

BANCROFTIAN FILARIASIS IN THAILAND, A NEW ENDEMIC AREA†

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In December 1964, the Faculty of Tropical Medicine was informed of many cases of hydrocele occurring among villagers of Sangkla-buri district, Kanchanaburi province of West Thailand (Map 1), by Dr. Douglas O. Corpron, Director of the Kwai River Christian Hospital of the United Christian Missionary Society (the only hospital in that area). We then visited the area in 1965-1967 with a strong suspicion that we were dealing with *Wuchereria bancrofti* infection. This report describes the discovery of a new endemic area of sub-periodic bancroftian filariasis, a new type of filariasis in Southeast Asia.



Map 1—Showing Kanchanaburi province and Sangkla-buri district where bancroftian filariasis was found.

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GENERAL DESCRIPTION OF THE AREA

Sangkla-buri district is situated on both banks of River Kwai Noi at latitude 15° N. in the north-west of Kanchanaburi province, and is about 200 kilometres from the town and 27 kilometres from the Thai-Burmese border (Map 1, Kanchanaburi is about 125 kilometres west of Bangkok). The mean height is about 150 metres above sea level. The district is divided into 3 cantons and 24 villages. Its central part of about 2-3 square kilometres is a plain where most of the people live; the surroundings partly hilly and forested and partly mountainous. The River with its three tributaries passing through the district is used as the main water supply by the people in the district. The population is about 3,800; most of them are Thai, some are Thai-Karens who like to travel from village to village. There are groups of Karens and Mons who settle in villages in the semiforested areas on the outskirts of the district; they frequently travel across the border to and from Burma. The occupations of the local people are hunting, collecting forestry products, growing rice crops and vegetables and raising poultry; most of them are poor and unhygienic. Communication with the district is usually by boat; in the dry season jeeps and trucks can reach the district through small rough pathways. Walking is the usual means of travel from village to village. The weather is warm in daytime and cool at night. It is very hot in summer and rather wet and humid during the rainy season. Mosquitoes are plentiful in the rainy season but are rare in the dry

season due to drying up of water-collections and water-beds. Intestinal helminthic infections are not uncommon. Malaria is prevalent in the rainy season (June-October).

Before 1960 there was no health service in this district. However, since 1961 when the Kwai River Christian Hospital was established, the health situation of the people in general has improved. In 1964 Dr. D. O. Corpron, Director of the Hospital observed that hydrocele, funiculitis and orchitis were not uncommonly seen among the residents in many villages, which led us to make investigations during 1965-1967. We repeated same investigations in 1968 and confirmed the presence of sub-periodic bancroftian filariasis.

METHODS AND PROCEDURES

During 1965-1967 and in 1968 a field station from the Faculty of Tropical Medicine was established in the Kwai River Christian Hospital in the municipality area of Sangkla-buri district. Blood examinations in the villagers and suspected animal hosts, mosquito catching and identification and dissections for larvae of filarial worms, and observations on hydrocele and other clinical signs of filariasis in individuals were performed. The procedures have been described in detail elsewhere (Harinasuta *et al*, 1964).

Seventeen persons aged 8-67 years, with moderate number of microfilariae in the peripheral blood (about 20-80 microfilariae per 40 c.mm. blood during 18.00-20.00 hours) were chosen for study of the microfilarial periodicity. All subjects worked by day and appeared to be physically healthy. Blood films of 40 c.mm. were taken from each individual at 2-hour intervals throughout 24 consecutive hours and examined in the usual way. The results are discussed below.

The clinical features of filariasis in this area were analysed and recorded in detail.

RESULTS

1. Infection rates

a. Area in Sangkla-buri along River Kwai Noi (Map 2)

Blood examinations were made on 1,549 persons of 10 villages (about 40 per cent of the total population of the district), of whom 203 (13.1 per cent) had microfilariae in the blood; all the microfilariae were *Wuchereria bancrofti*. There were 135 cases (8.7 per cent) with clinical filariasis (hydrocele, funiculo-orchitis, etc.) Details are shown in Table 1.

b. Area along River Maenam Mae Klong (Map 1-2)

In the eastern part of Kanchanaburi province, another river called "Maenam Mae Klong" runs parallel to River Kwai Noi, the upper parts of the two rivers being about 40-50 kilometres apart. Blood examinations for microfilariae of *W. bancrofti* and observations on the clinical manifestations of bancroftian filariasis were made in 10 villages along the upper part of River Maenam Mae Klong. The results revealed the presence of a few positive cases in some villages only, as shown in Table 2.

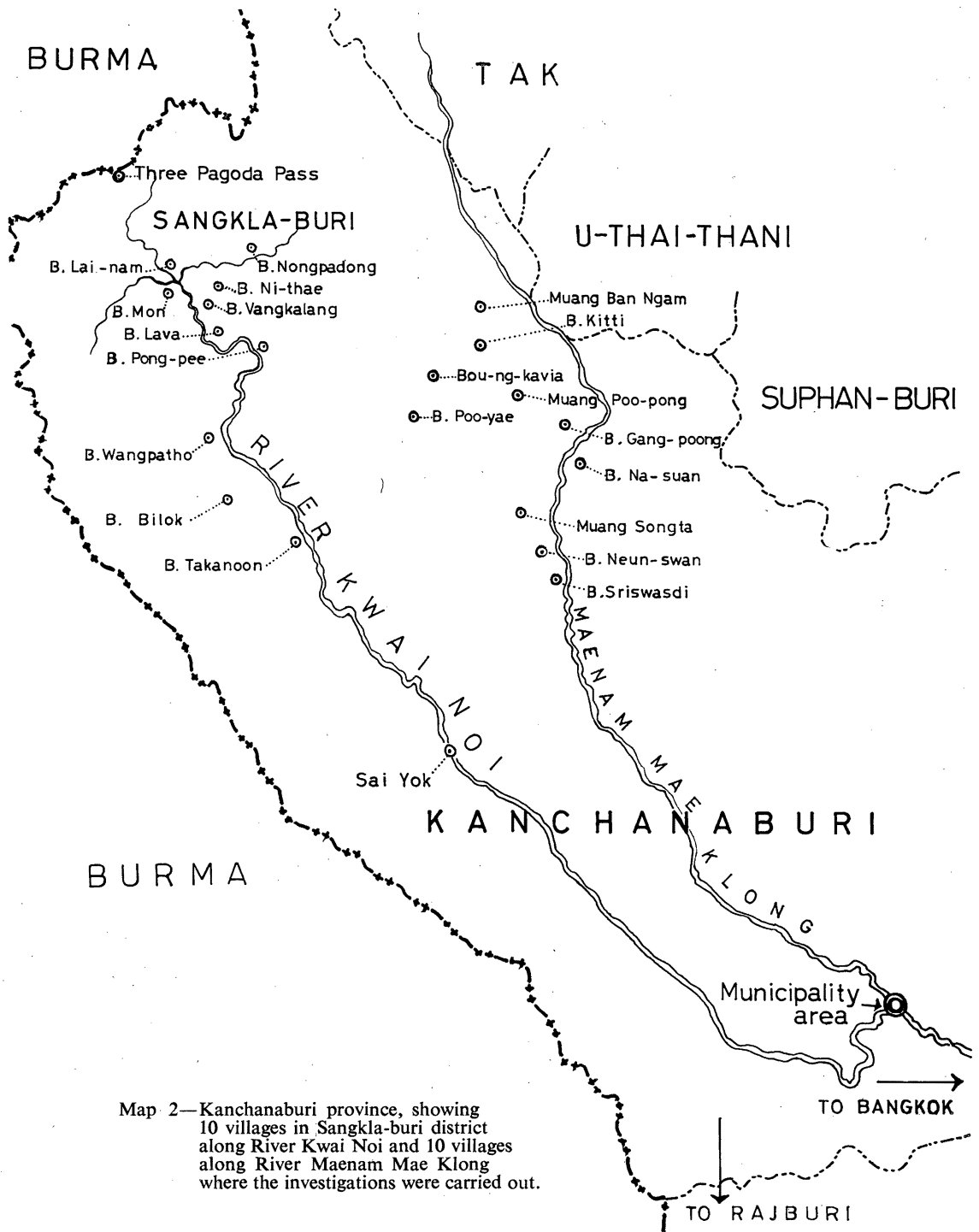
2. Age and sex

The age-group distribution of 203 individuals from Sangkla-buri with microfilariae was studied. The youngest was 2 years of age, the oldest was 87. The ratio of males to females was about 2:1. Details are shown in Table 3.

3. Microfilarial density*

The density of microfilariae in those 203 positive cases was also calculated. It was found that the average number of micro-

* Since the numbers of microfilariae seen in the blood films in general were not large, a volume of 40 c.-mm. blood was adopted as the standard sample for comparing the results.



Map 2—Kanchanaburi province, showing 10 villages in Sangkla-buri district along River Kwai Noi and 10 villages along River Maenam Mae Klong where the investigations were carried out.

Table 1
 Showing the results of blood examinations for microfilariae of
W. bancrofti in 10 villages of Sangkla-buri along River Kwai Noi.

Village	No. exam.	Mf-positive		No. with clinical filariasis.	
		No.	Per cent	No.	Per cent
1. B. Nongpadong	36	10	27.8	0	0
2. B. Lai-nam	319	47	14.7	27	8.5
3. B. Mon	111	4	3.6	13	11.7
4. B. Ni-thae	433	57	13.2	20	4.6
5. B. Vangkalang	53	11	20.8	29	54.7
6. B. Lava	103	21	20.4	12	11.7
7. B. Pong-pee	81	18	22.2	7	8.6
8. B. Wang patho	226	20	8.8	13	5.8
9. B. Bilok	54	6	11.1	6	11.1
10. B. Takanoon	133	9	6.8	8	6.0
Total	1,549	203	13.1	135	8.7

Table 2
 Showing the results of examinations for bancroftian filariasis in 10 villages
 along River Maenam Mae Klong in Kanchanaburi province.

Village	No. exam.	No. of mf-positive for <i>W. bancrofti</i>	No. of cases of hydrocele, funiculo-orchitis, etc.
1. Muang Ban Ngam	37	0	2
2. B. Kitti	83	3	1
3. B. Bou-ng-kavia	35	5	3
4. Muang Poo-pong	22	5	0
5. B. Poo-yae	10	3	3
6. B. Gang-poong	40	0	0
7. B. Na-suan	77	1	1
8. Muang Songta	21	0	0
9. B. Neun-swan	45	0	0
10. B. Sriswasdi	154	0	0
Total	524	12 (2.3%)	10 (1.9%)

Table 3

Showing the results of blood examinations for microfilariae of *W. bancrofti* in 10 villages along River Kwai Noi according to age and sex.

Age-groups	Males		Females		Both sexes		
	No.	No.	No.	No.	No.	Mf-pos.	
	Exam.	Mf-pos.	Exam.	Mf-pos.	Exam.	No.	Per cent
0-4	114	1	96	1	210	2	1.0
5-9	96	2	115	6	211	8	3.8
10-14	98	2	118	5	216	7	3.2
15-19	60	5	67	5	127	10	7.9
20-24	59	12	66	9	125	21	16.8
25-29	72	19	52	6	124	25	20.2
30-34	82	20	65	10	147	30	20.4
35-39	55	18	36	4	91	22	24.2
40-44	44	18	32	4	76	22	28.9
45-49	48	11	26	2	74	13	17.6
50-54	33	10	24	7	57	17	29.8
55-59	17	5	14	1	31	6	19.4
60+	29	14	31	6	60	20	33.3
Total	807	137 (17.0%)	742	66 (8.9%)	1549	203	13.1

filariae per positive individual was 29.32 per 40 c.mm. blood, and the mean microfilarial density of all films examined was 3.84 per

40 c.mm. blood. 60.3 per cent of the positive cases showed 1-20 microfilariae per 40 c.mm. blood. Details are shown in Table 4.

Table 4

Comparing the density of microfilariae of *W. bancrofti* in all 203 positive cases from Sangkla-buri.

No. of microfilariae per 40 c.mm. blood	Males	Females	Both sexes
1-10	48	37	85 (41.8%)
11-20	22	13	35 (18.5%)
21-30	16	6	22 (10.8%)
31-40	10	5	15 (7.3%)
41-50	14	1	15 (7.4%)
51-100	18	2	20 (9.8%)
101-200	9	2	11 (5.4%)
Total	137	66	203 (100.0%)

4. Microfilarial periodicity

The periodicity of the microfilariae was studied in 17 positive cases, all of which

showed nocturnal periodicity, with peak counts at 18.00-22.00 hours. However, it was observed that the microfilariae were also present in significant numbers in the peri-

pheral blood during the daytime in all. When each count was expressed as a percentage of the peak count in the particular individual (Turner and Edeson, 1957), the

mean counts at 10.00-12.00 hours were more than 20% of the peak count, indicating a nocturnal sub-periodic character. Details are shown in Table 5 and Fig. 1.

Table 5

Showing the counts of microfilariae of *W. bancrofti* and (in brackets) the counts expressed as percentages of the peak count in 17 microfilaria carriers in 10 villages in Sangklaburi along River Kwai Noi, Kanchanaburi province, taken at 2 hours intervals over a period of 24 hours (maximum counts bold), all being males.

Carrier No.	age	Microfilariae counts at hours/40 c.mm. blood											
		10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	2.00	4.00	6.00	8.00
1.	26	15(25)	19(32)	23(39)	55(93)	37(63)	59(100)	20(34)	11(19)	9(15)	23(38)	6(12)	7(12)
2.	36	11(17)	23(35)	26(41)	35(55)	48(75)	59(92)	64(100)	6(6)	16(25)	14(22)	11(17)	8(13)
3.	45	8(73)	3(27)	2(18)	11(100)	9(81)	11(100)	8(73)	7(63)	5(43)	11(100)	3(27)	2(18)
4.	35	3(11)	1(5)	6(23)	7(27)	11(42)	10(35)	3(11)	5(19)	8(31)	26(100)	2(8)	1(5)
5.	24	5(5)	31(29)	41(38)	48(45)	52(49)	94(51)	107(100)	93(89)	96(90)	76(66)	3(8)	8(8)
6.	20	30(32)	39(41)	29(31)	94(98)	95(100)	90(97)	76(81)	29(31)	19(21)	5(5)	11(12)	19(21)
7.	30	7(8)	13(14)	28(32)	71(81)	77(87)	88(100)	57(64)	54(61)	24(27)	76(86)	29(33)	12(13)
8.	31	10(12)	9(11)	35(43)	42(92)	53(66)	81(100)	72(89)	13(11)	20(25)	37(46)	7(8)	6(7)
9.	8	27(11)	25(10)	38(11)	56(23)	89(32)	173(71)	241(100)	146(61)	147(61)	120(41)	56(23)	64(22)
10.	16	6(50)	5(42)	11(92)	6(50)	4(33)	2(17)	5(42)	12(100)	1(8)	4(33)	5(42)	2(17)
11.	38	11(26)	17(39)	26(64)	12(28)	24(56)	43(100)	25(58)	31(72)	24(56)	7(16)	2(5)	4(9)
12.	67	8(18)	3(7)	16(35)	28(62)	28(62)	43(95)	21(47)	45(100)	23(51)	13(29)	7(25)	6(13)
13.	53	4(10)	4(10)	12(32)	21(55)	33(87)	38(100)	12(32)	24(63)	17(45)	14(37)	7(18)	3(8)
14.	52	29(38)	28(36)	57(74)	51(66)	75(95)	77(100)	25(32)	59(72)	39(51)	43(56)	12(16)	17(22)
15.	42	9(12)	32(41)	35(45)	33(42)	8(11)	39(50)	78(100)	28(36)	14(18)	8(11)	7(9)	9(12)
16.	36	10(22)	11(24)	77(66)	12(27)	27(60)	34(76)	45(100)	17(38)	16(36)	13(29)	16(36)	7(16)
17.	33	5(6)	28(35)	39(48)	36(44)	55(68)	81(100)	78(96)	42(52)	12(15)	35(43)	13(16)	9(11)
Average		22.1%	25.8%	43.1%	58.1%	62.8%	81.4%	68.2%	52.5%	36.4%	44.6%	18.5%	13.4%

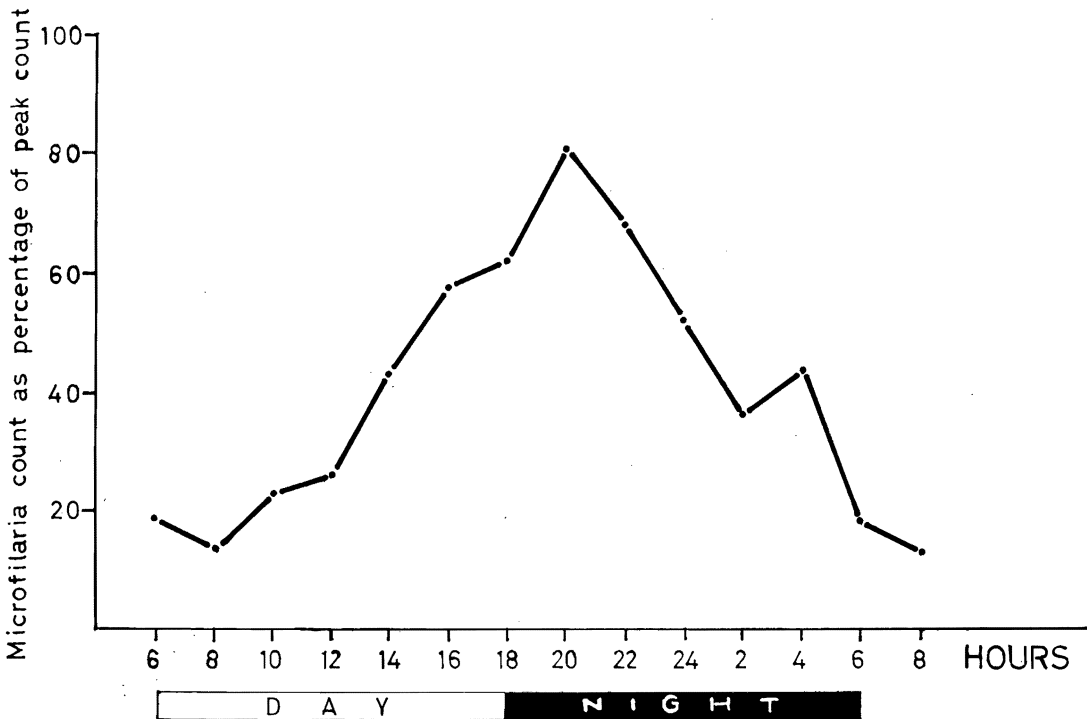


Fig. 1— Showing the periodicity of *W. bancrofti* microfilariae in Sangkla-buri district, Kanchanaburi province of West Thailand (based on 17 cases).

5. Clinical manifestations

Of the 1549 persons examined, 135 cases (8.7%) had clinical features of bancroftian filariasis which included funiculo-orchitis in 115 cases (7.4%), hydrocele in 47 (3.0%),

chyluria in 17(1.1%), edema of legs in 5(0.3%) and low abdominal pain in 1 (0.06%); many cases had two or more clinical symptoms and signs. The ratio of males to females was about 22:1. Details of the clinical manifestations are shown in Table 6.

Table 6

Showing the clinical manifestations* of bancroftian filariasis in 135 cases in 10 villages in Sangkla-buri along River Kwai Noi, Kanchanaburi province.

Symptoms and signs	No. of cases		
	Males	Females	Both sexes
1. Funiculo-orchitis	72	0	72
2. „ + hydrocele	31	0	31
3. „ + hydrocele + chyluria	2	0	2
4. „ + hydrocele + chyluria + edema of legs	1	0	1
5. „ + chyluria	6	0	6
6. „ + chyluria + edema of legs	1	0	1
7. „ + edema of legs	2	0	2
8. Hydrocele	12	0	12
9. Hydrocele + edema of legs	1	0	1
10. Chyluria	1	5	6
11. Chyluria + low abdominal pain	0	1	1
Total	129	6	135

* Fever was not included in this series because of the high incidence of malaria infection in the area (about 30% at the time of study).

The age-group distribution of the cases with clinical manifestation was studied, especially those with funiculo-orchitis (115 cases) and hydrocele (47 cases). The results are shown in Table 7.

The lesions of all 135 cases with positive symptoms and signs in connection with microfilaraemia were studied. Details are recorded in Table 8.

6. Animal hosts

The blood of 31 cats and 12 dogs (there were not many domestic animals in Sangkla-buri) were examined. Only microfilariae of

Dirofilaria immitis were found in one dog. No *W. bancrofti* was discovered in any animal.

7. Mosquitoes in the area

Two field stations for catching mosquitoes (by human bait method at 18.00-20.00 hours) were set up at the villages of Lai-nam and Ni-thae, where the microfilarial positive rate was 14.7% and 13.2% respectively. Three periods of survey of mosquitoes were made during May 1965 - June 1966 (14 months). The total number of mosquitoes collected was 9,303 (2,538 mosquitoes in the first period, 1,581 in the second and 5,184 in the third) which consisted of 6 genera and 47 species. Details are shown in Tables 9 and 10.

Table 7

Showing the funiculo-orchitis and hydrocele in bancroftian filariasis in Sangkla-buri according to age and sex.

Age-groups	No. exam.	Funiculo-orchitis		Hydrocele	
		No. positive	Per cent	No. positive	Per cent
0-14	637	3	0.5	1	0.2
15-19	127	5	3.9	1	0.8
20-24	125	6	4.8	0	0
25-29	124	17	13.7	3	2.4
30-34	147	22	15.0	7	4.8
35-39	91	27	29.7	8	8.8
40-44	76	6	7.9	5	6.6
45-49	74	11	14.9	9	12.2
50-54	57	6	10.5	7	12.3
55-59	31	4	12.9	1	3.2
60 +	60	8	13.3	5	28.3
Total	1549	115	7.4	47	3.0

Table 8

Showing the distribution of the lesions in 135 clinical cases of bancroftian filariasis and the findings of microfilariae among them.

Clinical features	No. of cases			Total	No. with microfilariae in blood
	With rt-sided	With lt-sided	With both-sided		
Funiculo-orchitis	56	41	18	115	42 (36.5%)
Hydrocele	22	16	9	47	15 (31.9%)
Chyluria	-	-	-	17	5 (29.4%)
Edema of legs	3	1	1	5	3 (60.0%)

Table 9

Showing the total species of mosquitoes caught at Lai-nam and Ni-thae village of Sangkla-buri district by human bait method during May 1965-June 1966.

Genus	No. of species collected	No. of mosquitoes collected
<i>Aedes</i>	15	4,167 (44.8%)
<i>Anopheles</i>	18	2,851 (30.6%)
<i>Armigeres</i>	5	552 (5.5%)
<i>Culex</i>	7	1,762 (18.5%)
<i>Mansonia</i>	1	5 (0.05%)
<i>Udaya</i>	1	2 (0.02%)
Total	47	9,303

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Table 10

Showing the detailed species of mosquitoes caught and dissected in Lai-nam and Ni-thae villages of Sangkla-buri district by human bait method during May 1965 - June 1966.

Genus	Species	No.collected	No.dissected
<i>Aedes</i>	<i>aegypti</i>	10	10
	<i>albopictus</i>	580	571
	<i>albotaeniatus</i>	60	60
	<i>alboscuteclatus</i>	2	1
	<i>annaldali</i>	3	1
	<i>caecus</i>	57	57
	<i>flavipennis</i>	1	-
	<i>harveyi</i>	557	545
	<i>khazani</i>	6	2
	<i>lineatopennis</i>	3	3
	<i>niveus group</i>	2,775	2,750
	<i>poecilus</i>	23	23
	<i>stenoctrus</i>	11	11
	<i>vexans</i>	76	76
	<i>vittatus</i>	1	-
<i>Anopheles</i>	<i>aconitus</i>	1	1
	<i>aitkeni</i>	1	-
	<i>annularis</i>	1	1
	<i>argyropus</i>	12	12
	<i>balabacensis</i>	59	55
	<i>barbumbrosus</i>	11	9
	<i>campestris</i>	67	62
	<i>kochi</i>	83	78
	<i>maculatus</i>	1,511	1,468
	<i>minimus minimus</i>	261	220
	<i>nigerrimus</i>	6	6
	<i>philippinensis</i>	209	209
	<i>peditaeniatus</i>	12	12
	<i>subpictus malayensis</i>	1	1
	<i>subpictus subpictus</i>	1	1
	<i>tessellatus</i>	2	2
	<i>umbrosus</i>	1	1
<i>vagus</i>	612	587	
<i>Armigeres</i>	<i>annulipalpis</i>	10	10
	<i>annulitarsis</i>	366	360
	<i>flavus</i>	104	104
	<i>magnus</i>	9	9
	<i>subalbatus</i>	63	60

Table 10 (continued)

Genus	Species	No. collected	No. dissected
<i>Culex</i>	<i>bitaeniorhynchus</i>	14	14
	<i>fuscocephalus</i>	78	75
	<i>fatigans</i>	52	50
	<i>gelidus</i>	6	6
	<i>sinensis</i>	29	29
	<i>tritaeniorhynchus</i>	1,296	1,269
	<i>whitmorei</i>	251	251
<i>Mansonia</i>	<i>uniformis</i>	5	5
<i>Udaya</i>	<i>argyrurus</i>	2	2
Total	47 species	9,303	9,079

8. The mosquito vector

From 9,079 dissections, *W. bancrofti* larvae in stage I were found in 25 mosquitoes of 2 *Aedes* and 3 *Anopheles* species, in Stage II in

6 mosquitoes of 2 *Aedes* and 1 *Anopheles*, and in Stage III in 6 *Aedes niveus* mosquitoes. *Dirofilaria* spp. larvae in stages I-III were also found in *Aedes* and *Anopheles* mosquitoes. Details are summarized in Table 11.

Table 11

Showing the detailed results of positive mosquitoes with larvae of *W. bancrofti* and *Dirofilaria* spp.

No.	Species	No. dissected	No. of positives for <i>W. bancrofti</i>				No. of positive for <i>Dirofilaria</i>			
			Stage			Total	Stage			Total
			I	II	III		I	II	III	
1.	<i>Ae. albopictus</i>	571	-	-	-	-	-	-	2	2
2.	<i>Ae. albotaeniatus</i>	60	-	-	-	-	-	1	-	1
3.	<i>Ae. caecus</i>	57	-	-	-	-	-	-	2	2
4.	<i>Ae. harveyi</i>	545	4	2	-	6	-	1	-	1
5.	<i>Ae. niveus</i> group	2724	13	3	6	22	2	-	-	2
6.	<i>Ae. vexans</i>	76	-	-	-	-	-	-	1	1
7.	<i>An. barbumbrosus</i>	9	-	-	-	-	-	-	1	1
8.	<i>An. campestris</i>	62	-	-	-	-	-	-	4	4
9.	<i>An. maculatus</i>	1468	4	-	-	4	1	-	-	1
10.	<i>An. minimus minimus</i>	220	2	-	-	2	-	-	-	-
11.	<i>An. philippinensis</i>	209	-	-	-	-	-	-	1	1
12.	<i>An. vagus</i>	587	2	1	-	3	-	-	3	3

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Of all 5 species of mosquitoes found to have *W. bancrofti* larvae, the infection rate of filariasis in *Ae.harveyi*, *Ae.niveus* group, *An. maculatus*, *An. minimus minimus* and *An. vagus* were 1.11%, 0.81%, 0.27%, 0.91%

and 0.51% respectively. However, only *Ae. niveus* was found to harbour the infective larvae, i.e. 20 infective larvae of *W. bancrofti* in 6 *Ae. niveus* group, an infective rate of 0.22%. Details are shown in Table 12.

Table 12

Showing the infection rate and infective rate of *W. bancrofti* in the mosquitoes caught at two field stations in Sangkla-buri district during May 1965 - June 1966.

Species	No. mosq. dissected	No. mosq. with larvae at stage			Infection rate per cent	Infective rate per cent
		I	II	III		
<i>Ae. niveus</i> group	2,724	13	3	6	0.81	0.22
<i>Ae. harveyi</i>	545	4	2	0	1.11	-
<i>An. maculatus</i>	1,468	4	0	0	0.27	-
<i>An. minimus minimus</i>	220	2	0	0	0.91	-
<i>An. vagus</i>	587	2	1	0	0.51	-

We have concluded that *Aedes niveus* group is probably the main natural vector of bancroftian filariasis in Sangkla-buri district of West Thailand.

DISCUSSION

The studies in this report reveal a new endemic area of bancroftian filariasis discovered in Thailand.* The interesting thing is that the infection is caused by sub-periodic *Wuchereria bancrofti*** which was recorded previously only in a few cases in Vietnam (Canet, 1952) and in the Philippines (Cabrera and Rozeboom, 1965). The mosquito vector has been found to be *Aedes niveus* group which has not been described before so far as is known. The clinical features of this strain of *W. bancrofti* are mostly the involvement of the genitalia and the urinary system of males,

considerable number of whom had microfilariae in the peripheral blood.

This sub-periodic bancroftian filariasis was located in Sangkla-buri district, Kanchanaburi province of West Thailand, which is a rural, elevated and semiforested area. It was largely confined to the western part of Kanchanaburi along the upper third of River Kwai Noi close to the Thai-Burmese border (we also made surveys on villagers residing along the lower part of River Kwai Noi but found no evidence of filariasis), but was present very rarely in the eastern part (River Maenam Mae Klong) of the province (Map 2). The microfilaria rates in 10 villages in the endemic area ranged from 3.6 to 27.8 per cent, the average being 13.1 per cent.

The microfilaria rate was low in children, being 1.0 per cent and 3.8 per cent in the 0-4-year and 5-9-year group respectively. It gradually increased up to 28.9 per cent in the 40-44-age group. In the higher groups the rate fluctuated, varying between 17.6 per cent and 33.3 per cent (Table 3).

* Wongsathuaythong *et al.* in 1963 reported many cases of bancroftian filariasis found in Narathiwat province, South Thailand not far from the Thai-Malaysian border.

** This finding was confirmed by a group of workers from many institutions who visited Sangkla-buri in August 1968 (Harinasuta *et al.*, 1970)

The youngest person harbouring the microfilariae was 2 years of age; the oldest was 87.

The average number of microfilariae per positive individual was not high, i.e. 29.3 per 40 c.mm. blood; 60.3 per cent of positives had an average of 1-20 microfilariae per 40 c.mm. blood (Table 4); 15.2 per cent of them had an average of 51-200 microfilariae per 40 c.mm. blood.

The microfilariae had a nocturnal sub-periodic character with peak counts at 18.00-22.00 hours. More males (17.0 per cent) had microfilariae in the blood than females (8.9 per cent) (Table 3). Clinical features were much commoner in males (129 cases) than in females (6 cases) (Table 6).

Out of 135 cases, 115 (85.2 per cent) had funiculo-orchitis. This symptom occurred in the youngest person aged 6 years old and in the oldest man of 80 years of age. The incidence of this symptom was very low in the children, being 0.5 per cent in the 0-14-year group. It increased with age, being 29.7 per cent in the 35-39-year group. In the higher groups the rate fluctuated, ranging from 7.9 per cent to 14.9 per cent (Table 7).

Out of 115 funiculo-orchitis cases, 42 (36.5 per cent) harboured microfilariae in their blood (Table 8).

In the case of hydrocele, the youngest patient was 9 years old; he had had the first sign one year previously and harboured 42 microfilariae per 40 c.mm. blood. The oldest patient was 87 years of age; he also harboured the microfilariae.

The results in Table 8 indicated that more cases had the symptoms of funiculo-orchitis and hydrocele on the right side than on the left or on both sides.

Most of the 17 chyluria cases were in the 20-29 age group; 11 were males and 6 females. Microfilariae were found in 5.

No elephantiasis was seen. There was slight edema of the legs with some pitting on pressure in 5 cases, 3 of which showed microfilariae in the blood.

The domestic animals in the district were not found to harbour microfilariae of *W. bancrofti*.

Surveys of the local mosquitoes for the natural vector of *W. bancrofti* in the first year of our investigations were performed without success. *Ae. harveyi*, *An. maculatus*, *An. minimus minimus* and *Culex fatigans* were suspected of being the vectors. In the second year it was found that infective larvae were seen in many *Ae. niveus* group mosquitoes. Thus we consider *Aedes niveus* group as the natural vector of this strain of sub-periodic *W. bancrofti*, with an infective rate of 0.22 per cent.

SUMMARY

1. A new endemic area of *Wuchereria bancrofti* infection in Thailand was discovered in 1965. It was in Sangkla-buri districts, Kanchanaburi province of West Thailand, along the upper part of River Kwai Noi close to the Thai-Burmese border. The area is rural, elevated and semiforested.

2. According to surveys made in 1965-1967, the microfilaria rates among villagers in 10 villages ranged from 3.6 per cent to 27.8 per cent, an average of 13.1 per cent. The youngest person who harboured microfilariae in the blood was 2 years of age, the oldest was 87. The ratio of males to females was about 2:1.

3. Microfilarial periodicity was studied in 17 persons; in every case it was found to be

nocturnal sub-periodic with peak counts at 18.00-22.00 hours.

4. Clinical manifestations were found in 8.7 per cent of the people examined. They consisted mainly of funiculo-orchitis and hydrocèle (94.8 per cent); chyluria, edema of legs and low abdominal pain were found in some cases. There was no elephantiasis.

5. The blood of 31 cats and 12 dogs was examined. No *W. bancrofti* microfilariae were recovered.

6. Mosquitoes in the area were caught and identified. In 9,079 dissections (including 2,724 *Aedes niveus* group) the infective rate in *Aedes niveus* was 0.22 per cent. *W. bancrofti* larvae in stage I and stage II were also found in *Ae. harveyi*, *An. maculatus*, *An. minimus minimus* and *An. vagus*, the infection rate for which was 1.17, 0.27, 0.91 and 0.51 per cent respectively. Since stage III (infective) larvae were found only in *Aedes niveus* group, this mosquito is regarded as the natural vector of bancroftian filariasis in this area.

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