

Filariasis in Negri Sembilan – A follow-up study

by Winnie C. Cheah
Cheong, W. H.
Mahadevan, S.

and Karen P. F. Lai
Sivanandam, S.

Institute for Medical Research,
Kuala Lumpur.

Introduction

TWO YEARS after the initial filariasis blood survey in a Negri Sembilan rubber plantation made by the Filariasis Research Division, Institute for Medical Research, Kuala Lumpur, in May 1970 (Ramachandran *et al.* 1971), another team from the same Division carried out a re-survey in August 1972 to assess the epidemiology of filariasis in and around the same area i.e. Sua Betong Estate (shaded area, inset Fig. 1). Hetrazan had been given to the positive patients in 1970. The estate management was divided and sited (Fig. 1) as:

1. South Division or Hospital Division
2. Domum
3. Sungei Ujong Division
4. Factory and
5. Labuan Bileh (a new division)

Sungala Estate was a small estate nearby, under a separate management but was included because cases had been suspected there.

Entomological studies to incriminate the vectors were then outside the scope of that particular survey. The present study includes entomological and parasitological studies in both the estates of Sua Betong and Sungala.

The general geography of the site had been described by Ramachandran *et al.* (1971). At the

time of this blood survey, a change from rubber planting to oil palm planting, had been initiated and was expected to be expedited.

The estimated population in the area was 2533 at the time of survey with age groups ranging from 6 months to 72 years.

Survey methods

The IMR research team of 7 was assisted clerically by 4 public health inspectors assigned by the Chief Medical and Health Officer, Seremban. They were divided into 4 units who functioned simultaneously between 1900–2200 hours on four successive nights.

Thick blood films of 20 c.mm. peripheral blood from the finger were made using a graduated capillary pipette fitted with a simplified non-breakable Sinton pipette (Sivanandam & Dondero, 1971). Dried overnight, the films were stained with diluted Revector Giemsa (35 drops of 7.6% concentrate per 100 ml. buffered distilled water, pH 7.2).

With the co-operation of the management, as many of the former positive patients in the 1970 survey as possible were each given their own 1970 survey numbers to identify themselves during the re-survey.

In a period of five months in the last and first quarter of the year several visits were made to the two estates to conduct human baited trap, bare leg and a few cattle shed catches using 2 men and 3 men respectively throughout the night. All catches were identified and dissected for infections. The num-

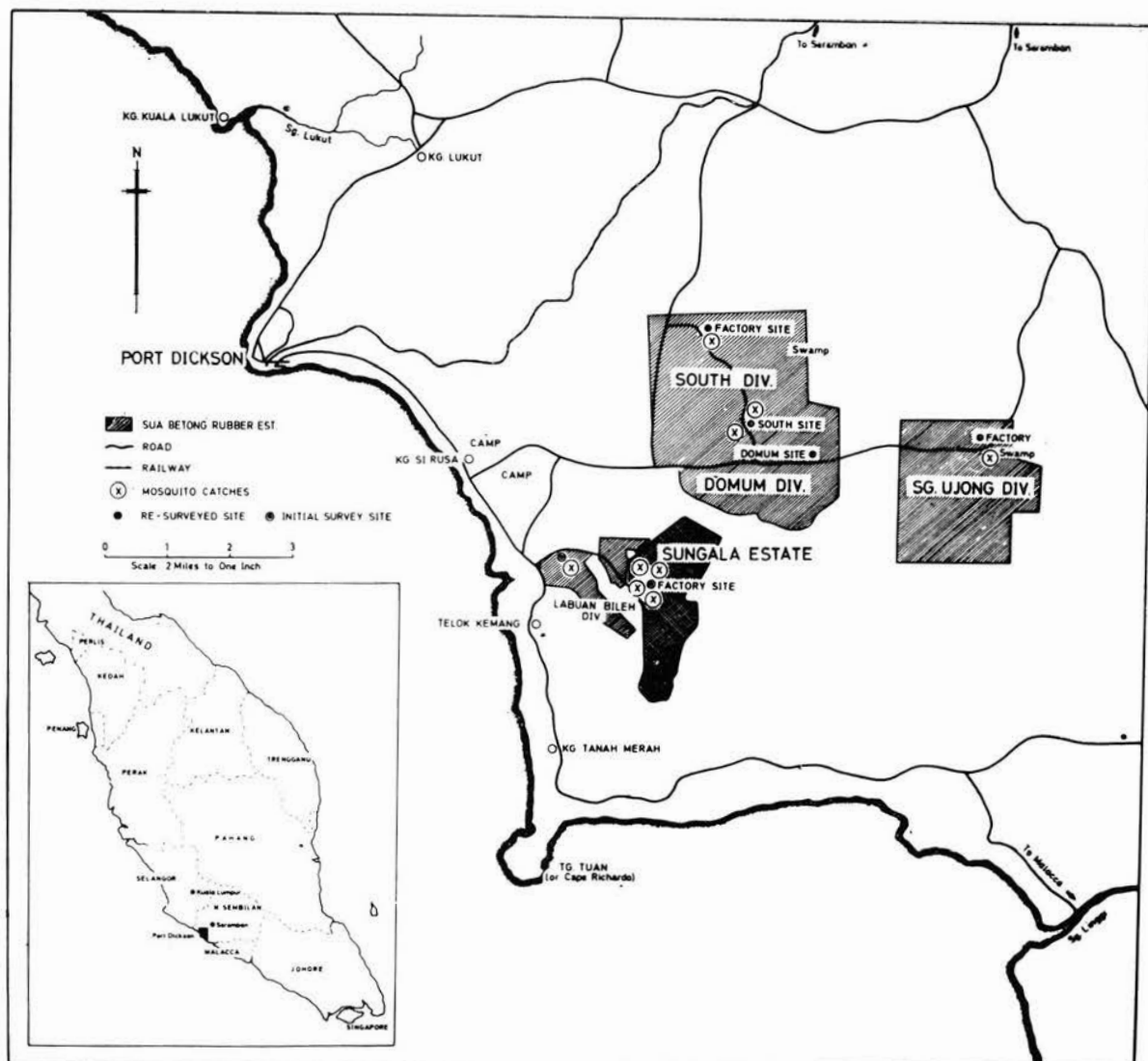


Fig. 1. Map showing filariasis survey sites in Negri Sembilan.

bers of anophelines were so small that except for three specimens they were disregarded from the examinations.

A total of 13 cats belonging to the families of the Hospital Division were also examined for microfilariaemia.

Periodicity and clinical studies were not made.

Results

A total of 2,154 blood films representing 85% of the population was obtained. The results of the distribution of microfilarial carriers in 1970 and 1972 are given in Table I.

Re-surveyed areas

In the 4 re-surveyed areas of Dumum, Factory, Sungei Ujong and South Division, a total of 1696 subjects were examined. Of these, 810 were males and 886 were females (Table II).

38 of them had microfilaria of the subperiodic strain of *Brugia malayi* in their blood. This indicated that the microfilarial rate was 2.3%. Of the 38 that were positive, 28 were males and 10 were females. This represented 3.4% of the males and 1.1% of the females (Table II).

Table I

Distribution of microfilarial carriers in the two survey areas carried out in 1970 and 1972.

	Sub-Divisions	1970			1972		
		No. Exam.	No. Positive	%	No. Exam.	No. Positive	%
Re-surveyed areas	Domum	327	31	9.5	275	4	1.4
	Factory	314	6	1.9	343	4	1.1
	S. Ujong	588	33	5.6	499	16	3.4
	Hospital (South)	637	26	4.1	579	14	2.4
	TOTAL:	1866	96	5.1	1696	38	2.3
New Areas	Labuan Bileh				110	2	1.8
	Sungala				348	24	6.9
	TOTAL:				458	26	5.7
	Total for area	1866	96	5.1	2154	64	3.02

Carriers of microfilaria were found in all age groups above one year (Table II). 19 infants below one year of age were examined but they were all negative. The 2 youngest carriers were a 3-year old Chinese boy from the Sungei Ujong area and another 3-year old Indian girl from the South Division. The oldest was a 72-year old unemployed Indian who was away in India during the 1970 survey. There was no difference in the proportion of microfilarial carriers in the 4 male and 4 female children below the age of 10 years.

In the population above the age of 10, it was found that only 4 non-Indians were carriers of microfilaria. All the other 26 carriers were all Indians, of which 22 were males and only 4 were females.

Table III shows the occupations of the population in the re-surveyed areas. 8 of the younger non-schooling children were infected with microfilaria; 2.2% (6/270) of the Indians and 1.3% (2/154) of the Chinese. Of the 11 infected students, 4% (10/246) of the Indians were positive for microfilariae but only 0.8% (1/121) of the Chinese were so. 3% (8/268) of the Indian tappers and 0.6% (1/163) of the Chinese tappers were found to be carriers. The group of "others" were personnels who were mainly indoor workers during the day e.g. office workers, shopkeepers, peons, and sweepers. 4.6% (7/152) of these Indians and 6% (1/17) of these Malays were positive. None of the Chinese in this group were positive.

Of the 173 unemployed personnels, only one Indian and one Chinese were infected. All the housewives were negative.

New Areas

In the new areas of Labuan Bileh and Sungala, 458 subjects were examined, 250 males and 208 females (Table II). Microfilaria was found in the blood of 26 people, this meant 5.7% of the group. 19 of them were males and 7 females.

41 children below the age of 5 years were found to be negative. The youngest carrier was a 7 year old Indian male student belonging to a family of 8, where the father, a 43 year old tapper and 2 other brothers aged 11 and 13 years were also positive. The oldest positive subject was a 47 year old tapper who had worked in Sungala Estate for more than 20 years.

Tables II and III also show that in the 5-9 year old age group, 2 Indian boys and 1 Indian girl were positive. Above the age of 10 years, only 5 non Indian were positive, 1 Chinese male tapper, 2 Malay school-boys, 1 Malay male and 1 Malay female tappers. The rest of the 21 positive population were Indians, 15 of them male and 6 of them female. 4 of them were non-schooling children, 10 were students, 6 were tappers and 1 was a peon. All the housewives and unemployed were negative.

35 of 96 former (1970) patients with microfilaria were followed-up successfully. 6 of these were positive and 29 were negative, (Table IV).

Table II
Distribution of microfilarial carriers by race, age and sex groups.

Age group in years	INDIANS			CHINESE			MALAYS			TOTAL		
	No. Exam.	No. Pos. (%)	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Pos. (%)
1	7	4	-	2	5	-	38	57	1(2.6)	-	9	10
1-4	54	67	1(1.5)	34	37	2(6.9)	2	9	-	91	113	2(2.2)
5-9	105	96	3(3.1)	53	50	-	6	10	-	164	156	2(1.2)
10-14	86	95	6(6.9)	50	37	1(2.7)	8	10	-	144	142	6(4.1)
15-19	81	86	3(3.7)	11	16	-	5	8	1(20.0)	97	110	4(4.1)
20-29	62	73	6(9.6)	22	44	1(2.2)	5	8	-	89	125	6(6.9)
30-39	48	58	1(2.0)	28	32	-	7	7	-	83	97	1(1.2)
40-49	44	42	3(6.9)	17	24	-	3	2	-	64	68	3(4.7)
50-59	29	36	-	5	11	-	1	2	-	35	49	-
60	25	11	3(12.0)	9	5	1(11.0)	-	-	-	34	16	4(11.7)
Age group in years	No. Exam.	No. Pos. (%)	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Pos. (%)
	380	21(5.9)	1(2.5)	40	1(2.5)	1(4.0)	38	4	4(10.0)	458	26(5.7)	7(3.3)
	208	15(7.2)	6(3.4)	25	15	1(4)	17	21	3(17.6)	250	208	19(7.6)
1	3	3	-	-	2	-	-	-	-	3	3	-
1-4	24	12	-	2	2	-	-	1	-	26	15	-
5-9	44	22	2(4.5)	6	1	-	1	5	-	51	28	2(3.9)
10-14	46	31	7(15.2)	5	4	-	5	-	1(20.0)	56	35	8(14.3)
15-19	28	32	3(10.7)	3	1	-	4	3	1(25.0)	35	36	4(11.4)
20-29	15	24	-	4	1	1(25.0)	1	5	-	20	30	1(3.3)
30-39	17	26	-	2	5	-	3	5	-	22	36	-
40-49	15	12	3(20.0)	2	1	-	1	2	1(100)	18	15	4(22.2)
50-59	10	7	-	1	1	-	1	-	-	11	7	-
60	6	3	-	1	-	-	1	-	-	8	3	-
Age group in years	No. Exam.	No. Pos. (%)	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Pos. (%)
	1489	53(3.6)	6(1.1)	532	6(1.1)	5(3.7)	133	5	5(3.7)	2154	64(2.9)	64(2.9)
Entire Survey	1489	53(3.6)	6(1.1)	532	6(1.1)	5(3.7)	133	5	5(3.7)	2154	64(2.9)	64(2.9)

Table III

Distribution of microfilarial carriers by occupational groups.

		INDIANS		CHINESE		MALAYS		TOTAL	
		No. Exam.	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Exam.	No. Pos. (%)
Re-surveyed Areas	Non-students	270	6(2.2)	154	2(1.3)	37	-	461	8(1.7)
	Students	246	10(4.0)	121	1(0.8)	17	-	384	11(2.9)
	Tappers	268	8(3.0)	163	1(0.6)	16	-	447	9(2.0)
	Housewives	21	-	7	-	8	-	36	-
	Others	152	7(4.6)	26	-	17	1(6.0)	195	8(4.1)
	Unemployed	152	1(0.6)	21	1(4.7)	-	-	173	2(1.1)
		1109	32(2.8)	492	5(1.0)	95	1(1.0)	1696	38(2.3)
New Areas	Non-students	87	4(4.6)	11	-	3	-	101	4(3.9)
	Students	100	10(10)	11	-	11	2(18.1)	122	12(9.8)
	Tappers	94	6(6.3)	16	1(6.6)	10	2(20)	120	9(7.5)
	Housewives	9	-	-	-	2	-	11	-
	Others	149	1(2.0)	2	-	11	-	62	1(1.6)
	Unemployed	41	-	-	-	1	-	42	-
		380	21(5.9)	40	1(2.5)	38	4(10)	458	26(5.7)

Table IV

Follow-up Positives of 1970

No. of successful follow-up cases	35
No. of 1970 positives and 1972 negatives	29
No. of 1970 positives and 1972 positives	6

As shown in Table V the 5 subjects who were positive both in 1970 and 1972 had microfilarial densities lower in 1972. 5 of them were tappers, 4 males and 1 female, of which 1 had his microfilaria count almost unaltered i.e. from 9-8 mf per 20 cubic millimetres blood. The other 4 had their microfilarial densities reduced to 11-25%. The last positive subject was an unemployed Chinese with microfilarial densities of 2 mf per 20 cubic millimetres in 1970 and 1 mf per 20 cubic millimetres in 1972.

Of the 29 who were positive in 1970 and negative in 1972, 18 had densities of 1-9 mf per 20 cubic millimetres, 2 with 50-59 mf per 20 cubic millimetres; and the rest with 10-30 mf per 20 cubic millimetres.

Table VI compares the distribution of microfilaria densities in the 1970 and 1972 population. In the re-surveyed areas, the density distribution has fallen from 60 to 31 subjects with 1-9 mf per 20 cubic millimetres; 19 to 6 subjects with 10-19 mf per 20 cubic millimetres and only 1 with microfilarial density above 20-29 mf per 20 cubic millimetres.

In the new areas, microfilarial densities were spread out; 14 with 1-9 mf per 20 cubic millimetres, 7 with 10-19 mf per 20 cubic millimetres, 2 with 20-29 mf per 20 cubic millimetres and 3 with more than 30 mf per 20 cubic millimetres.

At Sua Betong Estate 3,723 mosquitoes of 24 species were collected in the equivalent of 30 nights catches (see Table VII). Again members of the *Mansonioides* and *Culex* were in abundance. Out of the 3,158 specimens examined five infections were observed, four in two species (*M. bonneae* and *C. gelidus*) with *Setaria* type and one with the early stage II larvae of *Brugia malayi* in *M. bonneae*. The specimen was taken in the bare leg catch. This gives a crude infection rate of 0.035% in *Mansonia bonneae* in both estates.

Table V
Microfilarial density-change from 1970 to 1972

Patient No.	mf density change	% Change	Race	Age	Sex	Occu.
1113	2-1	50%	Ch.	67	male	None
2374	39-6	16%	Ind.	23	male	Tapper
3158	4-1	25%	Ch.	22	female	Tapper
3187	9-8	88%	Ind.	21	male	Tapper
3495	9-1	11%	Ind.	42	male	Tapper
3527	7-1	14%	Ind.	40	male	Tapper

Table VI
Microfilarial Density (per 20 c.mm.).
Distribution in 1970 and 1972.

Microfilaria Density per 20 cubic millimetre	1-9	10-19	20-29	30-39	40-49	50-59	60
No. of Subjects in 1970	60	19	8	3	1	2	3
No. of Subjects in 1972 Resurveyed Areas	31	6	-	-	1	-	3
No. of Subjects in 1972 New Areas	14	7	2	1	-	1	1

Table VII
Sua Betong rubber estates, Port Dickson
Total number of filaria mosquitoes caught, dissected and examined for filaria infections

Mosquitoes (24 spp.)	No. Caught	No. Dissected	With <i>Brugia malayi</i>	With <i>Setaria</i> spp.
<i>Anopheles</i> (2 spp.)	2	2	-	-
<i>Aedes</i> (4 spp.)	57	17	-	-
<i>Mansonia</i> (9 spp.)	3229	2995	1(0)	1(0)
<i>Culex</i> (8 spp.)	400	136	-	3(0)
<i>Armigeres</i> (1 sp.)	35	9	-	-
Total	3723	3158	1(0)	4(0)

At Sungala Estate a total of 3,002 mosquitoes of at least 37 species were collected in the equivalent of 58 night catches in total (see Table VIII). The largest numbers taken were members of the *Mansonioides* followed by the *Culex* group. Six members of the *Mansonioides* and seven of the *Culex* were found in the area. 2,597 specimens were examined with six infections seen in four species. However, five of the infections, three in *M. uniformis* and one each in *M. crassipes* and *Culex gelidus* were of the *Setaria* type measuring 1165 u - 2300 u in length and 23 u - 26 u in breadth. 44 specimens collected

were mainly stage III found in the head, thorax and abdomen. The other infection was that of *Brugia malayi* with 7 stage I larvae in the thoracic muscles. The specimen was taken in the human bait trap.

Discussion

From the two surveys done in 1970 and 1972 (Table I), it was encouraging to note that the microfilarial rate had fallen from 5.1% to 2.3%. However, the newly surveyed areas had a microfilaria rate of 5.7%.

Table VIII

Sungala and Labuan Bilek rubber estates, Port Dickson
Total number of filaria mosquitoes caught, dissected and examined for filaria infection

Mosquitoes (37 spp.)	No. Caught	No. Dissected	With <i>Brugia malayi</i>	With <i>Setaria</i> species
<i>Anopheles</i> (6 spp.)	11	1	—	—
<i>Aedes</i> (9 spp.)	346	119	—	—
<i>Mansonia</i> (10 spp.)	1835	1760	1(0)	—
<i>Culex</i> (9 spp.)	681	492	—	—
<i>Armigeres</i> (2 spp.)	127	90	—	—
<i>Uranotaenia</i> (1 spp.)	2	2	—	—
Total	3002	2597	1(0)	—

As had been significant before, the 1972 survey also proved that almost three times more men than women were infected. Children below the ages of 10 years again showed no difference in having the infection.

Tappers and students were the most susceptible personnel. In the resurveyed areas, 2.9% of the students and 2% of the tappers had the infection and in the new areas, it was 9.8% of the students and 7.5% of the tappers. Though *Mansonia* mosquitoes are outdoor biters, about 20–25% of them can be found indoors by 7.00 a.m. Students awake early to prepare for school before 7.00 a.m. during which time some of the vector *Mansonia* mosquitoes were still lurking indoors. They would also be outdoors before 7.00 a.m. walking to school. Tappers began work as early as 4.00 a.m. out in the estate where the *Mansonia* vectors bite outdoors, (Wharton 1962). Higher prevalence relating to more chances of exposure to mosquitoes was also found in the tapping areas of Sungala Estate, Domum, Sungei Ujong and South Divisions as compared to the Factory workers who worked indoors and during the day.

Ethnically, the Indians proved to be the more susceptible group with a microfilarial rate of 2.8% in the resurveyed areas and 5.9% in the new areas. This could be related to their attire. (Wharton 1962) observed that *Mansonia* mosquitoes has a preference for the lower parts of the human body. The Indian tappers wore shorts while tapping; the Malays wore sarongs and the Chinese wore long trousers. A high microfilarial rate could also be observed in students (9.8% in Sungala & Labuan Bileh) who wore shorts or skirts.

35 of the 96 former (1970) positive patients remembered to bring along their identification

numbers given to them by the Estate management. 6 or 16.6% of them were again positive for microfilaria (Table IV). Though the microfilarial density of 4 subjects had fallen to less than 25%, of their 1970 densities two others had almost no change. A personal interview with 12 subjects prompted us to feel that the mass treatment given in 1970 was not satisfactorily supervised.

It should be realised and emphasized at this point that treatment of microfilarial carriers should be carried out more strictly. Hetrazan is a very difficult drug to accept as it requires 6 doses given at weekly intervals. Some of the side effects of the drug include fever and vomiting especially after the first dose in those subjects with early and symptomless infections. Hence firm personnels should be posted to supervise the complete administration of the dosage. In 1970, Ramachandran had recommended that because of the irregular attendance at Control Centres, it was necessary for Control Team members to visit the settlement 8 to 10 times to achieve these results.

As most of the findings of the nocturnal habits of the population were done verbally at the time of blood sampling, many of them gave unconvincing answers about whether they use mosquito nets or not. For example, members of a same family often gave untallying reports as to whether they used nets or not. Generally, it was the children who told us that they did not have nets at night, while their mothers claimed that they did. Except for the toddlers, the folks slept after 8.00 p.m. They all closed their doors and windows throughout the night.

From the previous results showing the youngest infection to be in a one year old child it seems very likely that there was active transmission going on and although the Sua Betong area has been reportedly

mass treated with hetrazan in 1971 (Ramachandran *et al.* 1971), the infections still persists in the four main areas with an average microfilaraemia of 2.1%.

Although mature larvae were not taken, upon epidemiological grounds, we could say with some confidence that the primary vector in the area is undoubtedly *M. bonneae*. The areas are heavily surrounded by swamps though not so obvious in the Labuan Bilek area of Sungala estate. Although more nights were spent in Sungala estate fewer mosquitoes on an average were taken per night both in the bare leg catches and especially in the human bait trap. When compared to the bare leg catches at Sua Betong there seem to be roughly twice as many mosquitoes there; possibly the mosquitoes moved from the Sua Betong area swamps across to the Sungala, Labuan Bilek area. The last named itself is rather close to the developed main road and rather coastal thus less conducive for *Mansonia* breeding with three times less positive cases.

Thus, the impression gathered from the verbal investigations was that most of the personnel did not use mosquito nets. They closed up their doors and windows when they sleep. This did not prevent the mosquitoes from coming in because the ventilation grills above their doors and windows permitted entry.

The survey in cats showed no microfilaria in their peripheral blood. Unfortunately, the number

surveyed here was small, only 12, even though they were from the families with microfilaraemia. A more complete coverage of the prevalence in the domestic cat is recommended for future re-surveys.

Acknowledgements

The authors wish to thank the Managers and Staff of the two rubber estates, at Sua Betong and Sungala for their keen support and help throughout the parasitological and entomological surveys. We are also grateful to the technical staff of the Divisions of Filariasis and Medical Entomology, Institute for Medical Research, Kuala Lumpur for valuable service, and to Dr. G.F. de Witt, Director, Institute for Medical Research, for his permission to publish this paper.

References

- Ramachandran, C.P., Dondero, T.J. Jr., Mullin, S.W., Sivanandam, S. and Stevens, S. (1971) - Filariasis in a rubber plantation in Negri Sembilan, West Malaysia. *Med. J. Malaya*. **25**: 273-277.
- Sivanandam, S. and Dondero, T.J. Jr. (1971) - A rapid Giemsa staining method for microfilaria in thick blood films. (Laboratory Demonstration). *S.E. Asian J. trop. med. pub. Hlth.*, **2**: 413.
- Sivanandam, S. and Dondero, T.J. Jr. (1971) - A simplified, non-breakable Sinton pipette. (Laboratory Demonstration). *S.E. Asian J. trop. med. pub. Hlth.*, **2**: 415.
- Wharton, R.H. (1962) - The biology of *Mansonia* mosquitoes in relation to the transmission of filariasis in Malaya. *Bull. No. 11, Inst. Med. Res. Malaya*.