Study of Mosquito-Borne Diseases in Some New Irrigation Schemes in Sri Lanka, with Particular Reference to Filariasis and Arboviral Diseases

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Introduction

Although the Anti-Malaria Campaign has carried out data collection on mosquito-borne diseases in Sri Lanka's new irrigation areas, little or no information has been obtained concerning the transmission of filariasis and arboviral diseases. A World Health Organization/Panel of Experts for Environmental Management (WHO/PEEM) study was designed to provide some of the missing information. This paper is an interim report.

Past experience in Sri Lanka indicates that the vector-borne diseases needing investigation fall into three categories: 1) those arising as a direct consequence of new irrigation works (malaria and Japanese encephalitis); 2) those due to associated population movement, concentration, and urbanization (filariasis and dengue): and 3) those due to the opening of new jungle land when man may become involved in an existing sylvatic cycle of infection. Examples of the latter would be tick typhus and Kyasanur Forest disease (KFD) which is found in Mysore, India. Both of these arc tick-borne diseases, yet the possibility of similar mosquito-borne diseases also exists.

Japanese Encephalitis (JE). This is a major health problem in many parts of Asia with an increasing number of cases reported in India, China, and Southeast Asian countries such as Thailand. It is a severe illness with a high fatality rate (20-65%) and a high degree of residual disability (paralysis, tits, etc.) in survivors.

In Sri Lanka, encephalitides form an important health problem, accounting for an annual average of 1,030 hospital admissions and an average case fatality of 38% (range of 25-45%). Studies' suggest that JE accounts for 43% of the diagnosed cases. The disease appears to be endemic in Sri Lanka with imported cases occurring sporadically. Although major epidemics have not occurred, a few outbreaks have been reported in Kurunegala, Jaffna, and Vavuniya. Serological surveys indicate that JE occurs in certain parts of the country such as the western coastal areas, Kurunegala, Anuradapura, and Batticaloa districts, and around Tissamaharama. Although there is no specific treatment for JE, the prevalence is not considered high enough to justify an immunization program. However, there is no doubt that it is presently a more important problem in Sri Lanka than poliomyelitis.

The main vector of JE in Sri Lanka, *Culex tritaeniorhynlus,* breeds in rice fields, and its distribution pattern is therefore closely associated with ancient and newly developed irrigation schemes.

Dengue. Endemic in Asia for decades, Dengue has become a major disease and cause of death in children in Southeast Asia since the appearance of the Dengue Haemorrhagic Fever (DHF) in 1954. Last year in Thailand alone there were 60,000 cases of DHF.

Studies' indicate that dengue is endemic in Sri Lanka, occurring in most areas below an elevation of 914 meters with maximum incidence in Colombo. A few cases of DHF occur each year, with a slight upward trend of 7 cases (one death) in 1983 to 8 cases (one death) in 1984.

Filariasis. Filariasis is believed to be endemic in

[1] Vitarana, T. 1982. *Viral Diseases* in Southeast Asia and the *Western Pacific.* Academic Press. pp198-204

[2] Vesenjak-Hirinjan, J.. et al. 1969. Bulletin of the *World Health Organization* 41:243, and others.

Table 2. Malaria incidence in selected localities at Kirindi Oya, March and September 1985.

	Lunugamvehera		Hamlet 5		Hamlet 6		Hamlet 11		Total	
	Mar	Sep	Mar	Sep	Mar	Sep	Mar	Sep	Mar	Sep
No. tested	273	324		576	413	483	151	394	837	1777
No. positive		1		3	19	25		-	19	29
Percentage		0.3	-	0.5	4.6	5.2	-		2.3	1.6
P. vivax		1		3	18	20		-	18	24
P. falciparum					1	5			1	5
Sex: M/F	-	1/0		2/1	10/9	18/7		-	10/9	21/8
Age: < 1				0						
1-5				0	5	8	- -		5	8
6–10				1	3	2				
11-15				0	2	2				
> 15		1		2	9	13			9	19

Filariasis. Table 3 shows that the microfilaria positive rates are low in both Kirindi Oya (0.14%) and Mahaweli C2 (0.09%).The three positives are among people who have come recently from outside the area. In view of the vector presence the possibility of spread to others in the area exists. The concentration technique was not used in testing.

Table 3. Prevalence of lymphatic filarisis[a/] in selected localities in Mahaweli System C and Kirindi Oya, February 1985.

	No Tested	Positive	
		Number	Percentage
Mahaweli			
Girandurukotte	472	1[b/]	0.21
Divulapelessa	559		
Belaganwewa	336		
Rotalawela	360		
Galporuyaya	389		
Millettewa	229	1[b/]	0.44
Sub. TOW	2345	2	0.09
Kirindi Oya			
Lunugamvehera	151		
Hamlet 6	507		
Hamlet 11	70	1[c/]	1.4
Sub. Total	728	1	0.14
Total	3073	3	0.1

a/ Measured as the microfilaria rate:
b/ employed as drivers by the Mahaweli Authority and originally from the south (not settlers).
c/ a female new settler from Matara.

Virology. Past virus activity is assessed on the basis of age stratified studies (Table 4). The interpretation of the results has been difficult due to the detection by the HI test of three types of response: a) true positives where antibodies to both JE and dengue occurred, b) questionable positives where only JE antibodies occurred, and c) nonspecific inhibitor type responses (NSI) where both JE and sindbis "antibodies" were present. More investigation, including the Neutralization Test on freshly collected venous blood will be needed in order to interpret results more clearly. The preliminary indications are that JE virus has caused sporadic infections in both Mahaweli C2 and Kirindi Oya, and that a few people have had dengue and chikungunya infections but these may have occurred outside the study areas.

Two hundred of the 389 Mahaweli C2 specimen pairs were tested to determine the extent of new virus infections. Only five showed sero-conversions to both JE and dengue but at low levels. These results need to be confirmed by NT, before it can be concluded that JE transmission is occurring. The Kirindi Oya specimens have not yet been tested. The blood samples from convalescent fever cases have yet to be collected and tested.

Of nine pigs bled from Tissamaharama, eight showed evidence of a flavivirus infection, and two tested by NT were confirmed positive for JE. This includes young pigs, and confirms that JE transmission occurs in this area.

to detect new virus infections occurring during the study period (i.e., the infection rate). In hamlets where the sample of new-settler children was inadequate, re-settler children under 10 years old were included. For the serological study two filter paper discs were soaked with blood on each occasion and, after drying, the serum was extracted and tested for antibodies by Clarke and Casals' modified Haemagglutination Inhi-bition (HI) test. From some of the HI positives which showed antibodies against dengue and JE, venous blood was collected and tested by a Neutralization Test (NT) using mice to establish the type of infecting virus. In view of the positive human JE, blood was collected from pigs on a farm in Tissamaharama and tested by HI and NT.

Results

Malaria An overall increase in malaria positives from 0.49% to 1.23% occurred in Mahaweli C2 during the study period (Table 1). The increase seems to occur in all age groups but in children under 5 years old (who were negative at the first bleed), 11 new positives appeared, including an infant. A disturbing feature is the increase of *Plasmodium fakiparum* cases (from 1 to 6) and of *P. vivax cases.*

It is noteworthy that in the township of Giranduru-kotte, where residual insecticide spraying is probably most effective, there were no positives on the second occasion. Two of the three hamlets (Rotalawela and Belaganwewa) with the most new settlers (who are likely to be non-immune), showed new positives at all ages, whereas both had no cases on the first occasion. Although Divulapelessa remained static at six positives, the appearance in three children under five years of age indicates continuing activity.

In Kirindi Oya the situation has remained more static with practically no positives in Lunugamvehera (Table 2). But there is continuing activity in Hamlets 5 and 6 with more being affected under five years of age in the latter. The increase of P. fakiparum cases to five in Hamlet 6 is noteworthy.

Table 1. Prevalence of malaria in selected localities in Mahaweli system C, February and August 1985.

	Giranduru-Kotte		Divulapelessa		Belaganwewa		Rotalawela		Galporuyaya		Alutharama		Total	
	Feb	Aug	Feb	Aug	Feb	Aug	Feb	Aug	Feb	Aug	Feb	Aug	Feb	Aug
No. tested	260	783	511	826	334	644	334	833	359		237	-	2035	3086
No. positive	1	-	6	6	-	4	-	28	3			-	10	38
Percentage	0.7	-	1.2	0.7	-	0.6	-	3.4	0.8			-	0.5	1.2
P. vivax	1	-	6	3	-	3	-	26	2			-	9	32
P. fakiparum			-	3	-	1	-	2	1			-	1	6
Sex: M/F	0/1	-	4/2	3/3	-	1/3	-	12/15	3/0			-	7/3	17/23
Age: <1							-	1					-	1
1-5			-	3			-	7					-	10
6-10		-	1			1	-	3	-			-	1	4
11-15		-	2				-	2						
>15	1	-	3	3		3	-	15	3					