of 5 grain tablets of quinine bi-hydrochloride. This facility was afforded until about 1945 when mepacrine and proguanil (paludrine) were made available instead. In 1950 the government withdrew its supplies through post offices and now relies on ordinary trade channels to ensure that mepacrine and paludrine are available for purchase from any trader in the Colony.

Anti-larval control has never been attempted except in the larger urban areas. Malaria is a seasonable disease in Southern Rhodesia and it is difficult to arrange for anti-larval work to be started up at the beginning of each rainy season and difficult to employ usefully an anti-malaria staff during the dry winter months.

A. gambiae in view of its breeding sites is very difficult to control and even where anti-larval work was tried (usually by oiling) the results achieved gave little encouragement to the lukewarm to continue the effort. Anti-larval measures have been employed by the municipal health authorities but more as an anti-mosquito effort than as a measure against malaria.

Despite the fact that so little has been done to control malaria by specific measures the malaria experience of the European community has materially improved over the half century.

The gradual development of the Colony, hindered though it has been no doubt by malaria, has resulted in an improvement in the position. In comparison with the rates previously quoted which applied to the years 1904-08, the same indices for 1944-48 showed 1.4 per cent of hospital admissions and 4.6 per cent of registered deaths of Europeans to be due to malaria and blackwater fever. The proportion of European infant deaths from malaria, however, remains high and 8 per cent of such deaths are registered as due to this cause.

In 1946 the experimental control of malaria by residual insecticides was initiated. Certain small out-stations at lower altitudes were chosen where malaria (and blackwater fever) exercised a heavy toll year by year. All European and African dwellings on the station were treated with DDT preparations and the African villagers' huts situated within two miles of the station were also treated. The residual insecticide was applied twice in each season, at first in December at the onset of the rains and again in March when the rains were ceasing and the malaria incidence usually reaches its peak. In these stations, despite the fact that some were ideally situated for a perfect malaria transmission, the malaria incidence in both races fell markedly, parasite rates were lower, adult vectors were unobtainable and larvae had virtually disappeared. Yet not far away from the perimeter of the controlled area the malaria pattern was as before.

With the aid of funds provided by the Southern Rhodesia State Lottery Trustees, £50,000 was set aside for a two year programme of malaria and bilharziasis control. This was inaugurated in September 1949. It was hoped by organising an effort against both diseases by a single organization that staff, transport and equipment

would be beneficially employed throughout the whole year. Techniques for bilharziasis control had been developed to such an extent that it was felt that now both diseases could be dealt with, malaria control occupying each unit from October to April and bilharziasis control May to September. It was decided to make the experiment as simple as possible and try to apply one measure against each disease thoroughly rather than employ a number of measures and then never be able to decide which one had actually produced the results. In malaria control only residual insecticide spraying was done, no organized prophylactics, no propaganda on protective clothing, bed nets, or gauze screening of dwellings and no anti-larval measures at all.

The residual insecticide spraying programme was further simplified in that, while all African huts and houses were treated, including kitchen shelters (which at times may be used as sleeping quarters for the young members of the family), only living rooms and bedrooms of European houses were treated. No kitchens, passages, lavatories, store-rooms or open verandahs were treated. Residual insecticide was applied, however, to all gauze enclosed verandahs and sleeping porches. Ceilings were not treated. In the same way in bilharziasis control only one measure was used, the killing of the freshwater snails, which are the intermediate hosts, by spraying with copper sulphate strong solution on to all collections of surface water in rivers and streams.

The area chosen for the experiment was the Upper Mazoe River catchment, 1,900 square miles in extent, lying to the north of Salisbury. The area included a good cross-section of Southern Rhodesian activity, native reserves, farms, small mines and small urban settlements. It is an area with a sinister reputation for malaria and is subject to severe annual visitation of the disease which seriously interferes with the productivity of a fertile and well-mineralised valley. Bilharziasis was also an important problem with infection rates in children of up to 80 per cent.

Four teams were organized, each under a European supervisor, provided with a 3-ton lorry for transport and with an average of 15 labourers for residual insecticide application and copper sulphate spraying as the season dictated. In immediate charge of the operations and in charge of the central stocks of chemicals and the general administration is a health inspector who had previously shown particular interest in this type of work. He has a light 1/2 ton lorry for transport.

Stirrup pump sprayers were used exclusively and gave every satisfaction.

The first spraying was made with DDT preparations only, the Valley being treated from below up to the source of the Mazoe River well in advance of the usual annual invasion of Anopheles gambiae from the lower altitudes. The second spraying three months later was a combination of DDT preparations for use in European dwellings and BHC wettable powder (12½% gamma isomer content) used for all African habitations and those European dwellings where the occupants agreed to BHC being used. The number of these was surprisingly large and the product used, manufactured by Klipfontein Organic Products in the Union of South Africa, has so little of the objectionable odour that most householders preferred BHC to DDT because of the better effect on flies.

The rate of application of BHC was about ¾-gallon of spray per African but and an average of one gallon per room in houses. It is calculated that the material was being applied at the rate of 370 mg per square foot and that the gamma isomer concentration was 46 mg per square foot.

All field operations were checked by a separate staff supplied by the research laboratory, Salisbury, and the officer in charge of the laboratory was in overall supervision of the whole project.

Including both sprayings, a total of 66,712 huts were treated and 6,122 rooms in European dwellings. The expenditure on the scheme for malaria control for a single malaria season was as follows:

European salaries	£1,663	9	7
Native salaries	922	15	6
Rations	620	15	6
Travelling and Transport	1,242	18	4
Miscellaneous	536	1	0
DDT	6,312	12	1
BHC	2,750	0	0
Equipment	85	3	5
Upkeep and Repairs	36	16	0
	£14,140	9	9

Making allowances for stocks remaining, the average all-in cost of a single treatment is 3/4d (three shillings and fourpence Rhodesian) per hut or room. If

BHC is used the cost of chemicals alone is about 10d per hut or room.

One of the chief problems which has to be faced in setting out such a field experiment is to decide what yardstick should be used to measure the efficiency or otherwise of the methods used. There would appear to be a need for some agreed standard method of assessing results. It is difficult to set standards in a disease which shows such protean manifestations as malaria. Nevertheless, an effort should be made to lay down standards sufficiently elastic to be measured even under the most primitive conditions and yet with enough common agreement to allow comparisons to be drawn. Vital statistical and morbidity figures are rarely possible except for the more highly organized communities and even then there may be so little past experience that the data obtained has no or little comparison value. Impressions are useful but of little value in comparisons with other areas where malaria control is being applied.

The achievement of the Mazoe Valley health project in respect of malaria control can therefore only be set out in rather general lines.

The results obtained were quite remarkable and changed what was rather cool interest in the project into enthusiastic co-operation by Europeans and Africans alike. The Africans noted the immediate results of domestic insects being destroyed in huge numbers. They experienced the comfort of sleeping soundly throughout the night unmolested by mosquitoes, ticks and cockroaches. The Europeans noted not only the complete freedom of themselves and families from attacks of malaria but noted that their African labour worked harder and better, probably on account of having a good night's rest, but also that the sickness rates were very markedly reduced. Farmers from experience knew that if they were to reap their food crops and cure their tobacco, they must maintain a much greater labour force than would actually be working at the time of reaping and curing because of the high sickness rates resulting from malaria. A 25 per cent absentee rate on any one day was quite usual during February to April each year. They now found their labour force more than ample and a smaller force will be needed in the future if malaria continues to be controlled.

Statistics of African malaria morbidity are difficult to analyse by the following record of admissions of Europeans to Hospital suffering from malaria and blackwater fever during the first five months of each year is illuminating. The Mazoe Valley hospitals receive patients from the area controlled during the 1949-50 season while Sinoia hospital serves a district adjacent to the Mazoe Valley.

Hospitals	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
Sinoia Hosp.	63	118	79	110	75	93	62	36	22	54	68
Mazoe Hosps.	89	71	75	113	79	95	100	64	38	55	2

For the ten years 1940-49 the hospitals had an average admission of European cases of malaria and blackwater fever for the first five months of the year of 71 at Sinoia and 78 at the Mazoe hospitals. On closer investigation, it was found that the two cases who were admitted during 1950 almost certainly contracted their infections outside the area under control.

In African malaria, the parasite rates, etc. in children in the native reserves provides perhaps a better indication though it is admitted that the evidence is of more value in showing a long term improvement in the malaria incidence in Africans. The following figures refer to surveys of native reserves within and adjacent to the controlled area in which normally a comparable picture would be expected. The survey was conducted two months after malaria transmission would have ended:

Children 1-16 years	Number Examined	Blood Films Parasites present	Gametocytes present	Spleen Palpable
Treated areas	869	353 (40.6)	57 (6.5)	114 (13.1)
Adjacent areas	256	198 (77.3)	36 (14.1)	69 (27.0)

The entomological check of the results was also satisfying. A total of 1,800 huts in the treated area were carefully examined after the application of a knock-down spray and from these only 9 A. gambiae and 3 A. funestus were recovered.

From 300 untreated huts in adjacent areas a total of 494 A. gambiae and 12 A. funestus were obtained. Extremely large numbers of cockroaches, flies and bed-bugs were obtained in the unsprayed huts but they were conspicuous by their absence in the treated dwellings. The checking surveys were made 1 - 2 months after

the application of residual insecticides.

The experimental control of malaria (and bilharziasis) will be continued in this area with the aid of the funds provided by the State Lottery Trustees until September 1951.

In the light of the experience already gained it has been decided to investigate two lines of attack for the future. Steps are now in hand to encourage all Town and Village Management Boards and the larger industrial, mining and agricultural groups of population to undertake an over-all BHC residual spraying campaign to protect their communities. The importance of treating African dwellings as a first priority is being stressed as it is in these, of course, that the mosquitoes obtain their blood meal containing gametocytes. In fact it may well be that in mixed communities of Europeans and Africans, European dwellings could be neglected by the local authority, leaving to the individuals concerned whether they would use a residual insecticide or employ a commercial firm to undertake the application for them. In closely settled communities the transport charges which have proved to be a considerable item of the Mazoe Valley budget will be eliminated and as labour for this work should be available from the general pool of labour employed by each local authority the cost should not exceed 10d per hut or room per treatment. This it is considered is well within the financial power of even the smallest community and would produce immediate results in improved health and working efficiency.

The second line of advance which is now under investigation is to inaugurate a ten-year plan to apply BHC residual insecticide to all habitations in the native reserves of the colony, the campaign to be linked as in the Mazoe Valley project with a bilharziasis control campaign covering the same areas.

It has been estimated that one team consisting of a European supervisor and ten to twelve Africans with all the necessary transport, equipment and chemicals can be operated for £5,000 a year. This estimate includes a proportion of the costs of the checking organization.

One such unit can apply two treatments during the malaria control season to 13,000 to 15,000 huts.

A rough estimate of the per capita cost is 20d per head for malaria control and 13d per head in respect of bilharziasis control.

Consideration is now being given to starting this work in September 1951 with five teams to cover 14 native reserves in Northern Mashonaland with an area of 3,600 square miles and a population of 174,000. The low population density of 48 per square mile means that transport costs form a very big item in the budget, actually 21%. The area selected for first attention is and could be a much better food producing area and so it is expected that early economic advantage will be reaped.

Until now the European development of Southern Rhodesia has clung to the high plateau area and there has been little incentive to opening up areas of lower altitude such as the Sabi and Zambesi Valleys. Some of the reluctance to do so stems from the heavy malaria toll which would inevitably have to be faced.

Development of these large areas of virtually empty land with irrigation possibilities can now be faced with more equanimity and assurance than would have been possible ten years ago.