

The control of malaria among the Orang Asli in West Malaysia

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Introduction

THERE ARE 53,000 Orang Asli (Aborigines) in West Malaysia belonging to 18 different ethnic groups, the majority with their own distinct language. These ethnic groups form three main communities, the Negritos, the Senoi and the Malayu Asli. Only 3% of the total are Negritos; the Senoi and Malayu Asli are numerically equal. Most Orang Asli are animists by religion. In spite of their different ethnic origins, economically and socially the Orang Asli form a distinct community.

Economically they can be divided into three groups:

- (i) Deep Jungle Nomadic: Only 2% of the Orang Asli are nomadic. They have no settled agriculture. They live on jungle roots supplemented by what they can catch by hunting and fishing.
- (ii) Deep Jungle Settled: They practise shifting cultivation, felling and burning areas of jungle each year and planting cassava, hill rice, millet and

maize. They hunt with blow-pipes, using poisoned darts and also catch animals in traps.

(iii) Jungle Fringe: About half the Orang Asli live in the jungle fringe areas or in settled villages outside the jungle. Most continue to hunt and fish in the jungle and practise shifting cultivation. Many also have smallholdings, rearing hens and goats, and some own rubber trees or coffee plants. Those living near the coast are usually fishermen.

Medical treatment for the deep jungle Orang Asli

Prior to 1955, no special medical service was provided for the Orang Asli and the majority were outside the reach of any medical care. In 1950, many of the deep jungle Orang Asli were resettled by the Government in camps near the jungle fringe. In these camps, there was a very high mortality and morbidity; the mortality rate was 90 per 1,000 per annum compared with a birth rate of 23 per 1,000 per annum.¹ In 1953, the government opened 12 deep jungle forts and the Orang Asli were

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Typical Orang Asli longhouse in the jungle.

allowed to leave the peripheral camps and settle near one of the forts. Medical aid posts were established in these forts and in 1955, two medical officers were appointed with responsibility for the medical care of these Orang Asli.

Since 1960, the medical services to the Orang Asli have undergone great expansion. Now there are 65 jungle medical posts manned by trained medical assistants, each with a helicopter landing zone and a radio transmitter/receiver set. In addition, there are 72 emergency evacuation aid posts with part-time staff similarly equipped with radio and helicopter pad. At Gombak, near Kuala Lumpur, there is an Orang Asli base hospital with accommodation for 400 patients and also the central radio control station. There are six doctors, two dentists, 13 nursing sisters and over 200 auxiliary medical staff working in the Orang Asli medical service. Using this medical organisation, the service

is concentrated on preventive medicine — tuberculosis control, malaria control, mass inoculations with B.C.G., D.P.T. and poliomyelitis vaccines, maternity and child welfare services and health education.

Early malaria control measures

In October, 1935 a malaria survey was made by Dr. H.M. Nevin² at Kampong Ayer Denak, Perak, a lowland Semai community living behind a tin mine. He found in children under 10 years old a spleen and parasite rate both of 35%. A week later, prophylactic treatment with Pamaquine was started and this was given to the children in bi-weekly doses for a number of years. The malaria prevalence in the community was reduced to under 5% (see Table No. 1).

No further malaria control measures among the Orang Asli are recorded until the malaria eradication pilot project in 1961. Four Orang Asli villages in Selangor, with a total population of 245, were included in the malaria eradication pilot project. All the houses in these villages were sprayed with D.D.T. every six months from April 1961 to April 1964 (six cycles) and "Daraclor" was distributed monthly from April 1961 until October 1963. Half of the population took the drug during the first year, rising to 75% taking the drug monthly at the end of the distribution period.³

In 1964, funds were obtained through the Malaria Advisory Board to give prophylactic chemotherapy to all Orang Asli. Starting in June 1964, two tablets of "Daraclor" (chloroquine 300mg + pyrimethamine 30mg) has been distributed monthly from all medical posts and travelling dispensaries to as many Orang Asli as possible. Probably about

TABLE I
Control of Malaria in Lowland Orang Asli at Kg Ayer Denak, Perak in 1935-37.

Date	Age	Number examined	Palpable Spleen	Malaria Parasites	F	V	Q	Mixed
10.1935 ^a	Under 10	52	18 (34.6%)	18 (34.6%)	12	3	3	—
10.1935 ^a	10+	66	3 (4.5%)	4 (6.0%)	3	1	0	—
12.1936 ^a	All	69	3 (4.3%)	4 (4.6%)	2	3	0	—
7.1937 ^a	All	117	5 (4.3%)	6 (5.1%)	3	3	0	—
12.1970 ^b	All	152	—	26 (17.1%)	4	18	0	4

a. Dr H.M. Nevin. Plasmaquine (Pamaquine) was given to all schoolchildren from 11.1935; 0.02 Grams twice weekly to children over 3 years and 0.01 Gram twice weekly to children under 3 years.
b. Col. Francis Cadigan, U.S. Army Research Unit.

50% of the population took the drug in any one month.

The National Malaria Eradication Programme

The National Malaria Eradication Programme in West Malaysia was launched in 1967. Spraying was started in Perlis in the north in 1968 and the eradication programme is moving southwards down the peninsula in eight stages.

In 1969, it was agreed that the large expanse of jungle in the north inhabited only by Orang Asli should be treated as a special area in the National Eradication Programme. The jungle area concerned is astride the central mountain range in parts of the states of Perak, Kelantan and Pahang, stretching from the Thai border in the north to the Selangor border in the south; to the west in Perak it reaches the jungle fringe near the Tanjong Malim-Grik road and to the east in Kelantan and Pahang, it reaches the Kuala Lipis-Kuala Krai railway line but excluding the populated Cameron Highlands area (see map).

This 5,000-square mile area is covered by primary jungle broken only by isolated patches of Orang Asli shifting hillside cultivation. It is 300 feet above sea level at the jungle edges, rising over 6,000 feet in the central range. There are 18,000 Orang Asli living in scattered groups, mostly near the river valleys and at heights up to 3,500 feet.



Sleeping quarters in the longhouse. Note the spaces in the bamboo wall giving easy passage for mosquitoes.

Individual groups vary in size from two to 300 but most settled areas have populations between 20 and 150. The average population density is under four per square mile.

For the purpose of the malaria control programme, the area was divided into 40 zones each with a population of about 450. Two Orang Asli were recruited and trained to work in each zone. They are responsible for spraying all the houses in their zone with D.D.T. every three months and for the weekly distribution of prophylactic drugs to all the people living in the zone. Chloroquine 300mg and Pyremethamine 30mg is given weekly to everyone over 12 and Chloroquine alone in coated tablets or as syrup to children under 12. Prior to the initial spraying a detailed census of the population was taken. In the distribution of the drugs, the malaria workers are assisted by 56 medical personnel attached to the medical posts in the control area.

The spraying and distribution of drugs was started in nine zones, all in Kelantan, in January, 1970; in a further ten zones, all in Perak, in April 1970, and in 12 zones in Perak and Pahang in July 1970. In October 1970, operations were started in a further four zones in Perak. In the remaining five zones, all lying peripherally in Perak, spraying and drug distribution was started in June 1971.

The two malaria workers in each zone remain in the jungle for periods of three months and during this time take a random 30 thick blood films and also blood films from any Orang Asli with fever (passive case detection). At the end of three months, the workers return to the Orang Asli Hospital, Gombak to collect their pay. The returns of the workers are examined and the workers are interviewed while they are at Gombak, so that any problems can be discussed and the progress

MAP OF WEST MALAYSIA SHOWING THE ORANG ASLI MALARIA CONTROL AREA



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of the work assessed. There are radio transmitter receiver sets in every jungle zone and there are monthly airdrops by parachute of rations and medicines, so there is no difficulty in communicating with the workers while they are in the jungle and no difficulty in supplying them.

Supervision of these 80 malaria workers is difficult as all are working in isolated jungle terrain. Six malaria inspectors have been trained and are employed making surprise checks on the work of the 80 spraymen. Moving mostly on foot from one zone to another, working in pairs, the inspectors check the houses to see if they have been sprayed properly and whether they agree with the details given in the sprayman's return. The urine of the villagers is tested for Chloroquine with Meyer's reagent to see if those stated to have taken Chloroquine have in fact Chloroquine in their urine. Workers found to have made false returns are replaced by new workers; so far it has been necessary to replace 18 of the original malaria workers. In addition, there is a Peace Corps malaria control worker, a nurse and a doctor who make regular checks on the progress of the malaria control programme in the jungle.

Most valuable are the investigations and checks made by personnel outside the Department of Orang Asli. The United States Army Research Unit at the Institute for Medical Research, under Colonel Francis Cadigan, M.D., have made regular three monthly blood surveys in selected areas and also periodic entomological surveys.

Problems in implementing the present malaria control programme

At first, there was a little resistance to spraying, as some of the Orang Asli were suspicious or frightened at having their houses sprayed and a few abandoned their houses after they had been sprayed. After overcoming the initial resistance, the majority of Orang Asli are keen to have their houses sprayed. There are now only isolated objections to spraying, usually when there is sickness in a house or where the sprayers have upset a family. According to the sprayers' returns, 92.7% of the houses were sprayed at least three times in 1971 covering 90.6% of the population.

The weekly medication with anti-malarial drugs is a much more difficult undertaking. Many of the children were not used to swallowing tablets and even the coated (Resochin) chloroquine tablets are somewhat bitter. Recently, supplies of Nivoquine syrup have become available. The weekly dose of Chloroquine 300mg + Pyrimethamine 30mg produced giddiness in 10-15% of the adults and in

these people the weekly dose is halved. In most zones, it is physically not possible to reach all the houses each week to distribute the drugs. In some of the higher districts, there is literally one house on each hill and many houses have only one small family living in them; the whole population in the zone is scattered thinly over a large area. Where it is not possible for the malaria workers or one of the medical staff to visit a house each week, a supply of the antimalaria drugs is left with the headman or some responsible person. The Orang Asli make frequent trips into the jungle hunting or fishing and are often away for several days at a time; absence in the jungle is a frequent reason for the weekly drug not to be given.

From the returns submitted by the malaria workers, an average of 68% of the total population of the villages visited take the prophylactic drug; of the remainder roughly two-thirds are away in the jungle and the other third refuse to take the drug. The malaria workers, on an average, give out the medicines themselves to 15% of the population weekly, a further 45% every two weeks and the remainder once a month. In 1972, the total number of malaria workers was increased from 80 to 90; the additional ten men are being used to work in zones where the population is very scattered to improve the weekly drug distribution.

There are a number of extenuating circumstances which were not foreseen and were largely beyond our control. In June 1971, a big terrorist camp was found in one zone in Perak and a large area affecting four zones was placed under a 24-hour curfew lasting several weeks. Spraying and drug distribution was not possible during this period. Many police and troops moved into eight zones following this incident and it is uncertain whether they were all taking prophylactic drugs.

A timber road has been constructed from Lasah, Perak running eastwards through the Perak jungle and across to Kelantan; there has been considerable felling of trees and a number of construction and timber workers have entered the area.

Heavy rain and flooding in December 1970 and again in December 1971 stopped the malaria workers from moving around and drug distribution was severely impeded for three weeks in many areas. A former worker was killed by a tiger in one zone and fear of tigers brought spraying and drug distribution to a standstill in this zone for the last quarter of 1971.

Results

In the pilot national pre-eradication project in

TABLE II
Malaria Blood Surveys at Kampong Bukit Manchong, Selangor.
(total population 150)

Date	Total Examined	Total Positive.	Percentage Positive.	F	V	Q	Mixed
1960 ^a	61	41	66%	22	11	2	6
1961 ^b	220	87	38%	44	31	2	10
1962 ^b	350	37	10%	14	22	0	1
1963 ^b	434	29	6.5%	1	27	1	0
1964 ^b	83	3	3.6%				
1967 ^c	98	0	0	0	0	0	0
1.1971	21	1	4.7%	1	0	0	0

(a) R.H. Wharton, A.B.G. Laing and W.H. Cheong, Institute for Medical Research, Kuala Lumpur.
(b) W.H.O. Malaria pre-eradication team representing the total of 22 surveys in the village.
(c) F.L. Dunn, C.P. Ramachandrum and L.F. Yap, Institute for Medical Research, Kuala Lumpur.

TABLE III
Malaria Blood Surveys in Selangor Orang Asli before and after Starting Monthly Prophylaxis with Chloroquine 300mg + Pyrimethamine 30mg.

Location	Date	Source	Total Examined	Total Positive	Percent Positive	F	V	Q	Mixed
1960-1963									
Bukit Chiding	8.1963	Eyles	100	30	30%	13	11	3	3
Ulu Lui	10.1960	W.L.&C.	103	57	55%	19	18	16	4
K. Penson	10.1960	W.L.&C.	65	31	48%	14	9	2	6
Sg Lallang	10.1960	W.L.&C.	14	12	86%	0	10	1	1
Bukit Lanjan	11.1960	W.L.&C.	43	15	37%	9	5	0	1
Bukit Legong	11.1960	W.L.&C.	23	11	48%	4	5	0	2
Total			348	156	45%	59	58	22	17
						(19%)*	(2%)*	(7%)*	

March, 1967

All 48 Selangor Orang Asli Villages (Population 3,812)	W.H.O.	1,131	134	11.9%	49	73	6	6
					(4.3%)	(6.5%)	(0.5%)	

Eyles = D.E. Eyles, U.S. Public Health Service, I.M.R., K.L.

W.L. & C. = R.H. Wharton, A.B.G. Laing and W.H. Cheong, I.M.R., K.L.

W.H.O. = W.H.O. Project No 20 Malaysia, Quarterly Field Report, First Quarter, 1967.

* Mixed infections are included in the percentage rate.

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Selangor, there was an Orang Asli population of 245 in four villages. There was a single smear crude malaria parasite rate of over 50% before the onset of six monthly D.D.T. spraying and monthly distribution of "Daraclor" in 1961; this dropped to 1.7% in March 1964 when spraying and drug distribution had been stopped.³ In Bukit Manchong, the largest of these villages with a population of 150, the parasite rate dropped from 66% in 1960 to 3.6% in March 1964 at the end of the pilot project (see Table No. 2). Three years later, Dr. F.L. Dunn examined the blood of 65% of the total population of the village and found no malaria⁴. In a small survey in 1971, one positive case was found.

The monthly mass distribution of Chloroquine + Pyrimethamine, started in July 1964, reduced the single smear crude malaria parasite rate from over 30% to about 10% (see Tables Nos 3 and 4). In the deep jungle, the prevalence fell further in the higher communities; in a small community living above 3,000 feet, the prevalence fell from 28% to 4%. In the deep jungle area as a whole, the prevalence of *Plasmodium falciparum* fell from 17% to 3% and *P. malariae* almost disappeared, falling from 9.4% to 0.2%. In contrast, the prevalence of *P. vivax* remained the same at about 5%. Four years later, in 1970, when the monthly distribution of the prophylactic drug had probably lost some momentum as suggested in the slight rise in the *P. falciparum* and *P. malariae* rates, the *P. vivax* rate had fallen to 2.2%. Among the Orang Asli living in Selangor in lowland jungle fringe or coastal swamp communities, the monthly Chloroquine + Pyrimethamine distribution reduced *P. falciparum* from 19% to 5% and also had a significant effect on the *P. vivax* rate which fell from 20% to 6.5%.

Three monthly spraying with D.D.T. and weekly distribution of Chloroquine + Pyrimethamine was started in the greater part of the deep jungle Orang Asli area in 1970; the results are so far inconclusive. The slides examined in 1970 and 1971 (shown in Table No. 5) were taken by the malaria sprayers in 31 of the 40 zones where spraying was started not later than July 1970. Included under 1970 are only those slides taken before the onset of spraying and weekly drug distribution or within three months of the onset.

The samples are biased in that they probably represent the first 30 Orang Asli willing to give blood in each zone; those willing to give blood samples are probably more willing to take their prophylactic drugs. This would suggest that the total malaria parasite rate in the sample might

be lower than in the whole community, but it would not affect the relative prevalence of the different malaria parasites. It is interesting to note that whereas the incidence of *P. falciparum* has fallen from 10% to 1.3%, the incidence of *P. vivax* has remained at approximately 2%.

The results of some of the blood surveys made by Col. Francis Cadigan and his staff in the U.S. Army Research Unit are shown in Table No. 6. Being random unbiased surveys, they give an accurate picture of the malaria prevalence in certain areas. They show the marked seasonal variation in the disease and also suggest an overall fall in the infection rate of *P. falciparum*.

Discussion

The monthly distribution of Chloroquine + Pyrimethamine on an opportunity basis to Orang Asli, started in 1964, reduced the malaria crude parasite from over 30% to about 10%. *P. malariae* infections previously found in 7-15% of Orang Asli almost disappeared. The reduction of malaria to one-third was of great benefit to the health of the Orang Asli.

The control measures started in 1970, the three monthly spraying with D.D.T. and weekly drug



Spraying with D.D.T. in an Orang Asli house. This house has open sides.

TABLE IV
Malaria Blood Surveys in deep jungle Orang Asli before and after the administration of monthly prophylaxis with Chloroquine 300mg + Pyrimethamine 30mg. Single smear crude parasite rates. Monthly prophylaxis started in July, 1964.

Height	Location	JULY, 1963 ¹					APRIL-MAY, 1966. ²								
		Total Examined	Total Positive	% Positive	F	V	Q	Mixed	Total Examined	Total Positive	% Positive	F	V	Q	Mixed
3,000 Feet +	Ulu Sg Mu, Pk.	25	7	28%	1	1	4	1	27	1	4%	0	1	0	0
1,000 Feet +															
1,000 ft	Kemar Post, Pk	86	29	34%	17	3	6	2	101	6	6%	3	3	0	0
1,000 ft	Chabai Post, Kn	40	16	40%	8	3	5	0	48	6	12%	3	2	0	1
1,200 ft	Kuah Post, Pk	25	9	36%	6	1	2	0	23	1	4%	1	0	0	0
		151	54	36%	31	7	13	2	172	13	8%	7	5	0	1
Under 1,000 Feet															
700 ft	Banding Post, Pk	13	6	46%	4	0	1	1	24	1	4%	0	1	0	0
700 ft	Yai Post, Kn	30	14	47%	6	4	3	1	47	6	13%	0	5	1	0
500 ft	Poi Post, Pk	35	12	34%	6	2	4	0	35	3	9%	2	1	0	0
500 ft	Sg Jenera, Kn	45	12	27%	6	2	4	0	96	15	16%	3	10	0	2
500 ft	Betau Post, Pg	48	10	21%	4	2	3	1	202	25	12%	5	17	1	2
		171	54	32%	26	10	15	3	401	39	9.7%	12	23	1	3
Total all areas		347	115	33%	58	18	32	7				3%			
				(17%)	(9.4%)	(5.2%)						(0.2%)			(5.7%)

1. D.E. Eyles, U.S. Public Health Service.
 2. H.J. Fredericks, I.M.R., H.L.

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TABLE V
Prevalence of Malaria among Orang Asli in the deep jungle area.

Date	Total Examined	Total Positive	Falciparum	Vivax	Malariae	Mixed	Species Unknown
A. 1970	2,038	268 (13.2%)	200 (9.9%)	46 (2.2%)	11 (0.5%)	8	1
B. 1971	2,076	78 (3.8%)	26 (1.3%)	41 (1.9%)	4 (0.2%)	1	6

A = Slides taken prior to or within three months of start of D.D.T. spraying and weekly prophylaxis with Chloroquine and Pyrimethamine.
 B = Accumulated slides taken throughout 1971 after spraying with D.D.T. and weekly drug distribution for a period of over three months.

prophylaxis with Chloroquine and Pyrimethamine, are aimed at stopping malaria transmission and in this they have so far been unsuccessful. Over 90% of the dwelling houses in the deep jungle area are being sprayed with D.D.T. every three months but it is uncertain how effective this measure is for the following two reasons:—

(1) Most Orang Asli houses are fragile structures raised off the ground on stilts; they are constructed of bamboo with an attap (palm leaf) roof. There is space between the bamboo struts on the floor and often a large space between the top of the walls and the roof. Sometimes one side is left open. Some Orang Asli houses are nothing more than lean-to shelters open all round. The female anopheline mosquito, after feeding, might well prefer to rest on a lush jungle leaf outside the house which is often as easy to reach as the sprayed bamboo wall of the house.



The house of a Negrito Orang Asli. With only a small sprayed surface area for the mosquito to rest on after feeding, the mosquitoes probably rest outside the house.

(2) The Orang Asli probably spend a third of their nights away from home, hunting, fishing, or at distant cultivation sites when they sleep in temporary shelters either on the ground or in trees.

The main problem in giving the weekly prophylactic drug is one of distribution — people spread thinly over a large hilly terrain who are often away from home. There is also some resistance to taking the drug. It has not been possible suddenly to persuade 18,000 scattered people to take the weekly Chloroquine and Pyrimethamine. The adults have to be educated in the importance of taking the drug, the children have to be taught how to swallow the tablets and the workers have to learn how best to distribute the drug over a large expanse of jungle. All this takes time but the effectiveness of the drug distribution is gradually being increased.

Dr. Ivan Polunin thought that some of the high deep jungle Orang Asli were free from malaria in all groups when he examined them three months after they had been resettled. Malaria was prevalent among the highest groups (over 3,000 feet) in 1963 before the start of monthly prophylaxis. Most of the present 40 deep jungle control zones are centred on river valleys rising from below 1,000 feet to above 3,000 feet, so it is difficult to correlate the blood slides collected with altitude. However, the incidence of malaria now appears to be very low in the higher populations and transmission may have been interrupted in a few groups living over 3,000 feet.

The widespread use of Chloroquine could lead to an increase in the Chloroquine resistant strains. The United States Army Research Unit at the I.M.R. has made a number of surveys in the Orang Asli control area and elsewhere. No increase has been found in the prevalence of Chloroquine resistant *P. falciparum* strains which are present

TABLE VI
Malaria Blood Surveys by the United States Army Research Unit
in the deep jungle Orang Asli Area.*

Date	Number of trimonthly spraying cycles	Time on Weekly prophylaxis	Total Slides	Total Positive	Per cent Positive	F	V	Q	Mixed
SHEAN POST, PAHANG (1,600ft)									
March, 1970	0	0	115	25	22%	22	0	3	0
Oct. 1970	1	3/12	136	28	21%	20	5	2	1
Feb. 1971	2	7/12	171	4	2%	4	0	0	0
June. 1971	3	11/12	119	6	5%	4	2	0	0
Nov. 1971	5	16/12	192	34	18%	28	5	0	1
Feb. 1972	6	19/12	257	20	8%	19	1	0	0
SATAH, PAHANG. Jungle Fringe. (430ft)									
Sept. 1970	1	2/12	52	13	25%	8	1	4	0
Nov. 1971	5	16/12	132	19	14%	4	10	2	3
Feb. 1972	6	19/12	130	2	2%	1	0	1	0
KEMAR, PERAK (1,000 ft.)									
March. 1970	0	0	97	9	9%	8	0	1	0
July. 1970	1	3/12	57	6	10%	3	1	1	1
Dec. 1970	2	6/12	36	0	0	0	0	0	0
July. 1971	4	12/12	34	1	3%	1	0	0	0
BATU 7/BATU 14 JALAN PAHANG, TAPAH. Roadside Jungle Fringe. (300-1,200ft)									
Oct. 1970	1	3/12	74	41	55%	20	6	0	15
Nov. 1970	1	4/12	54	23	44%	17	2	0	4
July. 1971	4	12/12	74	9	12%	7	2	0	0

* Captain R. Andre (Personal Communication).

in about 5% of patients with *P. falciparum* infestions.

Iodised salt is distributed to the Orang Asli in the deep jungle. Attempts are being made to mix Chloroquine with this salt with the idea of using it on trial in a low population high altitude situation where the Orang Asli families are living in isolated hill top houses several miles apart.

Meanwhile, the present intention is to continue with the control programme and attempt to improve its implementation, especially in respect of the weekly prophylactic drug distribution.

Summary

Earlier malaria control measures among the Orang Asli are noted. From 1964, an attempt was

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made to give monthly prophylaxis with Chloroquine and Pyrimethamine to all Orang Asli. This reduced the prevalence of malaria from over 30% to around 10%. Starting in 1970, three monthly spraying of all houses with D.D.T. and weekly distribution of Chloroquine and Pyrimethamine has been implemented in the large deep jungle area in the north and centre of the Malay peninsula. There has been a further reduction in the prevalence of malaria in this area. The problems of implementing the programme are discussed. The

effectiveness of the D.D.T. spraying is questioned in view of the openness of the walls of the houses and the number of nights that the Orang Asli spend out of their houses.

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