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The Chief of the Malaria Section has the honour to communicate hereunder the following note

ORGANIZATION AND ADMINISTRATION OF MALARIA CONTROL IN SWAZILAND

by

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INTRODUCTION

Swaziland, smallest of the three High Commission territories in South Africa, is some 6,700 square miles in area; it borders in the east on Portuguese East Africa, in the north and west on the Transvaal and in the south on Zululand.

Topographically Swaziland consists of three different regions, the highveld with an altitude ranging between 3,500 and 5,000 feet, the middleveld with an altitude averaging approximately 2,000 feet and the bushveld with an altitude of 500 to 1,000 feet.

In the bush and middleveld areas malaria used to be endemic in varying degrees of severity. Malaria incidence in these parts used to show great variation from year to year; some middle and highveld areas were often subjected to severe malaria epidemics. Malaria in Swaziland is of seasonal character, each season lasting five to seven months according to the area. The main vectors were A. gambiae and A. funestus.

The population according to the last census taken in 1946 was at that time 181,000 Africans, 750 coloureds and 3,200 Europeans. Approximately two-thirds of the population live in malarious areas.

After an extensive malarial survey, comprising entomological and clinical investigation of the whole territory, control was started on a limited scale in rural areas in 1950. The reason for initiating the scheme on a limited scale was to ascertain the cost of rural control under local conditions, and to observe the effect of residual insecticides on the main vectors, A. funestus and A. gambiae as well as the effect of control on malaria incidence amongst the rural population.

Control work was gradually extended from year to year until in 1954 all malarious areas in Swaziland were covered including European-owned farms which intersect the rural native areas throughout the territory. The inclusion of these farms was necessary as, especially in years of heavy vector breeding, these uncontrolled islands with their numerous native compounds and scattered kraals formed a source of rather intensive vector infiltration into controlled rural areas. Special mention must be made of large irrigation schemes which have recently been constructed partly by private enterprise and partly by the Colonial Development Corporation in the territory. These irrigation schemes, especially those where rice-growing activities are in operation, form a source of particularly heavy vector breeding.

Routine control in rural areas consists of imagocidal methods only, with residual insecticides, performed at regular intervals according to the length and severity of transmission. Control on irrigation schemes has had to be intensified by larvicidal methods as well as more frequent spraying of human habitations. Additional larvicidal methods are also in force in the two main villages of the territory, namely Bremersdorp and Stegi.

ORGANIZATION

The permanent staff of the present malaria unit consists of two European officers, i.e. a malaria medical officer who is in charge of the scheme and a health inspector who supervises and directs field operations; these officers are assisted by an African staff of one senior native malaria assistant and ten fully-trained native malaria assistants.

A temporarily employed unskilled labour force (working only during the transmission season) does the actual spraying under direct supervision of a native malaria assistant. Both European officers have, besides their malaria work, other duties to perform, the malaria medical officer being in charge of the public health laboratory of the territory and the health inspector being in charge of general public-health work. The permanent African staff, however, devotes itself wholly to malaria work.

The training of the permanent native malaria assistant staff has been done throughout by the malaria medical officer and health inspector at the public-health laboratory in Bremersdorp (which has a central position in the territory) and in the field. Each native malaria assistant has a basic knowledge of malaria entomology and is made fully conversant with all methods of control and with the equipment used. The trained native malaria assistant then serves as malaria field officer, and is in charge of a district averaging approximately 400 square miles. He is provided with a bicycle and full equipment for his field work.

During the off-season the native malaria assistant has to visit all kraals in his area and to submit an accurate hut count which serves in the assessment of insecticides needed in the ten different districts of Swaziland. Suitable positions for insecticide depots are chosen in each district, and the depots are each served with insecticide before the commencement of spraying operations. The malaria assistant has also to mark and investigate all breeding places and collect anopheline larvae, if present, to be submitted to the laboratory for identification. Finally, he has to collect blood slides (thick-drop) from children, by the method of "random sampling", and forward these regularly to the laboratory for examination.

The blood surveys, done during the off-season as well as throughout the transmission season in all districts, form a most important part of the control scheme. As it is well known that check-spraying of huts with a knock-down insecticide does not give a true reflection of the presence of malaria vectors in a sprayed area and accordingly does not convey the degree of efficiency of a control scheme, we rely mainly on the results of blood surveys. Especially in a country of seasonal malaria,

a comparison between parasite rates amongst infants and children during the off-season and the transmission season gives a very accurate and informative picture of the position of malaria transmission in a controlled area. A local break-through of control can easily be spotted, and immediate investigation into the cause can be made.

Great care is taken that the number of children (blood-slides) examined in each area is large enough for statistical purposes, and also that the total number of cases examined in all areas is kept approximately the same for every year; approximately 5,000 slides are examined annually.

Immediately after the first summer rains or when larvae of the malaria vector are found in an area, control measures commence. A labour force, recruited by the native malaria assistant in his own area, starts the spraying of all huts immaterial of whether a hut is used as a sleeping room, kitchen or store-room. With the exception of kraals and compounds on European farms and irrigation schemes, which are sprayed by mobile gangs (a three-quarter ton truck is used for this purpose), all spraying is done on foot under the constant supervision of the local native malaria assistant.

Although no native villages exist in rural areas, and native kraals especially in the bushveld areas are often widely scattered, it has become possible to cover all malarious districts (approximately 4,500 square miles) in a period of about six weeks. To achieve this end a total labour force not exceeding 100 is employed. It is particularly important to expedite spraying operations as much as possible not only for economical reasons but also in order to prevent malaria transmission in parts of the districts as yet unsprayed, especially in years of abundant vector breeding.

Spraying of huts is done by gangs of two labourers working as a team; one operates the pump while the other sprays out the whole hut interior. The standard equipment now in use is the plunger type knapsack sprayer (Misto Practikus) of capacity three gallons; this pump is rather expensive (£14) but is very reliable and has even in the hands of raw natives given very satisfactory and lengthy service.

The work of a labour gang and the average number of huts sprayed daily depends naturally on the density of kraals in a given area. It has been of great assistance having kept an accurate record of work done in each sub-district over several years, and it is now possible to ascertain exactly the time and labour force necessary for the spraying of a particular area within the given period of six weeks. It has further become possible to economize considerably in the cost of labour, the average cost under local conditions now being kept at 2½d. per hut.

During a year of normal transmission, i.e. without spread of vectors into middle and highveld areas usually free of malaria, a total of 92,000 huts are treated at a time. Of these, 50,000 receive a second spray-treatment during the season and about 5,000 a third treatment.

The residual insecticide in use is benzene hexachloride (gammexane) wettable powder, with a 10 per cent. gamma content. During the last malaria season some of the bushveld areas were sprayed for the first time with dieldrin, huts receiving one treatment only at the beginning of the season. Our experience with this insecticide has recently been summarized in a paper "A comparison between the use of dieldrin and gammexane in the control of rural malaria in Swaziland", shortly to be published in the East African Medical Journal.

After completion of each spraying operation, the duty of the native malaria assistant consists of check-spraying of huts at regular intervals in his area during day and night time. This work is amplified by checks carried out by the health inspector and senior malaria assistant on respective tours throughout the territory. All mosquitos thus recovered are sent to the laboratory for identification. Collecting of larvae and blood-slides as described previously, form a further part of his routine duties. In addition, group surveys of children living in bushveld areas are done by the malaria medical officer, health inspector or senior malaria assistant during the transmission season - these are arranged by the local native malaria assistant.

The afore-mentioned additional larvicidal control is carried out in Bremersdorp, stegi and on irrigation schemes by specially trained labourers who work under the supervision of a native malaria assistant. DDT emulsion, as well as dieldrin, are used as larvicides.

RESULTS OF PRESENT SCHEME

It is beyond the scope of this report to give a detailed account of results achieved, and it must suffice to mention briefly the present position of malaria in table form. The figures represent the past transmission season, which was characterized by exceptionally heavy and prolonged rainfall; in accordance, breeding of A. gambiae, now apparently the only vector in Swaziland, was very intense and widespread. Larvae of the vector were recovered from all bushveld areas in great numbers throughout the season, but despite the abundant appearance of A. gambiae in its larval stage it was exceedingly difficult, and in most areas impossible, to recover adults by check-spraying inside the huts; the number of A. gambiae caught never exceeded one in 20 huts tested.

The following table gives the parasite rates of infants and children in three age groups for pre-control year 1945/46 and for the past season 1954/55; figures in brackets denote parasite rates during the non-transmission season 1954. All slides were collected from children in bushveld areas treated with BHC. In the middleveld areas malaria has now almost ceased to exist.

	1945/46 %	1954/55 %	(Non-transmission season 1954) %
1 - 12 months	38.0	1.2	(0.7)
1 - 5 years	75.5	1.7	(1.9)
6 - 16 years	46.7	2.5	(1.1)
Total rate in children	53.6	1.8	(1.2)

The above table is self-explanatory. It is of interest that in spite of the abundant breeding of A. gambiae during last season, parasite rates did not materially exceed those observed during the off-season. It is of further interest to note that on irrigation schemes where additional larvicidal control and intensified

hut-spraying operations were in force, the parasite rate was considerably higher (six per cent.) than rates in rural areas where only adulticide control was in operation.

EXPENDITURE

The following analysis is based on prices applicable during 1954/55. It must, however, be stated that in the meantime the cost of dieldrin has been considerably reduced since last year, and the cost of BHC has been lowered by approximately 1d. per lb. Salaries of trained native malaria assistants vary according to length of service from £10 to £19 per month. Wages for casual labourers are £4 per month. Neither malaria assistants nor casual labourers receive food rations. Only half salaries of the malaria medical officer and health inspector are debited against the malaria-control scheme, since these officers are also engaged in other work as mentioned above and can devote only half their time to malaria duties.

Cost analysis

	£
Half salary, malaria medical officer	841
Half salary, health inspector	447
Malaria assistants (including senior malaria assistant)	3 078
Casual labourers	1 767
Insecticides	3 388
Equipment	348
Transport	1 170
Total expenditure	£10 039

For the assessment of the per capita cost of malaria control, only figures of the 1946 census are available. The population then was given as 181,000 Africans, 750 coloureds and 3,200 Europeans. It is now estimated that the African population is nearer 200,000. There is no accurate data available as to the number of people

actually protected by the scheme, but as two-thirds of the territory is covered by malaria control it may be fair to assume that approximately two-thirds of the population is protected.

Taking the above figures as basis for calculation, the per capita cost of malaria control is 13d. per annum[1] and the per capita cost for persons protected is 19½d. per annum.[2]

Although huts in Swaziland vary considerably in size, the average surface area per hut sprayed has been estimated as 600 square feet. According to this, a total surface area of 88,200,000 square feet (147,000 huts) was sprayed during the last transmission season, or 717 square feet per protected person.

CONCLUSIONS

It has to be understood that the organization outlined in this report and the type of work covered by the members of the malaria-control unit applies naturally to conditions existing in this rather small territory. It is not intended to infer that in African territories in general, rural control of A. gambiae be effected at such a relatively low cost per head of population. Past experience has, however, shown that the economy and efficacy of a control scheme depends not only on a sound and thorough knowledge of local malaria problems, but also to a great extent on the methods used in training, sifting, guiding and supervising the auxiliary staff. As reliability, initiative and resourcefulness of the local African leaves much to be desired, it is a matter of skill and patience on the part of the officer in charge to build up an efficient African staff and to be constantly on guard for loop-holes and pitfalls (of these there are many) in the control scheme.

The duration of the present control scheme, and the question as to whether relaxation or even discontinuation can be effected, is governed by local conditions. Swaziland is in the unfortunate position of having its eastern border adjoining

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[1] About 15 cents USA

[2] About 23 cents USA

territories where no malaria control is enforced. Every year a considerable infiltration of malaria vectors takes place, especially along rivers flowing into Portuguese East Africa. Further, people of this territory frequently visit the neighbouring territories, acquire an infection and return with a fresh load of parasites to Swaziland.

As one of the first prerogatives for a relaxation of malaria control in a country is the reduction of the parasite-load of the local people to a safe level, or better even to nil, this goal is difficult to achieve under local conditions, and unless an effective malaria control is done in the neighbouring territories, or in any case for a safe distance along our borders, it would be unsound policy to reduce control at the present moment. It is felt that here in Swaziland the criteria for a relaxation or discontinuation of malaria control, as set out in the fourth and fifth reports of the Expert Committee on Malaria, have not as yet been achieved, and although we are nearing the end-point of transmission a total interruption of transmission has not been possible and it is difficult to see how this can be effected under present conditions.