

Annual Report of the Anti Malaria Campaign 2006.



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1. Introduction

The number of malaria cases reported during the year continued to decline during the year under review, maintaining the trend that has been established during the past several years. The total number of reported cases was 591 positives, which was comprised of 564 vivax infections and 27 falciparum &/or mixed infections. The highest reported number of cases was from the district of Kurunegala. A high number of cases were also reported from the districts of Vavuniya, Anuradhapura & Trincomalee.

Although the declining trend continues to be maintained it should be remembered that there continues to exist a host of natural and social factors that could influence a resurgence of malaria in the island. Taking this into consideration the Anti Malaria Campaign under the able guidance of the Hon. Minister of Healthcare & Nutrition and the Department of Healthcare & Nutrition has continued with the implementation of a programme of action to further reduce the burden of malaria in the country.

The Campaign has succeeded in developing a programme of work that can be implemented in both the cleared areas and the uncleared areas of the Northern & Eastern Provinces. This programme has taken into account the difficulties faced in implementing a control programme in the conflict affected areas of the country and has succeeded in reducing the burden of the disease in these areas as well.

A matter of serious concern to the Campaign at present is the lack of interest shown by provincial health staff in some districts to continue carrying out the activities under the malaria control programme. The mistaken belief that malaria is no longer a case of concern for these districts could result in jeopardizing the malaria control efforts not only in these particular districts but could affect the entire country as well. It is therefore important for all concerned to continue to contribute actively to the malaria control efforts in the country.

Considering the present favourable malaria situation in the country the Anti Malaria Campaign reorganized the objectives and strategies of the Campaign at the end of 2006. The revised objectives and strategies of the Anti Malaria Campaign are as follows;

Objectives of the Anti malaria Campaign

- To reduce the API among at risk populations in the country by the year 2009, to a level less than 25% of that in 2005 (0.4)
- To reduce the proportion of *P falciparum* infections to less than 3% of all reported malaria of infections by the year 2009(2005 -5.7%)
- To sustain zero mortality from malaria.
- To prevent outbreaks/epidemics of malaria in the country
- To eliminate the occurrence of malaria infections in pregnant women by the year 2009
- To reduce the proportion of malaria infections in children below 5 years to less than 5% of all reported infections by the year 2009 (2005-10%)

Strategies of the Anti Malaria Campaign

- To provide early diagnosis & prompt treatment of malaria patients and asymptomatic parasite carriers
- To plan & implement selective & sustainable vector control measures based on the principles of IVM
- Forecasting, early detection, prevention of outbreaks, and the rapid & effective containment of outbreaks
- To reassess regularly the country's malaria situation, in particular the ecological, social & economic determinants of the disease and evaluation of malaria control activities.
- Enhance community participation and partnership building for effective and sustainable malaria control
- Promotion of human resource development and capacity building
- Promotion of operational research

2. Epidemiology

The district-wise morbidity pattern in Sri Lanka has undergone drastic changes during the last two decades due to the conflict situation prevailing in several districts of the Northern and Eastern Provinces. Prior to the period of conflict, only a very small percentage of the total country-wide morbidity was recorded from these districts. During the 1990s the proportion of cases being reported from the Northern & Eastern districts was approximately 70% of all cases reported during some years. From the year 2000, there has been a marked reduction in the incidence of malaria reported in the country. During the year 2006, a total no. of 1,076,121 blood smears were examined by the surveillance system of the Anti Malaria Campaign. These blood smears revealed a total of 591 confirmed malaria cases out of which 564 were *P. vivax* infections and the rest had *P. falciparum* or mixed infections (9- *Pf* and 18 -mixed infections). In fact the number of confirmed malaria patients recorded during the year 2006 is lowest for 25 years since 1962. The highest recorded number of malaria infections was reported from Kurunegala district (42%) in the year 2006. The districts of Vavuniya, Anuradhapura and Trincomalee contributed 40% to the total country morbidity in the year 2006. The prevailing civil unrest in Vavuniya and Trincomalee contributed to this situation. The proportion of indigenous falciparum cases reported continued to decline (5%) in comparison to preceding years.

Table 1: Parasite formula 2001- 2006

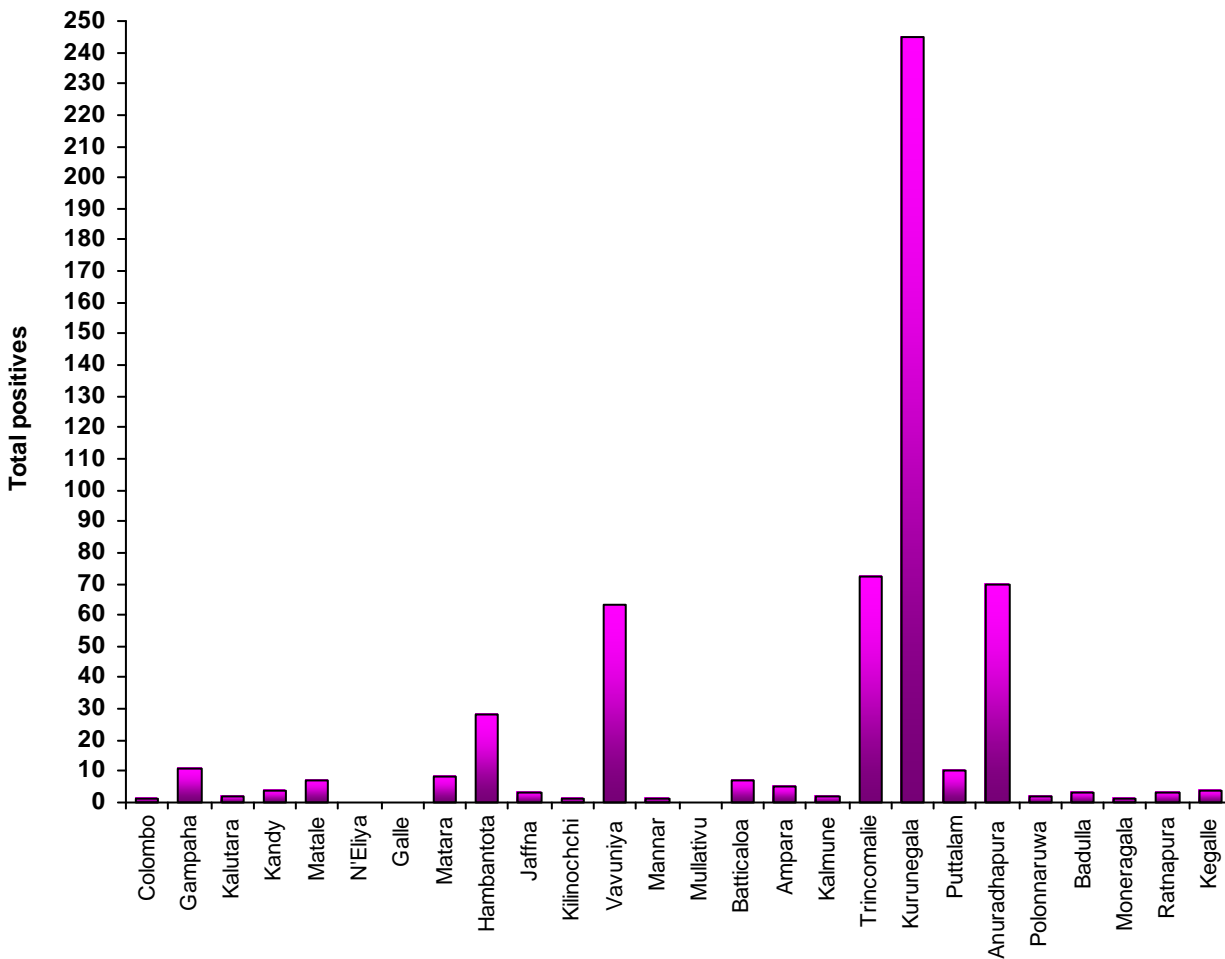
Year	% P.v.	% P.f.
2001	84	16
2002	88	12
2003	88	12
2004	85	15
2005	92	8
2006	95	5

Reported mortality due to malaria in Sri Lanka has been extremely low in the recent past. There were no deaths due to malaria reported in the year 2006.

Table 2 : District-wise screening and microscopically confirmed malaria cases detected in 2006

District	Blood smears examined	Positives	<i>P.vivax</i>	<i>P.falciparum</i>
Colombo	49568	1	0	1
Gampaha	36359	11	11	0
Kalutara	9890	2	2	0
Kandy	27737	6	2	4
Matale	17487	7	6	1
Nuwara Eliya	334	0	0	0
Galle	796	0	0	0
Matara	13489	8	8	0
Hambantota	41163	28	28	0
Jaffna	109891	3	3	0
Killinochchi	27016	1	1	0
Vavuniya	33554	84	83	1
Mannar	13177	1	1	0
Mullaitivu	26844	0	0	0
Batticaloa	109551	7	7	0
Ampara	65718	9	7	2
Trincomalee	48254	74	74	0
Kurunegala	128826	247	238	9
Puttalam	30565	11	8	3
Anuradhapura	124311	78	74	4
Polonnaruwa	56335	2	2	0
Badulla	22954	2	2	0
Moneragala	57228	1	1	0
Ratnapura	20846	4	2	2
Kegalle	4228	4	4	0
Total	1076121	591	564	27

Figure 1. Microscopically confirmed malaria cases (district wise) - 2006



Major factors influencing malaria morbidity in the island

The monsoon rains continue to be the single most important factor contributory to malaria morbidity in the island. The North East monsoon and to a lesser extent the South West monsoon both result in the creation of numerous vector breeding sites. The increased breeding of vectors in these sites result in an increase in malaria morbidity reported. In addition the continuing conflict situation prevailing in several districts of the Northern and Eastern Provinces have periodically resulted in the displacement of thousands of people rendering them vulnerable to malaria infections. This situation has also contributed to an increase of malaria infections reported from the bordering districts in the North Central and Uva Provinces as well. The

breakdown of the civil administration, inability to carry out routine control measures, the presence of large numbers of displaced persons and logistical issues have been contributory to this situation.

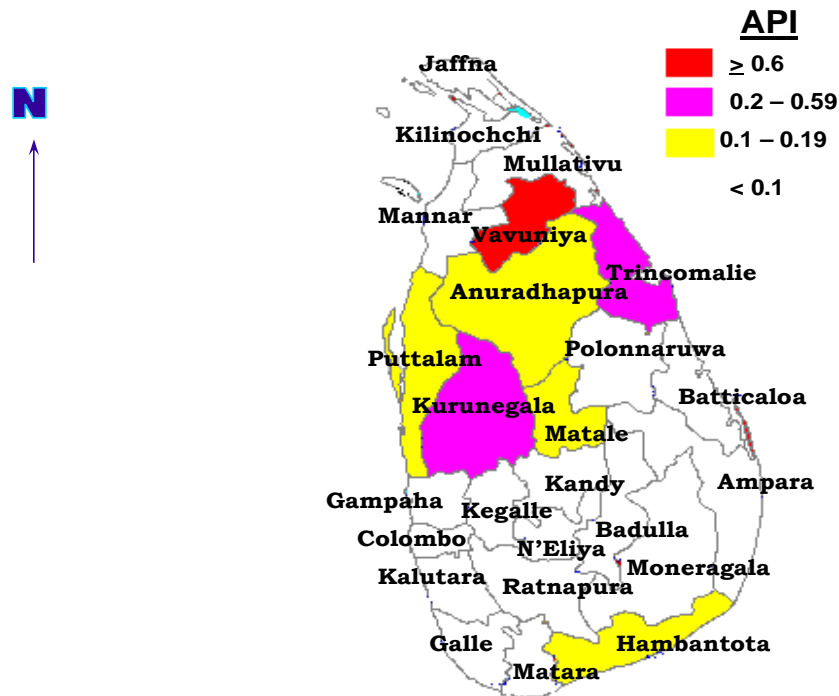


Figure 2. Intensity of district-wise malaria transmission 2006 (API - Annual Parasite Incidence).

Information Management

Timely processing and analysis of information collected from the field and the implementation of control measures has also received increased attention during the recent past. To facilitate this most Regional Malaria Offices have been equipped with computer facilities to enable the officers to rapidly utilize the gathered data (parasitological and entomological) in a meaningful manner. Some of these computers are presently over five years old and it is planned to provide new computers to all the offices during the next year.

The following data is reported by the regions to the Anti Malaria Campaign Headquarters on a monthly basis;

- (a) Malaria morbidity (age-wise and sex-wise)
- (b) Malaria mortality (age-wise and sex-wise)
- (c) Entomological data regarding vector surveillance and susceptibility to insecticides.
- (d) Vector control activities carried out.

Entomological surveillance activities will be discussed in detail under the entomology section.

Epidemics/outbreaks

During the year under review no major outbreaks were reported. A few limited outbreaks were reported from several districts of the country. Among these were limited outbreaks in Hambanthota, Vavuniya, Trincomalee, Anuradhapura and Kurunegala districts. Suitable measures were implemented rapidly through the Regional Officers in each district to control these outbreaks.

Status of Drug Resistance

No resistance to first-line anti malaria drugs was reported for *P. vivax* infections and several cases of chloroquine-resistance were reported among *P. falciparum* infections detected. No indigenous cases of multi-drug resistance were reported from the country during the year.

Programme Priorities

Elimination of malaria deaths, reducing the proportion of indigenous falciparum malaria reported, minimizing the spread of chloroquine-resistant *P. falciparum* infections, delaying the emergence and minimizing vector resistance to insecticides through the implementation of eco-friendly integrated vector management strategy have been identified as programme priorities. Accordingly the objectives and strategies of the Campaign have been revised in December 2006 and the revised objectives and strategies are contained in Section 1 of this report. Due to the large proportion of malaria cases being reported from the Northern & Eastern Provinces of the country and from the adjoining districts, malaria control among the populations inhabiting these areas and especially among internally displaced populations remains an important part of the malaria control programme.

3. Parasitological Surveillance

The parasite surveillance mechanism of the malaria control programme is implemented mainly through Activated Passive Case Detection (APCD). All fever patients having signs and symptoms suggestive of malaria attending state hospitals located in malarious areas are screened for malaria parasites by examination of a blood smear at first visit. In addition, Passive Case Detection (PCD) is carried out in hospitals not located in malarious areas and smaller institutions where Public Health Laboratory Technicians (Microscopists) are not posted. Active Case Detection (ACD) is carried out through Mobile Malaria Clinics which operate in malarious localities situated far away from medical institutions and through focal screening of populations by home visits in outbreak situations.

The Anti Malaria Campaign recommends screening all fever patients that come to an APCD institution for malaria. However, the number of blood smears taken in such institutions has decreased over the years, as the malaria disease burden has fallen down drastically. In spite of this during this year, as in the previous years, screening suspected malaria patients that come to activated medical institutions (APCD) is the most widespread method used for the detection of malaria cases, accounting for 97% of the cases reported. Active case detection (ACD) and mobile clinics are carried out to facilitate early detection of malaria cases (including asymptomatic parasite carriers) thereby reducing the possibility of secondary transmission. ACD contributed to 32% of the total blood smears screened during the year and 16 malaria cases were detected through ACD (2.7% of all positives detected). Six of these cases were detected from mobile clinics conducted in the Vavuniya district.

Screening potential blood donors and donor blood for malaria is another important function carried out by Public Health Laboratory Technicians attached to the Campaign. Categorized under passive case detection (PCD), this accounts for approximately 19% of total blood smears screened. During the year screening of donor blood resulted in the detection of one *P. falciparum* infected blood donor. Screening of all donor blood for malaria parasites is mandatory before transfusion in the country at present.

Table 3 : Proportion of malaria cases detected through the surveillance mechanisms of the Anti Malaria Campaign in 2006

Method of detection	Proportion of blood smears	Proportion of cases detected
Activated Passive Case Detection	49	97
Active Case Detection	32	2.7
Passive Case Detection	19	0.3

Laboratory services

At present approximately 400 medical institutions in the island, located predominantly in the dry and intermediate zones of the country have been activated through the appointment of Public Health Laboratory Technicians and/or Public Health Field Officers. Even though this is roughly about 40% of all the medical institutions in the country, almost all the important medical institutions in the malaria endemic areas have been activated either by the appointment of a Public Health Laboratory Technicians and/or Public Health Field Officer. The district-wise number of activated medical institutions is shown in Table 4 above, with the number of Public Health Laboratory Technicians and Public Health Field Officers serving in these institutions.

Table 4 : Number of Medical Institutions activated for the detection of malaria parasites

Province	District	PHFO only	PHLT only	PHLT and PHFO	Total
Western	Colombo	0	0	0	1(central lab)
	Gampaha	0	8	0	8
	Kalautara	0	1	0	1
Southern	Galle	0	0	0	0
	Matara	0	0	2	2
	Hambanthota	0	5	5	10
Central	Kandy	2	4	5	11+reg.lab
	Matale	0	4	4	8+reg lab
	Nuwara Eliya	1	1	0	2
Sabaragamuwa	Rathnapura	2	6	6	14 +reg.lab
	Kegalle	9	0	4	13
North Western	Kurunegala	24	0	16	40 + 2 reg.labs
	Puttalam	3	8	9	20+reg.lab
North Central	Anuradhapura	4	4	29	37+reg.lab
	Polonnaruwa	2	2	7	11+reg.lab
Uva	Badulla	9	0	6	15+reg.lab
	Moneragala	7	0	10	17
Northern	Jaffna	14	0	6	20+reg.lab
	Kilinochchi	1	2	1	4
	Mullaitivu	1	0	0	1
	Mannar	3	1	0	4
	Vavuniya	0	0	2	2+reg.lab
Eastern	Ampara	10	3	5	18+ Kalmunai.reg lab
	Batticaloa	1	1	3	5+reg.lab
	Trincomalee	10	0	4	14
Total		103	50	124	

The proportion of medical institutions activated in the various provinces is shown in Table 5.

Table 5 : Percentage of Activated Medical Institutions

Province	Proportion of activated medical institutions
Western Province	6%
Southern Province	9%
Central Province	15%
Sabaragamuwa Province	32%
North Western Province	38 %
North Central Province	55%
Uva Province	41%
Northern Province	33%
Eastern Province	34%

Some of the larger institutions in the Western and Southern Provinces which are not in malaria endemic areas have no PHLTT and the malaria cases detected at these institutions may not be notified to the relevant Medical Officer of Health and the Anti Malaria Campaign. The medical institutions that have not been activated by the appointment of Public Health Laboratory Technicians in the endemic areas have been strengthened through the provision of malaria rapid diagnostic test kits, as a supplementary measure to screen malaria patients. In addition to this 20 Health Assistants, trained in malaria microscopy have been recruited on contract basis in the Northern and Eastern Provinces under the GFATM malaria control project.

Provision of Laboratory Items

The AMC Directorate provides microscopes and accessories in addition to supplying laboratory items and reagents required for malaria microscopy to the provinces. The Directorate also maintains buffer stocks of these items to be used in emergency situations. During the 2006 the following quantities of the items listed in table 6 were issued to the provinces mainly through the Regional Malaria Offices.

Table 6 : Laboratory items required for malaria microscopy issued to Regional Malaria Offices during the year 2006.

Item	Amount supplied
Blood lancets	539,300
Glass slides	362,800
Anisole	50 L
Cotton wool	18 kg
Ethanol 70%	20 L
Giemsa stain stock solution	125 L

Cross checking

The central laboratory of the AMC Directorate also functions as the reference laboratory for malaria microscopy. The Central Laboratory routinely carries out cross checking of blood smears. All positive blood smears and a percentage of randomly selected negative blood smears are cross checked to confirm the accuracy of diagnosis. Based on the results of cross checking a system of quality control for malaria microscopy is implemented through out the island.

4. Entomology

The entomological section contributed to the Malaria Control Programme in the year 2006 by continuing routine entomological investigations in many Districts. Towards the end of the year, two new entomologists (Ms. Jeevani Harischandra and Ms. Mihirini Hevawitharana) were posted to the Anti Malaria Campaign Headquarters after an absence of an Entomologist for nearly seven years.

Field investigations which included routine sentinel monitoring and outbreak investigations were carried out by the three entomological teams attached to Anti Malaria Campaign Directorate. The field staff consisted of five Entomological Assistants, Four Public Health Field Officers and nine dedicated labourers, additional labourers were used as when required from other sections in the headquarters. The total number of investigations carried out during the year was 36 and the Districts covered were Puttalam (16 times), Kurunegala (12 times), Hambanthota and Ampara (3 times each), Anuradhapura (2 times), Gampaha, Matale, Moneragala, Polonnaruwa, Rathnapura and Trincomalee (once each). More investigations were carried out in Puttalam and Kurunegala districts due to an ongoing research project evaluating the efficacy of Bifenthrin 10% w.d.p as a residual insecticide.

During investigations the following entomological techniques were used when and where feasible;

1. Pyrethrum Spray Sheet Collection
2. Cattle Baited Net Trap Collection
3. Cattle Baited Cadjan Hut Collection
4. Window Trap Collection
5. Larval Survey
6. Human Baited Night Collection
7. Susceptibility Test
8. Bio Assay (for residual sprays and treated mosquito nets)

Summarized data obtained from the entomological investigations carried out by the three entomological teams attached to AMC Headquarters and the data supplied by the entomological teams of the other districts are shown below.

The data collected from larval surveys are summarized in Table 7,8,9. The major vector, *Anopheles culicifacies* was found to be breeding mainly in rock pools, sand pools and stagnant ground water pools.

Table 7 : Results of larval Survey

Type of breeding place	No. of dips	No. of I & II instar larvae	No of III & IV instar larvae	An. culicifacies per dip	III & IV instar larvae			
					An. culicifacies	An. subpictus	An. annularis	An. varuna
Agricultural Well	2,795	592	665	0.11	301	26	0	49
Barrel	95	0	0	0	0	0	0	0
Built well	125,458	9,544	5,821	0.02	1,901	2,858	0	626
Burrow pit	11,078	1,792	959	0.00	25	198	0	56
Canal	21,217	3,377	1,893	0.02	382	691	26	180
Cemented tank	1,001	64	63	0.01	6	20	0	7
Connected pool	9,018	1,596	510	0.00	43	189	2	79
Drain	170	8	8	0	0	0	0	0
Gem pit	6,088	1,516	702	0.02	127	52	2	65
Ground pool	69,059	7,891	3,778	0.00	130	644	21	119
Hoof print	1,178	339	411	0.04	52	113	0	28
Irrigation canal	14,734	2,747	1,149	0.01	110	144	12	228
Lagoon	250	38	37	0	0	34	0	0
Marshy Land	1,417	165	129	0	0	45	0	0
Oya margin	28,813	7,065	3,033	0.02	451	81	0	1,376
Paddy field	27,135	5,484	2,721	0.00	117	335	27	117
Plastic tank	20	0	0	0	0	0	0	0
Ponds	48,455	4,490	2,158	0.01	565	751	0	235
Quarry pits	14,665	2,603	2,565	0.03	390	590	147	29
Rain water collection pools	8,646	3,711	1,512	0.00	24	382	11	64
River margin	20,635	6,431	2,323	0.01	229	81	0	1,487
Rock pools	15,769	5,609	4,160	0.09	1,382	649	6	672
Sand pools	31,852	13,172	6,090	0.08	2,506	825	7	1,181
Stagnant pools	2,080	1,289	372	0.05	96	19	0	95
Stream	7,977	2,993	1,666	0.01	43	117	35	436
Tank	13,961	1,822	1,122	0.00	11	173	175	23
Tree Hole	18	0	0	0	0	0	0	0
Trench	245	0	0	0	0	0	0	0
Tyre print	104	136	82	0.16	17	47	0	0
Unbuilt well	3,694	411	368	0.004	16	54	0	100

Among the most productive breeding sites identified through larval surveys were agricultural wells, tyre prints, rock pools and sand pools. Atypical breeding sites for A.

culicifacies that were sampled were included barrels, drains, lagoons, marshy lands, plastic tanks, tree holes and trenches. However none of these sites contained the larvae of *culicifacies*.

The indoor resting of the principal vector *A. culicifacies* and the secondary vector *A. subpictus* were determined through Pyrethrum Spray Sheet collections carried out in sprayed and unsprayed dwellings. The data obtained is summarized in Table 8.

Table 8 : Results of Pyrethrum Spray Sheet Collection

Insecticide	Days After Spraying	No. of Houses		Species	No. of Female				
		Positive	Negative		Total	UF	BF	SG	G
Deltamethrin	1-30	38	21	<i>An.cul</i>	23			5(21.74)	18(78.26)
				<i>An.sub</i>	51			19(37.25)	32(62.75)
	31-60	10	20	<i>An.cul</i>	7				7(100)
				<i>An.sub</i>	25			10(40)	15(60)
	61-90	10	36	<i>An.cul</i>	13				13(100)
				<i>An.sub</i>	7				7(100)
	91-120	40	10	<i>An.cul</i>	11				11(100)
			<i>An.sub</i>	52		3(5.76)	24(46.15)	25(48.07)	
	121-150	2							
	OD	224	94	<i>An.cul</i>	38			16(42.10)	22(57.9)
				<i>An.sub</i>	336	34(10.11)	17(5.05)	114(33.92)	171(50.9)
	DNK	10		<i>An.sub</i>	2			2(100)	
Etofenprox	1-30	29	134	<i>An.sub</i>	7			3(42.85)	4(57.15)
	31-60	84	128	<i>An.cul</i>	12	10(83.33)			2(16.67)
				<i>An.sub</i>	35		1(2.857)	13(38.14)	21(60)
	61-90	60	117	<i>An.cul</i>	6			2(33.33)	4(66.67)
				<i>An.sub</i>	15	3(20)		12(80)	
	91-120		70						
	121-150		40						
	151-180	20		<i>An.sub</i>	4			1(25)	3(75)
	OD	213	196	<i>An.cul</i>	113	14(12.38)	36(31.85)	29(25.66)	34(30.08)
				<i>An.sub</i>	523	85(16.25)	6(1.14)	155(29.63)	277(52.96)
	DNK	30	30	<i>An.cul</i>	4		1(25)	3(75)	
				<i>An.sub</i>	3			3(100)	
Fenitrothion	1-30		107						
	31-60		47						
	61-90		70						
	OD	87	90	<i>An.cul</i>	18	1(5.55)	13(72.22)	1(5.55)	3(16.66)
				<i>An.sub</i>	15	4(26.66)	1(6.66)	6(40)	4(26.66)
	DNK		2						
Lamda Cyhalothrin	1-30	2		<i>An.sub</i>	3			3(100)	
	31-60	10		<i>An.cul</i>	2		2(100)		

	OD	126	40	<i>An.sub</i>	93	1(1.07)		54(58.06)	38(40.86)
Cyfluthrin	1-30		26						
	31-60		5						
	151-180		30						
	OD	962	97	<i>An.cul</i>	81	29(35.80)	23(28.39)	14(17.28)	15(18.51)
				<i>An.sub</i>	835	56(6.70)	19(2.27)	287(34.37)	473(56.64)
	DNK	110	10	<i>An.sub</i>	127	4(3.15)	17(13.38)	34(26.77)	72(56.69)
Unsprayed		1093	1609	<i>An.cul</i>	262	3(1.14)	51(19.46)	100(38.16)	108(41.22)
				<i>An.sub</i>	1581	137(8.66)	37(2.36)	520(32.89)	887(56.10)

OD- Spraying over due

DNK – Do not know when spraying was last done

The susceptibility status of *Anopheles culicifacies* to different insecticides was tested using standard WHO procedure and impregnated test papers provided by WHO. Results are given in Table 9. In addition to the results below susceptibility tests were also carried out in Buttala, Chilaw, Kebithigollewa, Manipay and Point Pedro. But the numbers of mosquitoes collected in these localities were not sufficient to draw meaningful conclusions. In addition susceptibility tests were carried out for Etofenprox, Lambda cyhalothrin, Alpha cypermethrin and Malathion.

Table 9 : Results of susceptibility tests carried out for *Anopheles culicifacies* against various insecticides

Health Area	No of Tests	No.of.Mosquitoes Tested (% 24 Hours Mortality)					
		Deltamethrin 0.05%	Permethrin 0.75%	Bifenthrin 0.20%	Bendiocarb 0.10%	Propoxur 0.10%	Fenitrothion 1%
Anamaduwa	5			96(100)	95(97.89)		
Arachchikattuwa	4				80(98.75)		
Arachchikattuwa	5			105(100)			
Arachchikattuwa	8						170(93.52)
Bingiriya	6			115(100)			
Galewela	4					80(100)	
Galewela	7	112(100)					
Galewela	5		78(100)				
Galewela	1				20(100)		
Horowpatana	2			40(100)			

5. Transmission risk reduction

Malaria in Sri Lanka being of the unstable type, rigorous vector control methods are necessary to prevent outbreaks/epidemics. The principal vector is *An. culicifacies*. However two other species *An. subpictus* and *An. annularis* are recognized as being secondary vectors. The principal vector being endophagic and endophilic, indoor residual spraying of insecticides as a vector control method is still necessary in areas where active transmission is occurring and in potential high risk areas. Some of the criteria used at present to identify such areas are;

- a. Active disease transmission with special emphasis on areas with *P. falciparum* cases being reported.
- b. Chloroquine resistant *P. falciparum* cases being reported.
- c. Outbreak-prone localities.
- d. Developmental project areas.
- e. Vulnerable population groups – presence of large numbers of internally displaced people

Other methods used widely to reduce risk of transmission include

- (i) Promotion and provision of insecticide-treated mosquito nets.
- (ii) Promotion of the use of other self protection methods.
- (iii) Selective application of chemical larvicides in identified breeding sites (“Temephos”).
- (iv) Breeding and introduction of larvivorous fish to potential breeding sites suitable for survival of fish (*Poecilia reticulata*, *Aplocheilus dayi*).
- (v) Space spraying as a temporary measure in special circumstances (egs : Camps for internally displaced persons).

An integrated vector management strategy is implemented in the country. Emphasis is placed on increased implementation of environmentally friendly vector control activities. During the year 2006, malaria vector control was achieved through the rational use of insecticides in rotation for indoor residual spraying (IRS), distribution of long lasting insecticide-treated nets (LLINs), introduction of larvivorous fish, impregnation of mosquito nets with permethrin and limited space spraying in special situations.

Indoor residual spraying of insecticides was carried out using the following insecticides Deltamethrin 5% w.d.p, Fenitrothion 40% w.d.p, Lambda cyhalothrin 10% w.d.p, Etofenprox 20% w.d.p and Cyfluthrin 10% w.d.p (Table 10). Bifenthrin 10% w.d.p was successfully used in a village scale trial and it was decided to commence operational use of Bifenthrin in 2007/2008. The total target population protected under the indoor residual programme was 794,694 during the year 2006. A total of 217,649 dwellings were sprayed with residual insecticides during the year. Fenitrothion was used in Kurunegala, Maho, Matale, Vavuniya, Kilinochchi and Mullaitivu districts and Etofenprox was used in Mannar, Trincomalee, Puttalam, Kalmunai, Batticaloa, Polonnaruwa and Moneragala districts. In Mannar, Mullaitivu, Ampara and Rathnapura districts Deltamethrin was used. Limited quantities of Lambda cyhalothrin were used in Kilinochchi & Mullaitivu districts and Cyfluthrin in Puttalam & Polonnaruwa districts.

Table 10 : Quantity of Insecticides used for malaria vector control during 2006

Insecticides	Stock available from 2005 (Kgs)	Purchases during 2006 (Metric Tons)	Usage during 2006 (Kgs)
Indoor Residual Spraying			
Deltamethrin 5% wdp (1 barrel = 11.25 kg)	nil	12	4151.2
Cyfluthrin 10% wdp (1 barrel = 9 kg)	90	6	654.6
Fenitrothion 40% wdp (1 barrel = 20kg)	11000	35	36847.1
Lambda cyhalothrin 10% wdp (1 barrel = 9 kg)	nil	6	1003.6
Etofenprox 20% wdp (1 barrel = 9 kg)	1357	15	9363.3

Bifenthrin 10% wdp (1 box = 8.5 kg) (For village trial)			593.4
Space spraying			
Technical Malathion (1 drum = 191 litres)	1597 litres	Nil	1406
Impregnation of Mosquito Nets			
Permethrin 10% EC (1 barrel = 25litres)	658 litres	Nil	512 litres
Permethrin 50% EC (1 bottle = 1 litre)	25	Nil	19 litres
Larvicides			
Temephos 1% sg (1 barrel = 25kg)	08 Barrels	Nil	200 kg
Temephos 50% EC (1 barrel = 25litres)	41 Barrels	Nil	425 litres
Growth Hormone Regulators			
Pyriproxifen 1% gr	--*	Nil	87.7 kg

* All stocks were distributed to regions.

One hundred thousand Deltamethrin impregnated long lasting insecticide treated nets were distributed among populations inhabiting malarious areas of the Kilinochchi, Kalmunai, Anuradhapura, Kurunegala and Maho regions. Approximately 400,000 people have been protected through the distribution of these nets and this protection is expected to be effective for 3 – 5 years. An estimated 13,060 nets were impregnated using Permethrin 10% EC and Permethrin 50% EC during the year. This is expected to provide protection to a further 52,240 people over a period of 6 – 9 months.

Larvivorous fish were introduced into abandoned wells and gem-pits as biological method of control. Long term monitoring of survival of fish in these sites needs to be undertaken to obtain data regarding the efficacy of this strategy and also to obtain data regarding the need for reintroduction of fish. Space spraying was done in some camps for the internally displaced and in Anuradhapura sacred city area during the Poson period, Madhu church area during the Madhu festival and in Kataragama sacred city area during the Kataragama festival period.

6. Administration

Cadre position of staff at the Anti Malaria Campaign Headquarters

The Anti Malaria Campaign Headquarters had following number of cadres as at end of year 2006.

Table 11 : Cadre position of staff at Anti Malaria Campaign Headquarters 2006

Category of Staff		Approved cadre	In position	
			Male	Female
1	Administrative Grade MOO	02	-	-
2	Community Physicians	03	1	1
3	Other Consultant			
4	MOO Gr I	01	-	-
5	MOO Gr II	04	3	2
6	MOO Preliminary	-	-	-
7	Parasitologist	01	-	1
8	Entomologists	02	-	2
9	Accountant	01	-	1
10	Development Assistants	-	2	4
11	Management Assistants	-	-	-
12	Data Entry Operator	02	-	1
13	HMAS - Grade I	-	-	3
14	HMAS - Grade II	-	3	1
15	Public Management Assistant Services	-	-	1
16	Store keepers	03	4	-
17	PHI	02	2	-
18	Entomological Assistants	05	4	1
19	Public Health Field Officers	10	4	2
20	Public Health Laboratory Technicians	22	2	6
21	Cinema Operator	01	-	-
22	Drivers	19	15	-
23	K.K.S.	01	1	-
24	Roneo Operator	01	1	-
25	Lab Orderly	03	-	1
26	Spray Machine Operators	19	15	-
27	Ordinary Labourers	-	10	2
28	Sanitary Labourers	-	30	1
29	Labourers (Casual)	-	6	1
Total		102	104	31

In December 2006 Acting Director Dr. R. R. M. L. R. Siyambalagoda sought and obtained a transfer to Peradeniya Teaching Hospital for personal reasons. Dr. Rabindra R. Abeyasinghe, Consultant Community Physician is presently the Acting Director.

Vehicles-

The Anti Malaria Campaign Headquarters requires an adequate number of vehicles in roadworthy condition to perform effective malaria control island wide including the cleared and uncleared areas in Northern and Eastern Provinces. At present AMC HQ has the following number of vehicles.

Table 12 : Vehicles available at Anti Malaria Campaign Headquarters 2006.

Type	Road Worthiness	Availability at HQ
Mitsubishi Lorry	Yes	i. 42-1607 ii. 42-9399 iii LC-0249
Mitsubishi Pajero jeep	Yes	32-6520
Mitsubishi van L200	Yes No, to be repaired	i. 60-7023 ii GP-2558 iii GP-2556 iv 42 - 1615
Toyota Double Cab	Yes	GQ-2646
Nissan Caravan Van	Yes	NA-3117
Ford Ranger Double Cab	Yes	PA-4589
Toyota Prado jeep	Yes	65-2966 (Transferred to GFATM project office)
Mitsubishi Lorry	Yes	42-1624 (Transferred to Kalmunai Hospital)
Mitsubishi D/Cab	Yes	JW 3482 (Released to Presidential Secretariat) JW-3476 (Transferred to Peradeniya Teaching Hospital)

Table 13 : Distribution of vehicles bought under GFATM Project in 2006

Type	Reg. Number	Present Station
Ford Ranger	WP PA 4591	RMO Office Moneragala
„	WP PA 4590	RMO Office Mullaitivu
„	WP PA 5488	RMO Office Anuradhapura
„	WP PA 7572	RMO Office Maho
„	WP PA 7571	RMO Office Kurunegala
„	WP PA 7570	RMO Office Hambanthota
	WP PA 7569	RMO Office Embilipitiya
	WP PA 7568	RMO Office Puttalam
	WP PA 7567	RMO Office Matale

Drugs-

AMC HQ always keeps an adequate amount of anti malarial drugs in stock to meet emergency requirements of the districts and medical institutions. Following tables show types of anti malarial drugs and the amount distributed to districts through the Regional Offices during year 2006.

Chloroquine Tablets-

Amount in stores (January 2006)	242,000
Amount received 2006	247,000
Amount issued	273,000

Table 14 : Issue of first line antimalarials to regions and medical institutions during 2006

RMO Region	Chloroquine tablets (150mg)	Primaquine tablets (7.5 mg)
Maho	35,000	2,000
Polonnaruwa	1,000	
Embilipitiya	5,000	
Trincomalee	17,000	
Matale	65,000	
Puttalam	2,000	
Hambanthota	12,000	
Kurunegala	22,000	10,000
Anuradhapura	30,000	10,000
Kandy	1,000	1,000
Mannar	1,000	
Kalmunai	5,000	
Vavuniya	50,000	
Badulla	3,000	2,000
Kegalle	2,000	2,000
Ampara	5,000	
HQ	7,000	1,000
S/L Army	1,000	10,000

Primaquine Tablets

Amount in stores (January 2006) 365,000

Amount received 2006 96,000

Sulphadoxine +Pyrimethamine (Fansidar)

Amount in store (January 2006) 445,600

Amount received 2006 3,500

Amount issued 2006 5,350

Table 15 : Issue of secondline antimalarials in 2006.

RMO Region/Institute	Sulphadoxine (500 mg) + Pyrimethamine (25 mg) tablets	Quinine tablets (300 mg)	Quinine vials
Maho	1,000	1,000	100
Matale	1,000		50
Kurunegala	1,000	1,000	
Hambanthota	100	200	10
Kandy	50		
Kalmunai	1,000	250	10
Kegalle	50		
Ampara	1,000		
Anuradhapura		1,000	25
Puttalam			100
Mannar			20
Moneragala			50
Headquarters		1,000	250
T. H. Kalubowila	50		
S/L Army	100		
Total issues	5,350	4,450	615

Quinine Tablets

Amount in store (January 2006)	16,350
Amount received	13,600
Amount issued	4,450

Quinine vials

Amount in store (January 2006)	4,605
Amount received 2006	1,000
Amount issued	615

7. Foreign funded projects

Many international organizations extend their assistance to malaria control programme in Sri Lanka in several ways. During the past few years Malaria control programme of Sri Lanka was supported by WB, WHO, RBM and GFATM.

During the year 2006, the WHO and GFATM assisted the Malaria Control Programme in Sri Lanka. In addition, the Anti Malaria Campaign received funds from the FAO for continuation of the Integrated Pest & Vector Management project.

WHO

WHO assistance to the malaria control programme in 2006 was under the 2006/2007 biennium programme of the Country Budget and included funding for the following activities:

- Developing technical capacity of malaria control staff in monitoring & evaluation (M&E) through the training of one central level (Dr. G. N. L. Galappaththy) and one district level full time malaria control officer (Regional Officer Anuradhapura Mr. S. R. Jayanetti) on M&E of malaria control activities for a period of six weeks at the National Institute of Communicable Diseases, New Delhi, India
- Reviewing and revising the existing tools for monitoring and evaluation of malaria control activities and developing new tools to monitor and evaluate the malaria control programme and Millennium Development Goals related to malaria through the conducting of consultative workshops for district level malaria control officers to develop M&E plans and review/revise existing M&E tools.
- Strengthening vector surveillance activities through the provision of reagents necessary for monitoring of vector susceptibility for insecticides. One consignment of impregnated papers was received in 2006.

- Developing knowledge & skills of middle level malaria managers in management skill of malaria control by conducting in service training programmes for Medical officers of Health in endemic districts on management of malaria control activities. The first programme was held in October with the participation of twenty five MOOH and the second programme was held in November with the participation of twenty four MOOH.

The Global Fund to fight Aids, Tuberculosis and Malaria (GFATM)

During the year 2006, the National Malaria Control Programme was supported by two GFATM Malaria Control Projects under the Round 1 & Round 4 grants. The Programmes are jointly implemented through a partnership between the Ministry of Healthcare & Nutrition and Sarvodaya Shramadana Movement of Sri Lanka. The GFATM Round 1 Malaria Control Project was started in year 2003 & the Round 4 project was started in 2005.

GFATM Round 1 Malaria Control Project

This project funds special activity carried out to enhance malaria control in conflict-affected districts in Northern, North Central & Eastern provinces. This project mainly focuses on marginalized populations in the districts of Anuradhapura, Polonnaruwa, Jaffna, Killinochchi, Mullaitivu, Mannar, Vavuniya, Trincomalee, Ampara, Kalmunai, Batticaloa and Moneragala.

The following activities were carried out during the year 2006.

- Conducting malaria mobile clinics in high risk areas.

Twenty malaria mobile clinics per month in each project district were conducted in addition to the provincial allocation, to reduce malaria transmission. Approximately 2,500 malaria mobile clinics were conducted (87% of target achieved) during the year 2006. A total of 188,000 blood smears were examined in the mobile clinics yielding ten positive cases (9 *P. vivax* cases & 1 *P. falciparum* cases).

- Enhanced entomological surveillance.

Six additional days of entomological surveillance per district per month were funded through the project to augment the entomology component of the National Malaria Control Programme

with the view to forecasting and preventing malaria outbreaks and epidemics. Overall a total of 593 additional days of entomological surveillance was carried out in the project districts utilizing project funds.

- District level In-service training programmes.

Twelve district level in-service training programmes for Public health Field Officers and 26 programmes for Public Health Inspectors were conducted on environment friendly malaria control methods. Programmes were also conducted for spray machine operators.

- Overseas training for district level malaria control officers and field staff.

One central level medical officer (Dr. U. J. Kaluarchchi) and five district level Regional Malaria Officers (RO Kilinochchi Dr. A. Thileban, RO Mannar Dr. V. Pathiraja, RO Kurunegala Dr. MDB Perera, RO Kandy Dr. PHD Kusumawathie and RO Rathnapura Mr. NB Munasinghe) were trained at the Vector Control Research Centre, India on malaria control in the programme of Training of Trainers.

- Nineteen Health Assistants were trained and recruited on contract basis to improve diagnostic facilities in hospitals of the conflict affected districts.
- Ninety five Spray Machine Operators were also recruited on contract basis to facilitate indoor residual spraying in project districts.
- Portable furniture was purchased for use by district & central level entomological teams.
- A mini bus was purchased for use of central entomological teams.
- Twelve monthly reviews of GFATM project activities were conducted with the participation of RMOO and representatives from Sarvodaya / Lions' International were conducted at Anti Malaria Campaign Headquarters.
- IEC materials (leaflets, exercise books, calendars) on malaria control strategies were produced & distributed in project districts.
- Operational research studies.

Under the project, two research projects were initiated with University of Colombo and University of Kelaniya.

GFATM Round 4 Malaria Control Project

This Project focuses on scaling up efforts of the National Malaria Control Programme in Sri Lanka and focus on poor, vulnerable populations living in six epidemic-prone districts of Sri Lanka which are at increased risk for malaria due to occupational factors. The focus districts are Moneragala, Matale, Rathnapura, Kurunegala, Puttalam and Hambantota. The Program is jointly implemented through a partnership between the Ministry of Healthcare & Nutrition and the Sarvodaya Shramadana Movement of Sri Lanka.

The following activities were carried out during the year 2006.

- Conducting malaria mobile clinics in high risk areas.

Ten malaria mobile clinics per month in each project district were conducted in addition to the provincial allocation, to reduce malaria transmission among vulnerable and mobile populations through early detection and treatment. Approximately 650 malaria mobile clinics were conducted (95% of target achieved) & 43,246 blood smears were examined from all six project districts during the year 2006. Only one positive case (*P.vivax*) of malaria was detected from mobile clinics.

- Enhanced entomological surveillance.

Five additional days of entomological surveillance was funded through the project to augment the entomological surveillance of the National Malaria Control Program with a view to forecasting and preventing malaria outbreaks and epidemics. In certain project districts, the enhancement of entomological surveillance has been affected during the first four months of the year. Although this has improved during the next quarters, overall a total of 366 entomological days were done achieving 85% of the target. Shortage of vehicles and delayed disbursement of funds to project districts during the first quarter of the year 2006, were reasons contributing to the failure to achieve 100% of the target.

- District level In-service training programmes.

Twelve district level in-service training programmes were conducted for PHII & PHFOO. One hundred and sixty eight PHII & 164 PHFOO were given training on implementation of environmentally friendly malaria control methods.

- Overseas training for district level malaria control officers and field officers.

Three Regional Malaria Officers (RO Hambanthota Mrs. B. S. L. Peiris, RO Puttalam Dr. D. A. R. Premasiri, RO Moneragala Mr. M Faizal) were trained at Liverpool School of Tropical Medicine on Biology of Disease Vectors & eight Public Health Inspectors were trained at the Vector Control Research Centre, Pondicherry, India under the project.

- Six double cab type vehicles were purchased for use by malaria control staff in project districts (see distribution under vehicles).
- One lorry was purchased to improve insecticide transport facilities to project districts.
- Operational research studies. A research project to evaluate the relative efficacy of two larvicides (Temephos & Pyriproxifen) was initiated in Kurunegala and Puttalam districts.
- Twelve monthly reviews on GFATM project activities with the participation of RMOO and representatives from Sarvodaya / Lions' International were conducted at Anti Malaria Campaign Headquarters.
- IEC materials (leaflets, exercise books, calendars) on malaria control strategies were produced & distributed in project districts. Sixty nine village level health education seminars were conducted.
- Twenty fish tanks were constructed to breed & distribute larvivorous fish in 6 project districts.

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I acknowledge the hard work put in by all the staff of the Anti Malaria Campaign Directorate, especially the Staff Officers who have contributed immensely to the reduction of malaria in the country and also contributed to making this Annual Report a reality. In this respect I particularly wish to thank Dr. Gawrie Galappaththy.

My sincere thanks go out to all the Provincial Directors of Health Services, Regional Directors of Health Services, the Regional Officers of the Campaign and the field staff who have all worked tirelessly over several years to reduce malaria in their respective areas. I also take this opportunity to thank Dr. R. R. M. L. R. Siyambalagoda, former Acting Director, Anti Malaria Campaign for the guidance and leadership provided during the greater part of the year under review.

I also wish to thank all the non technical staff of the Campaign who have contributed in no small measure to the success achieved by the Campaign.

Dr. Rabindra R. Abeyasinghe,
Acting Director, Anti Malaria Campaign.