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FILARIASIS AMONG ABORIGINES AND MALAYS LIVING CLOSE TO KUALA LUMPUR

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Introduction

Surveys to determine the incidence of filariasis among aborigines in Malaya are not many. Polunin (1951, 1953) while studying their medical problems reported the existence of malaria and filariasis (**Brugia** only) among aborigines inhabiting the hill forests of Pahang, Perak and Selangor. Wharton, Laing and Cheong (1963) made a number of preliminary investigations for malaria and filariasis among groups of aborigines in Selangor, Pahang and Perak states and their findings show a surprisingly high incidence of filariasis among aborigines living in comparatively close proximity to Kuala Lumpur, many of them being infected with **Wuchereria bancrofti**. It used to be thought that **W.bancrofti** infection occurred only among immigrants from India and China, until the findings of Wharton (1960) showed that the infection was present among rural Malays in Pahang living in complete isolation from urban populations. Laing and Wharton (1960) also found another focus of **W. bancrofti** among aborigines in the same locality and since then various small endemic foci have been recorded from several parts of Malaya, but these have not yet been fully investigated.

Laing and Wharton (1960) reported a 16% microfilariæ rate among aborigines living in Bukit Lanjan, a small village 10 to 12 miles from the city of Kuala Lumpur. 9 out of 43 people examined were positive for microfilariæ, and of these, 6 were a mixed infection of **W. bancrofti** and **B. malayi,** 2 of **B. malayi** and 1 of **W. bancrofti**. In most parts of Asia, **W. bancrofti** is transmitted by mosquitoes belonging mainly to the **Culex pipiens** group. In Malaya **C. pipiens fatigans** is a common house breeding mosquito and is found in abundance all over Kuala Lumpur. Thus with a focus of infection so close to the city of Kuala Lumpur, and with mosquitoes which may be potential transmitters, an investigation to assess the risks, if any, of the infection spreading to the urban areas of Kuala Lumpur was decided upon.

The investigations based on (a) a house to house population census, (b) blood parasite survey of man and domestic animals and (c) preliminary entomological investigations are reported here.

Topography, population and occupation

Bukit Lanjan is a small village situated in an inland hill area between the 10th and 11th milestones of Sungei Penchala Road in the Mukim of Batu and Sungei Buloh. It is about 3 miles from the town of Kepong, 5 to 6 miles from the new town of Petaling Jaya and 10 to 12 miles from the city of Kuala Lumpur. The village adjoins the border of Sungei Buloh forest reserve and has a population of 230 Temiar aborigines living in 3 groups and 148 Malays in 2 groups, all in close proximity to each other (see Fig. 1).

The houses are mostly on stilts with wooden walls and attap palm roofs. Most of the Malay population work in the towns of Kepong and Petaling Jaya. The aborigines, with the exception of a few who work in a nearby granite quarry, obtain their living from various pursuits in the jungle. They are under the protection of the Department of Aborigines. The aborigines and Malays have been living in the area for well over 60 years.

Parasitological Investigations

POPULATION SURVEY:

A house to house census of each group of aborigines and Malays was made. Each house was given a number which was exhibited clearly on the front. The following particulars of each family were recorded:— number in family, age, sex, length of residence,

TABLE I

Total Population	Total Examined	Percentage Examined	FILARIASIS					CLINICAL HISTORY	
			Number Positive	Microfilariæ Rate	B. malayi	W. bancrofti	Mixed Infection	Filarial Fever	Elephantiasis
148 MALAYS	110	74	2	1.8	2	0	0	2	0
230 ABORS.	167	73	29	17.3	15	10	4	11	0

clinical history of filariasis infection, and number and type of domestic animals kept. A sketch map of the locality showing the distribution of houses was also made.

BLOOD SURVEY:

Blood films of all those who could be persuaded to co-operate were taken after 7.00 p.m. 20c.mm. of blood was taken from the finger with a measured pipette and a thick smear made. Films were stained in Geimsa and examined for microfilariæ.

Random samples of blood were also taken from domestic animals available at each house during the day. Samples taken were from dogs, cats and monkeys.

Results

Table I summarises the results of blood surveys on the Malay and aborigine populations. There was no infection of **W. bancrofti** among the Malays and no cases of elephantiasis were seen in either group. Although a history of "kelinja" meaning filarial swelling or fever was recorded from a few persons, their accuracy cannot be taken without reservation. Of the 14 cases of **W. bancrofti** infections 8 were males between 20 to 40 years old and only 3 were adult females. The youngest person infected with **W. bancrofti** was a girl aged 4 and the oldest was a woman aged 60.

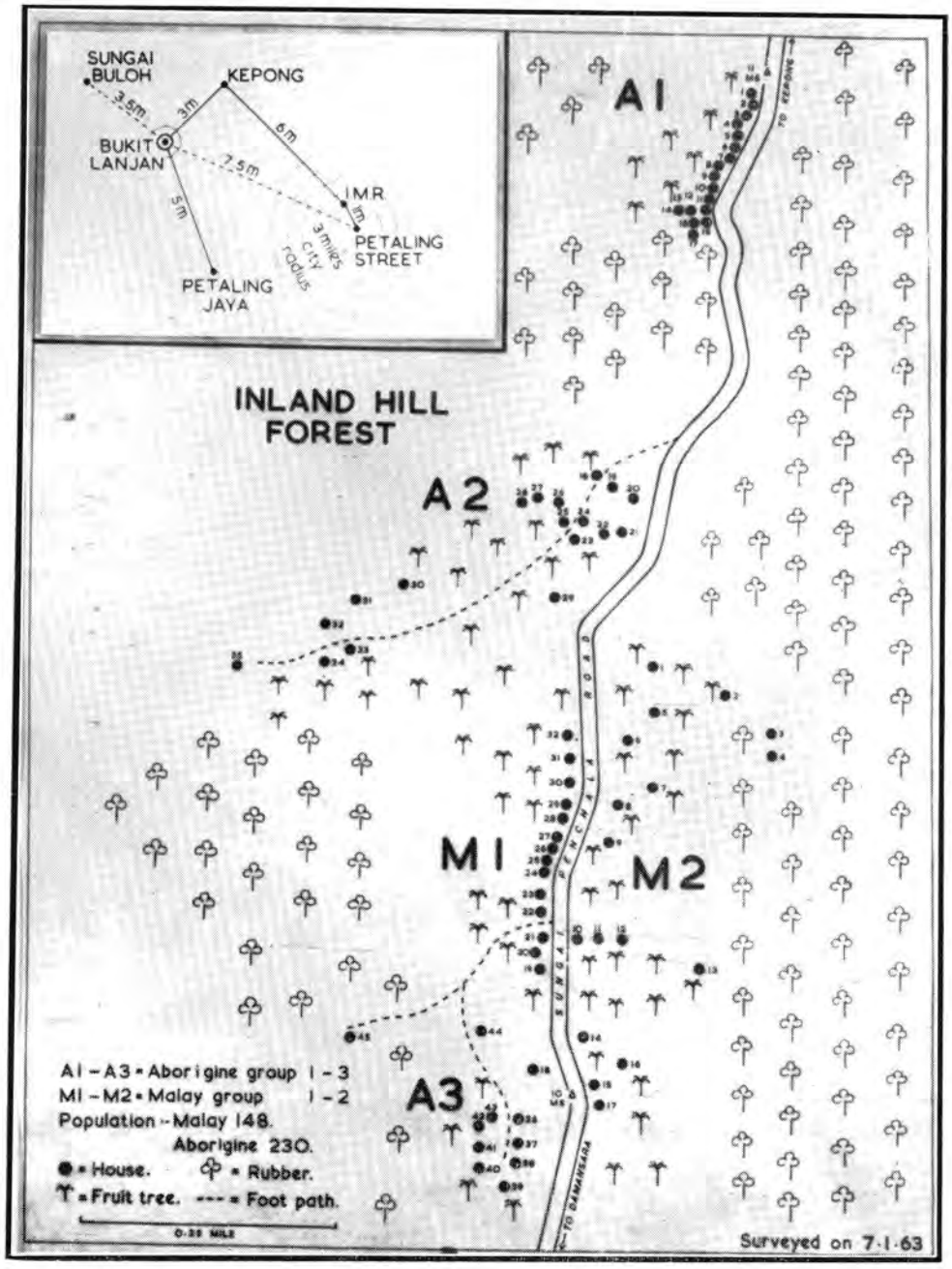
The results of the blood examination for filarial parasites in various domestic animals examined at Bukit Lanjan village is given in Table II. None of the animals showed infection with **B. malayi** although **B. pahangi** was found in 4 of the dogs examined.

Periodicity studies were made on 6 abori-

TABLE II

Animal	Number Examined	FILARIAL INFECTION		
		B. Malayi	B. Pahangi	D. Immitis
Cats	15	0	0	0
Dogs	10	0	4	4
Macaca Monkey	3	0	0	0

FIG. 1. Showing map of Bukit Lanjan vollage.



gines. 2 of them having **W. bancrofti** infection, 2 **B. malayi** and 2 having both the infections. 2 hourly microfilariæ counts on 20c.mm. of blood taken by finger prick was made starting at 10.00 a.m. and ending at 10.00 a.m. the following day. All the infections exhibited characteristic nocturnal periodicity, thereby showing infections were of periodic **W. bancrofti** and periodic **B. malayi.** The periodic **B. malayi** blood films when stained with Geimsa showed characteristic empty sheaths as well. Table III gives the microfilariæ counts obtained from the aborigines at 2 hourly intervals.

TABLE III

SPECIES	Name of Carrier	10.00 a.m.	Noon	2.00 p.m.	4.00 p.m.	6.00 p.m.	8.00 p.m.	10.00 p.m.	Mid-night	2.00 a.m.	4.00 a.m.	6.00 a.m.	8.00 a.m.	10.00 a.m.
W. bancrofti	J	0	0	1	0	3	7	13	11	10	11	10	6	0
	D	10	4	1	2	11	206	279	219	213	305	209	109	15
B. malayi	MO	3	0	1	1	1	5	28	35	35	43	23	25	8
	MA	2	0	0	0	2	39	78	126	92	149	126	32	4
Mixed Infection	W. bancrofti	8	0	0	0	6	22	94	131	157	125	111	23	20
	B. malayi	12	1	0	0	0	1	18	45	98	55	53	31	40
	W. bancrofti	0	0	1	0	2	13	9	15	33	32	8	4	0
	B. malayi	0	0	0	0	0	1	2	0	0	0	0	0	0
	C													

Entomological Investigations

A total of 70 nights of mosquito trapping with human bait traps starting at sunset and ending at sunrise were instituted at Bukit Lanjan aborigine settlement between the months of January and June 1963. A summary of the numbers and species of mosquitoes caught and results of their dissections for filariæ are given in Table IV.

No infections of **Brugia** or **Wuchereria** were found in any of the mosquitoes examined, but on 2 occasions **Dirofilaria immitis** infection was found in **Mansonia dives** and **Culex annulus.**

Anopheles

A. maculatus was the dominant anopheles caught while **A.letifer** was occasionally found. **A. maculatus,** although experimentally it can support the development of **W. bancrofti,** is most unlikely to be of any importance as a natural vector **A. letifer** on the other hand has been incriminated as a vector of **W. bancrofti** in East Pahang (Wharton, 1960) and could transmit the infection if conditions are favourable, but no natural infection in this species has been found in the present investigations.

Culicines

Among the wide variety of culicines caught, **Aedes, Culex** and **Mansonia** species were most common. **C. fatigans** which may be a vector of **W. bancrofti** at Bukit Lanjan (and has been shown to support development in subsequent experimental infections) were caught in the traps on a few occasions, but not in the large numbers as would be thought to maintain an active transmission. The paucity of **C. fatigans** trapped may be due however to their tendency to rest inside houses, and their preference for indoor baits.

Large numbers of **Aedes albopictus** and **Armigeres** species were caught but they are of no importance as vectors of **W. bancrofti** or **B. malayi.**

M. dives was the commonest of the **Mansonia** mosquitoes caught but Wharton (1962) has shown that they are poor hosts for periodic **B. Malayi. M. uniformis** were caught on a

TABLE IV

Showing the numbers of mosquitoes from Bukit Lanjan examined for Filaria Infection during the period from January — June, 1963.

Species of Mosquito	No. caught in Human Bait Trap (70 nights)	No. examined for Filaria
Mansonia		
Mansonioides		
bonneæ	1	1
dives	259	256*
uniformis	20	19
Coquillettidia		
annulifera	2	2
crassipes	2	2
ochracea	1	1
Anopheles		
aitkeni	1	1
letifer	7	5
maculatus	70	69
karwari	1	1
kochi	1	1
Culex		
annulus	213	213*
bitæniorhynchus	2	2
cinctellus	11	10
fatigans	39	38
gelidus	94	89
mimulus	9	9
nigropunctatus	12	12
pseudovishnui	69	66
sinensis	1	1
sparthifurca	5	4
tritæniorhynchus	25	25
Undetermined species	7	7
Aedes		
albopictus	243	241
Armigeres		
confusus	6	6
durhani	4	4
malayi	40	38
moultoni	5	5
subalbatus	57	57
Uranotænia		
campesteris	5	4
Undetermined species	2	—
Tripterioides		
aranoides	1	—
cœruleocephala	2	1
Malaya		
genurostris	1	—
Aedomyia		
catastica	1	—

*On two occasions **Dirofilaria immitis** infection was found.

few occasions and is the most probale vector for periodic **B. malayi** in the area, although no filarial larvæ were found in any of them on dissection.

During the first 3 months of trapping there was an unusually prolonged dry period resulting in relatively poor catches. These results although rather limited, have however provided some useful information on the mosquito fauna at Bukit Lanjan.

Experimental infections

C. fatigans being a common house breeding mosquito in and around the city of Kuala Lumpur would be the most likely vector to establish **W. bancrofti** infections in the urban areas. It is essential therefore to know the potentiality of the different strains of this mosquito species to support development of the microfilariæ of **W. bancrofti** to the infective stage.

5 different strains were tested. Each strain was fed on a **W. bancrofti** carrier from Bukit Lanjan and were then dissected 14.5 to 16.5 days later.

Adult mosquitoes of the various strains used in the experimental infections were obtained from the following places:—

(see Fig. 1, top left hand corner)

1. Bukit Lanjan strain — house catches at Bukit Lanjan aborigine settlement.
2. Petaling Jaya strain — house catches at Petaling Jaya.
3. Kepong strain — house catches at Kepong.
4. "Petaling Street" strain — house catches in Petaling Street situated in the heart of Kuala Lumpur.
5. I.M.R. laboratory colony — originally obtained from the island of Penang, and which has been maintained in the Institute for Medical Research insectarium for more than 90 generations.

The results of feeding the various strains of **C. fatigans** on a **W. bancrofti** carrier on different occasions are given in Table Va.

All the strains exhibited different rates of infectivity, the Bukit Lanjan and Petaling Street strains both giving an over 45% infectivity rate. It was thought that these differences may be due to variations in the microfilariæ density in the carrier's peripheral blood at the time of mosquito feeding.

Experiments were then carried out in which all the strains of **C. fatigans** were fed on the same carrier at the same time. The results of 2 such simultaneous feedings of the 5 strains are shown in Table Vb and Vc.

It appears from the results that variations in infectivity rate still occurred, though to a lesser extent, when the strains were fed under almost similar conditions. The occurence of different gene frequencies in the different mosquito populations may partly explain these differences. However, if there is only one major gene controlling susceptibility in **C. fatigans** (similar to that of **Aedes aegypti** to **B. malayi** — Macdonald 1962), one wonders why the gene should vary so much in frequency. It is beyond the scope of this paper to discuss the genetical aspects of susceptibility to **W. bancrofti** infections in **C. fatigans,** but it is hoped further work on these lines will be pursued.

Discussion

That there is no active transmission of **W. bancrofti** maintained in Bukit Lanjan village itself is shown by the low microfilariæ load which was found to be only 0.4; the absence of **Wuchereria** larvæ in any of the mosquitoes dissected and the absence of detectable infection in the Malays who had been living so close to the aborigines for such a long time.

It is an interesting finding that 11 out of the 14 **W. bancrofti** infections were in adult aborigines. As most, if not all of the working aborigine population enter the jungle to make their living, it is conceivable that they acquired their infection while at their place of work. If this is so, the vector which remains unknown, may turn out to be **A. letifer,** similar to the findings of Wharton (1960) in his Pahang survey on rural Malays.

The risk of the infection spreading to the urban areas of Kuala Lumpur is remote in spite of the existence of a focus of infection

TABLE Va — FED. ON THE SAME DONOR AT DIFFERENT — OCCASIONS

EXP. No.	Strain of Culex fatigans	Generation	Age of mosquito in days at the time of feeding	No. of microfilariæ per c.mm. at the time of feeding	No. of mosquito dissected	% infective
110	Bukit Lanjan	F2	6 — 7	0.8	146	53.0
108	Petaling Jaya	F2	6 — 7	4.4	148	13.0
116	Kepong	F1	5 — 6	3.0	149	26.0
106	Petaling Street	F2	6	2.7	214	45.0
100	I.M.R. Lab. colony	F92	2 — 7	4.0	198	12.0

TABLE Vb. — FED. ON THE SAME DONOR AT THE SAME — OCCASION

117	Bukit Lanjan	F3	5 — 6	1.8	100	30.0
	Petaling Jaya	F3	5 — 6	1.8	100	14.0
	Kepong	F1	5 — 6	1.8	100	12.0
	Petaling Street	F3	5 — 6	1.8	100	14.0
	I.M.R. Lab. colony	F93	5 — 6	3.0	56	11.0

TABLE Vc. — FED. ON THE SAME DONOR AT THE SAME — OCCASION

125	Bukit Lanjan	F4	6 — 7	4.3	100	25.0
	Petaling Jaya	F4	6 — 7	4.3	100	21.0
	Kepong	F2	6 — 7	4.3	100	25.0
	Petaling Street	F4	6 — 7	4.3	100	9.0
	I.M.R. Lab. colony	F94	6 — 7	4.3	100	4.0

nearby, and the presence of a potential vector in **C. fatigans.** In order to transmit the infection effectively, the aborigine carrier would need to have a sufficiently high microfilariæ density in his peripheral blood at the time of his visiting any of the nearby towns, and also remain long enough for **C. fatigans** to feed. The tendency of the aborigine to remain in his home rather than visit the towns, especially in the evenings and nightime, decreases such transmission risks.

The findings of the present investigation indicate that this focus of infection can best be controlled, if not eliminated entirely by the proper administration of the di-ethylcarbamazine drugs.

Summary

1. 167 aborigines and 110 Malays were investigated for filaria infections. 31 were positive, 10 being **W. bancrofti,** 17 **B. malayi** and 4 mixed infections. No. **W. bancrofti** infections were detected in the Malays.

2. 70 nights of mosquito trapping with human bait traps were instituted at Bukit Lanjan village. The dominant mosquitoes caught were **A. maculatus, M. dives, C. annulus** and **Aedes albopictus.** No infective larvæ of **W. bancrofti** and **B. malayi** were found in any of the mosquitoes dissected.

3. Experimental feedings of various strains of **C. fatigans** on a **W. bancrofti** carrier showed that all the strains were capable of supporting development of the microfilariæ to the infective stage. All the strains exhibited different infectivity rates.

4. It is concluded that any risk of the infection being transmitted to the urban areas of Kuala Lumpur can be eliminated by proper drug treatment of the aborigine population.

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