

Malaria Field Studies Khok Salung, Lopburi

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OBJECTIVES: 1. To examine a population reportedly infected with a susceptible strain of P. falciparum possibly transmitted by a vector other than A. balabacensis. 2. To obtain parasites and sera from patients parasitized with P. falciparum for comparative studies using C^{14} -isoleucine protein-incorporation culture method.

BACKGROUND: From unpublished data obtained at Khok Salung in August 1965 it appeared that this village was sufficiently isolated and large enough to perform extensive field malaria studies. Because of its geographical location, Khok Salung was expected to provide a study population undisturbed by migration and external population pressure.

In August 1965, a sick-call survey of 166 villagers provided 46 cases of malaria; 37 cases of P. falciparum and 9 cases of P. vivax. Seven cases were studied and treated with a standard therapeutic course of chloroquine diphosphate. All cases responded to the therapy and remained smear-negative for a minimum period of 7 days. This indicated that there was a possibility to observe an incidence of chloroquine sensitive P. falciparum which is not known to exist elsewhere in Thailand. The geographic characteristics of this area do not appear to provide a suitable breeding environment for A. balabacensis, and a potential vector/parasite relationships which might contribute to our knowledge of the biology of susceptible and resistant malaria seemed possible.

DESCRIPTION: The initial step in this field study was to survey the school children and map the village to obtain baseline infection rates and the location of any malaria present in the village (Fig. 1 and Table 1). Throughout the study period P. falciparum infection rates at sick-call were maintained. In addition periodic visitations were made to the agricultural sites used by the villagers.

School visitations and sick-calls were held in smaller villages located throughout the agricultural area (Table 2). The agricultural area is bounded on all sides by low hills thereby isolating it from neighbouring areas. The study sites were located approximately 15-20 km from the low hills bordering the area. School surveys were again performed toward the end of the study period.

Mosquito biting collections were made during a three-month-period in the agricultural areas of interest (Table 3). Sites for biting collection were selected on the basis of incidence of malaria in villagers residing or working in the area.

Twenty-one patients parasitized with P. falciparum were treated and followed clinically for twenty-one days. C^{14} -isoleucine protein-incorporation studies were attempted on blood samples from five of these subjects.

RESULTS: A school survey of 1218 students in Khok Salung showed no parasitemic children. Since school was in session there was probably little or no migration of the students to the agricultural areas. It therefore seemed likely that transmission was not occurring in Khok Salung.

Surveys of 431 school children within the agricultural areas showed 8 positive cases of P. falciparum. Sick-calls held in the agricultural areas showed 41 (4.4%) cases of P. falciparum among 926 patients examined for malaria.

During the period of 10 July–28 October 1971, sick-call was held daily at the Khok Salung Health Center. Sixty cases (17.3%) of P. falciparum were detected among 347 patients screened for malaria. All of the positive smears except one were from persons who freely admitted travelling regularly to the agricultural area surrounding Khok Salung. Extensive questioning of villagers indicated little travel outside the village and agricultural area.

Mosquito biting collections made from 28 July–4 September 1971, showed an extremely low density of Anopheles mosquitoes and no evidence for the presence of A. balabacensis (Table 3). Among the Anopheles mosquitoes collected the only known malaria vector was A. minimus. No mosquito dissections to determine infections were performed.

Among the 21 malaria patients studied 9 cases were lost to complete follow-up. Of the remaining 12 cases, 7 infections were sensitive to chloroquine, 2 showed an R-I type resistance, recrudescence occurred between days 8 and 14, and 3 an R-II type resistance. No R-III resistance was observed.

Although several attempts were made to culture Plasmodium falciparum by the in vitro system incorporating C-14 tagged isoleucine, none were successfully concluded. During the period of transmission in the agricultural regions an erratic and undependable electrical power system was the only source available, and the cultures overheated or could not be properly incubated. A reliable generator was obtained at the beginning of the dry season when transmission declined abruptly. Contamination was only a minor problem when an ultra-violet light could be used. Dust, pollen and occasionally a fungus contaminated some of the culture wells. A continuing impediment was the lack of assurance that the patients had not visited one of the 4 quacks who practised in the village. Since no western medicine was available to them prior to the visit of the SMRL team, they depended largely upon the services of these unlicensed practitioners. Patients could not be included in the study group if suspicion arose that they were receiving other compounds.

The isoleucine uptake test proved to be practical as a field expedient, despite the occurrence of culture failures, as was later confirmed by studies in Yala.

Of particular interest was the change in malarial incidence and in the local terrain since the initial study in 1965. The low hills surrounding the region have been practically denuded of vegetation in the interests of the charcoal industry. Crops have been changed from exclusively rice to broad fields of corn. The forest around Khok Salung proper has been removed and low scrub shrubbery only persists. The river is 3 km away and the only additional available water is stored rainwater. Mosquitoes are not abundant in the village, and only near the new corn fields and the river can potential vectors be obtained. The activities of the villagers have altered the environment in such manner as to deprive the major vector of Thailand, A. balabacensis, with suitable breeding sites.

SUMMARY: A malaria field study has been performed in a geographically isolated village where migration and population movement pressure was minimum. Surveys showed that all malaria was contracted in the agricultural area surrounding the village, most of which was not accessible to the investigators. Mosquito biting collections showed an absence of A. balabacensis, that combined with the geographical conditions tends to indicate the possibility of transmission by a vector other than A. balabacensis.

Among 12 P. falciparum patients studied, 7 were sensitive to standard susceptible chloroquine therapy. A field trial of the C¹⁴-isoleucine culture system showed it could be performed in the field if a proper electrical power supply can be provided.

Table 1.
School Survey—Khok Salung and Surrounding Areas

School	No. Students	<u>P. falciparum</u> positive cases	
		May 1971	October 1971
Village (Khok Salung)	934	0	0
Monastery (Wat Nong Taming, Khok Salung)	284	0	0
Village (Manau Wan I)	121	1	0
Village (Manau Wan II)	199	0	0
Village (Suan Madua)	112	7	ND*

* Not done.

Table 2.
Sick-Call Observations

Area	No. Patients	<u>P. vivax</u>	<u>P. falciparum</u>
Khok Salung Health Center	324	7	53
District Manau Wan	291	3	10
Village of Suan Madua	635	1	31
Total	1,253	11	94

No mixed infections were observed during the study period.

Table 3.
Mosquito Biting Collections

Mosquito Species	Date of Collection			
	28 July'71	10 Aug'71	31 Aug'71	4 Sept'71
<i>Aedes (stegomyia) sp.</i>	101	104	41	0
<i>Aedes (neomelaniconion) sp.</i>	2	0	20	16
<i>Aedes (ochlerotatus) sp.</i>	0	0	66	0
<i>Aedes (adimorphus) sp.</i>	1	0	44	206
<i>Culex (culex) sp.</i>	24	54	58	44
<i>Mansonia sp.</i>	2	4	0	2
<i>Anopheles (cellia) minimus</i>	0	6	0	0
<i>Anopheles (cellia) vagus</i>	0	3	3	0
<i>Anopheles (cellia) subpictus</i>	0	2	0	0
<i>Anopheles (cellia) nivipes</i>	0	1	0	1
<i>Anopheles (cellia) tessellatus</i>	0	1	0	0
<i>Anopheles (anopheles) sp.</i>	0	0	2	28
Total	130	175	234	197



