

Introduction

The number of malaria cases reported during the year 2009 continued to decline, maintaining the trend that has been established during the past several years. However with the escalation of the conflict in the Northern Province the number of cases reported among security forces personnel showed a marked increase. The total number of reported cases including security forces personnel and civilians were 558 positives, which comprised of 529 vivax infections and 29 falciparum &/or mixed infections. The highest reported number of cases was from the district of Mullativu. A high number of cases were also reported from the neighboring districts of Kilinochchi, Vavuniya and Hambantota, Moneragala districts.

With the cessation of the civil war that prevailed for more than 30 years in Sri Lanka, the Anti Malaria Campaign developed and implemented a programme of work that can be successfully implemented in both the previous cleared areas (transitional districts) and the recently cleared areas (conflict affected districts) of the Northern Province. This programme has taken into account the difficulties faced in implementing a pre elimination of malaria programme in the Northern province and eastern districts that have succeeded in reducing the burden of the disease.

Considering the favourable malaria situation in the country the Anti Malaria Campaign reorganized the objectives and strategies of the campaign at the end of 2008. This reorganization was done to transform the current successful control programme to a pre-elimination programme. The objectives of this reorganization will be to achieve phased malaria elimination in the country by the end of 2015. Accordingly the country was classified as three zones: non-conflict areas, transitional areas and conflict affected areas (figure 1);

a. Stable (non-conflict) districts

This area includes the districts of Puttalam, Kurunegala, Matale, Anuradhapura, Polonnaruwa, Kandy, Nuwara Eliya, Badulla, Moneragala, Hambantota, Marata, Galle, Kalutara, Colombo, Gampaha, Ratnapura and Kegalle.

b. Transition districts (recently cleared areas)

This area includes the districts of Trincomalie, Batticaloa, Ampara and Kalmune

c. Conflict affected districts

This area includes the districts of Jaffna, Mannar, Kilinochchi, Mullativu and Vavuniya

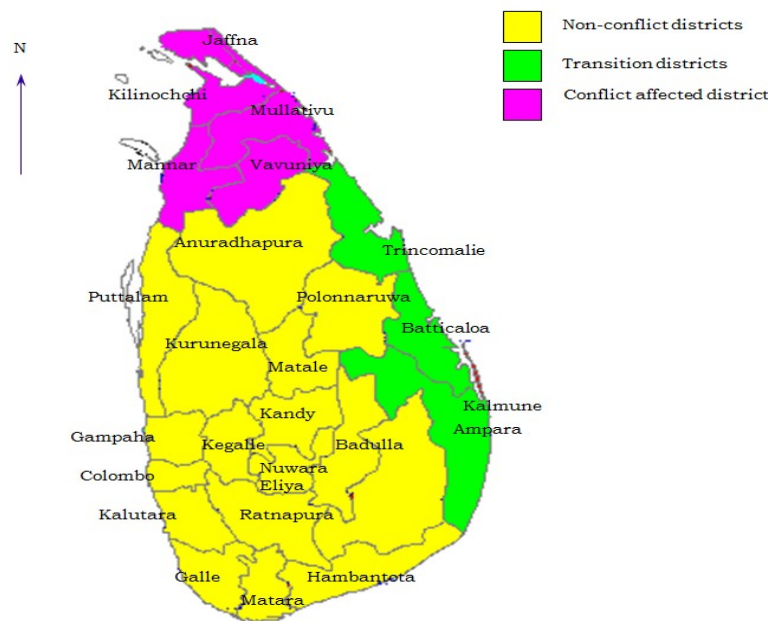


Figure 1. Distribution of malaria districts in three zones

The revised objectives and strategies of the Anti Malaria Campaign are as follows;

Objectives of the Anti Malaria campaign

1. To eliminate indigenous *P. falciparum* malaria by the year 2012 in non-conflict & transitional areas of the country.
2. To eliminate indigenous *P. vivax* malaria by the year 2012 in 75% of non-conflict & transitional areas of the country
3. To reduce API in conflict affected areas to 75% of the API reported in 2007, by the year 2012.
4. To maintain zero mortality from malaria in Sri Lanka

Strategies of the Anti Malaria campaign

- To provide early diagnosis and prompt treatment of malaria patients and asymptomatic parasite carriers.
- To plan and 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 and 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.

Epidemiology

The 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 country-wide morbidity was recorded from these districts.

A total no. of 909,632 blood smears were examined by the departmental staff attached to the medical institutions and the Anti Malaria Campaign including its regional offices during 2009. Following this screening 558 confirmed malaria cases were detected. This including 529 *P.vivax* infections and 29 *P. falciparum* or mixed infections (22- *Pf* and 7 -mixed infection) (table 1 and Figure 2, 3). Significantly 14 *P.vivax* infections, 13 *P.falciparum* or mixed infections were imported from other countries.

Table 1. Parasite formula 2001- 2009

Year	Proportion of <i>P.vivax</i> infections	Proportion of <i>P.falciparum</i> infections
2001	84	16
2002	88	12
2003	88	12
2004	85	15

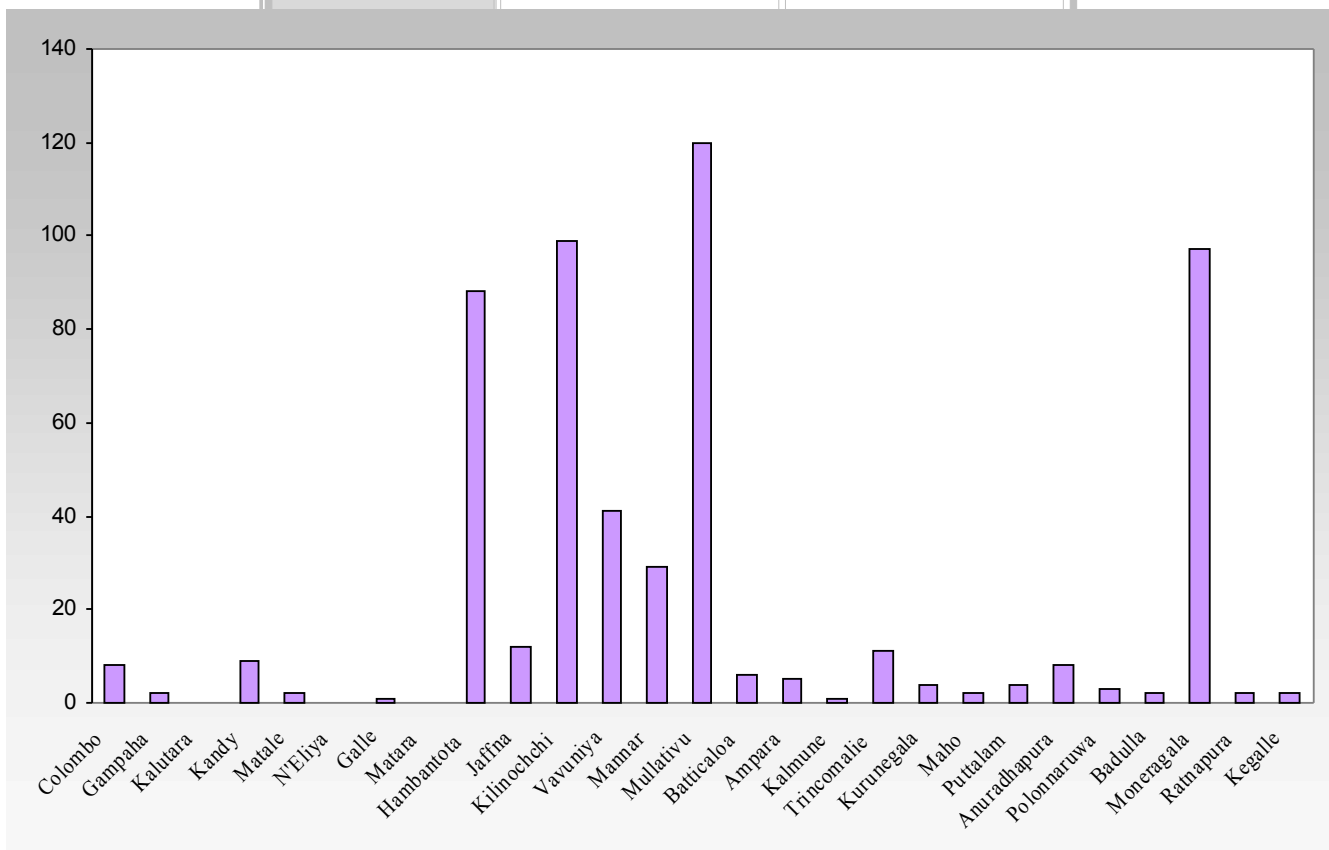


Figure 2. Microscopically confirmed malaria cases (district wise) - 2009

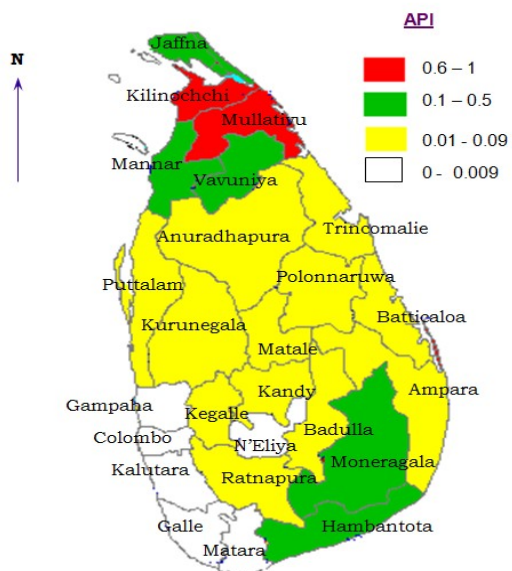


Figure 3. Intensity of malaria Transmission in Sri Lanka (represented district-wise) 2009 Information Management

Monthly reports are received at the Anti Malaria Campaign Headquarters which regard to the following:

- (a) malaria morbidity and mortality (age-wise and sex-wise)
- (b) entomological data regarding adult vector and larvae.
- (c) vector control activities carried out.
 - adulticiding
 - larviciding

Action is underway to complete provision of computer facilities to all the Regional Malaria Offices and subsequently to establish networking facilities and web based reporting system (with the assistance of GFATM Project).

Epidemics/outbreaks

The following parameters are used to forecast epidemics.

- (a) regular observation of fever incidence / and malaria morbidity in Medical Institutions.
- (b) monitoring of adult vector densities in sentinel stations, and by random spot checks.
- (c) monitoring of larval densities in sentinel stations.

There were no major epidemics reported in the year 2009. An outbreak was reported in the districts of Hambantota, Kilinochchi, Mulativu and Moneragala.

Action taken to prevent and control of these outbreaks:

- (a) Enhanced case detection and treatment in association with Sri Lanka Army Medical Unit and other security personnel.
 - at field medical points
 - at Army Medical Units and hospitals
 - in civilian hospitals used for the care and treatment of forces personnel.
 - providing chloroquine prophylaxis to forces personnel engaged in operations in the Northern province in the first half of the year 2009.

(b) Vector Control Activities

- Chemical larviciding
- Indoor Residual Spraying of insecticides.
- Health Education programmes.

Status of drug resistance

There were no reported resistance of vivax and falciparum infections to the current treatment regimen.

Drug policy

Treatment of vivax infections

All patients with *P.vivax* malaria should be given a course of chloroquine base at a dosage of 25 mg / kg over three days. This dose should be divided as follows and should be given as a single dose on **1st day – 10 mg/kg 2nd day – 10 mg/kg 3rd day – 5 mg/kg**

All these patients should also be given a course of primaquine base at a dose of 0.25mg/kg/per day over a period with fourteen days except pregnant mothers, infants and patients suffering from glucose – 6 – phosphate dehydrogenase deficiency (G₆PD)

Treatment of falciparum infections

All *P.falciparum* infected patients should be admitted to a medical institution where artemether-lumefantrine (Coartem[®]) is to be administered.

Number of (Coartem [®]) tablets to be administered				
	➤ 5 kg - less than 15 kg (Yellow pack)	15 kg - less than 25 kg (Blue pack)	25 kg - less than 35 kg (Orange pack)	Over 35 kg (Green pack)
0 hours	1	2	3	4
8 hours	1	2	3	4
24 hours	1	2	3	4
36 hours	1	2	3	4
48 hours	1	2	3	4
60 hours	1	2	3	4
Total	6	12	18	24

Coartem is not recommended - Less than 5kg, pregnant women during the first trimester and during exclusive breast feeding

A weight appropriate single dose of primaquine (0.75mg/kg) should also be administered to all *P.falciparum* patients on day 3 of treatment or prior to discharge from hospital, unless the use of primaquine is contraindicated. (for further details please refer to the general circular No. 1/014/2008 issued by the DGHS)

Programme priorities

Elimination of *P.falciparum* infections, management of vector resistance to some insecticides, elimination of malaria deaths and prevention of reintroduction and spreading of imported malaria in Sri Lanka have been identified as priorities. Malaria control among internally displaced populations in the conflict-affected Northern and Eastern provinces, and in the bordering provinces, was also considered as programme priority during the year 2009.

Surveillance

Surveillance mechanism of the malaria control programme is implemented mainly through Activated Passive Case Detection (APCD). All fever patients attending State Medical Institutions located in malarious areas are screened for malaria parasites by examination of a blood smear. In-addition Passive Case Detection (PCD) is carried out in the other State Medical Institutions by screening suspected malaria patients. Active Case Detection (ACD) is carried out through Mobile Malaria Clinics which operate in malarious localities situated far away from Medical Institutions. Detection of cases by home visits is done under special circumstances (egs. local outbreaks). 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 significantly. In spite of that during this year, as in the previous years, screening suspected malaria patients that come to activated medical institutions (APCD) is the most important method of detection of malaria cases, accounting for 83% of the cases detected. Active case detection (ACD) and Mobile clinics (Other methods) are done as a measure to detect malaria cases early (including asymptomatic parasite carriers) thereby preventing transmission.

Parasitological surveillance

The number of blood smears examined and number of microscopically confirmed malaria cases in each districts is given in table 2.

Table 2. Microscopically confirmed malaria cases detected at district / RMO region level

District	Total		Total species			Sex		Age group				
	Exd.	Pos.	<i>P.v.</i>	<i>P.f</i>	<i>Mixed</i>	M	F	Under 01 yr	1-5 yrs	6-9 yrs	10-14 yrs	Over 15 yrs
Colombo	58956	8	5	3	0	7	1	0	0	0	0	8
Gampaha	37560	2	2	0	0	2	0	0	0	0	0	2
Kalutara	13045	0	0	0	0	0	0	0	0	0	0	0
Kandy	33530	9	4	5	0	5	4	0	0	0	0	9
Matale	16032	2	1	0	1	2	0	0	0	0	0	2
N' Eliya	948	0	0	0	0	0	0	0	0	0	0	0
Galle	19204	1	0	1	0	1	0	0	0	0	0	1
Matara	20127	0	0	0	0	0	0	0	0	0	0	0
Hambantota	29121	88	86	2	0	88	0	0	0	0	0	88
Jaffna	74554	12	11	1	0	11	1	0	0	0	0	12
Kilinochchi	3856	99	94	3	2	97	2	0	0	0	0	99
Vavuniya	44251	41	40	0	1	41	0	0	0	0	0	41
Mannar	6569	29	27	1	1	29	0	0	0	0	1	28
Mullativu	962	120	118	2	0	119	1	0	0	0	0	120
Batticaloa	49831	6	6	0	0	5	1	0	0	0	0	6
Ampara	20809	5	4	1	0	4	1	0	0	0	0	5
Kalmune	33763	1	1	0	0	1	0	0	0	0	0	1
Trincomalie	73816	11	9	0	2	10	1	0	0	0	0	11
Kurunegala	78974	4	3	1	0	3	1	0	0	0	0	4
Maho	27317	2	2	0	0	1	1	0	0	1	0	1
Puttalam	31726	4	4	0	0	3	1	0	0	0	0	4
Anuradhapura	93158	8	7	1	0	8	0	0	0	0	0	8
Polonnaruwa	62508	3	3	0	0	3	0	0	0	0	0	3
Badulla	15111	2	1	0	1	2	0	0	0	0	0	2
Moneragala	35139	97	97	0	0	90	7	0	0	0	0	97
Ratnapura	20668	2	2	0	0	0	2	0	0	0	0	2
Kegalle	8097	2	2	0	0	2	0	0	0	0	0	2
Total	909632	558	529	21	8	534	24	0	0	1	1	556

Provision of laboratory items

The Central laboratory of the Anti Malaria Campaign Headquarters distributes laboratory items required for malaria microscopy to regional malaria offices. Some laboratory items (required for microscopy) issued during the year 2009 are given in table 3.

Table 3. Laboratory items distributed

District	Lancets	Giemsa stain (L)	Slides	Methanol (L)	Anisole (L)	Ethanol (L)	Microscopes
Ampara		5	122000			1	
Anuradhapur a	50000	7	10800	4	2		
Baddulla		5				1	
Batticaloa	30000	-					
Colombo					8	3	
Embilipitiya	20000		7200	1	1	1	1
Gampaha	10000	3	2500				
Hambantota	40000	3	25000	1	2		
Kalmune	50000	3	12200		1		
Kandy	10000	3	2500				1
Kegalle	10000	3			3		
Kilinochchi	20000	3	6408				
Kurunegala	30000	7	26600		2		
Jaffna	100000	1	10000				
Maho	20000	2	15800	1	1		
Mannar	5000	3	5000		2	1	
Matale	20000		15000				
Moneragala	30000	1	15800	1	1	1	
Polonnaruwa	10000	2	2500		3		
Puttalam	20000		13600				
Trincomalee	60000	13	28300	3.4	2		
Vavuniya	60000	4	20000	2.5	4	2.5	
TOTAL	595000	68	341208	13.9	31	10.5	2

Cross checking of blood smears

Central laboratory of the AMC directorate also functions as the reference laboratory for malaria microscopy. One of the main functions of the central laboratory is the cross checking of the blood smears received from different regional malaria offices. During the year 2009, 48809

blood smears have been received for cross checking. (127 *P. vivax*, 2 *P. falciparum*, 1 *P. vivax*, and *P. falciparum* mixed infection and 48679 negative blood smears). Out of these, 19705 blood smears have been cross checked by the PHLTT attached to the central laboratory and 6 false positives and 1 false negative (all *P. vivax*) have been detected.

Relief duty

During the year 2009, PHLTT attached to the central laboratory visited the refugee camps in Cheddikulam and Manik farm in Vavuniya district to conduct mobile malaria clinics. Some of these clinics have been organized by the Ministry of health and “Tharunyata Hetak” while the others were organized by the AMC Directorate to facilitate the heavy work load that had to be done by the RMO/AMC Vavuniya.

Inservice Training programmes for PHLTT

The Anti Malaria Campaign conducted 13 WHO funded in-service training programmes in collaboration with Faculty of Medicine, University of Colombo, in 2009. The training programmes were held at AMC Directorate utilizing the resources available at central laboratory.(this is in addition to the in-service training programmes organized by the AMC Directorate at Regional level for PHLTT).

Vector surveillance

A total of 43 malaria vector surveillance programmes were carried out by three central entomological investigation teams in 14 Districts during the year 2009. These included routine sentinel monitoring investigations and foci investigations. Districts covered were Kurunegala and Moneragala (six times each), Polonnaruwa, Kegalle and Puttalam, (five times each), Anuradhapura (four times) Matale (three times) Ampara and Trincomalee (two times each), Gampaha, Kandy, Badulla, Hambanthota and Ratnapura, (once each). In addition, a programme was carried out for Dengue vector surveillance in Hambantota district.

Data obtained from the investigations of the central teams and the data sent by the regional teams were summarized and results are shown in Table 4 to 10.

Larval surveys were carried out to determine the breeding places of vector mosquitoes in all the districts of the island except in Northern Province.

Table 4 : Results of larval survey carried out during 2009

Type of breeding place	No. of dips	No. of I& II instar larvae	No. of III & IV instar larvae	<i>An.culicifacies</i> per 100 dips	<i>An. subpictus</i> per 100 dips	<i>An. annularis</i> per 100 dips	<i>An. varuna</i> per 100 dips
Agricultural wells	4815	1996	1010	1.88	3.09	0.24	5.81
Brick pits	3761	926	1055	0.053	22.41	0	0.15
Burrow pits	8251	2425	1843	2.71	11.64	0.04	0.5
Canal	295	61	25	1.69	4.06	0	0
Cement tank	970	346	285	27.31	0.1	0	1.03
Coconut husk pits	110	17	6	0	2.72	0	0
Connected pools	5098	2327	1099	10.29	0.84	0.03	3.82
Drainage canal	440	296	197	0.9	31.59	0	0
Eba	160	65	6	0	0	0	1.25
Ela margin	12614	953	954	0.166	0.12	0.055	2.53
Fish tanks	220	32	30	0	12.27	0	0
Gem pits	3320	928	849	7.92	3.1	0.45	2.98

Type of breeding place	No. of dips	No. of I& II instar larvae	No. of III & IV instar larvae	<i>An.culicifacies</i> per 100 dips	<i>An. subpictus</i> per 100 dips	<i>An. annularis</i> per 100 dips	<i>An. varuna</i> per 100 dips
Ground pools	6280	546	468	0.33	2.05	0.03	0.92
Hoof prints	867	451	388	11.76	18.22	0	1.84
Irrigation canal	19942	1968	1678	0.78	3.38	0.07	0.75
Lagoon	290	11	8	0	2.75	0	0
Marshy land	1353	214	208	0	2.43	0.07	0.07
Stream bed pools	240	41	146	0	0	0	49.16
Oya margin	35456	6463	3146	1.26	1.17	0.002	5.12
Paddy fields	23000	2863	2293	0.02	1.34	0	0.2
Pond	1310	213	137	1.22	1.52	2.9	0.15
Prawn hatcheries	256	16	25	0	8.59	0	0
Quarry pits	10571	2842	1310	1.41	0.25	0.18	0.62
Rain water pools	6363	1645	1134	3.19	4.43	0	1.71
River margin	35057	10398	6382	2.48	0.38	0	11.82
Rocky pools	20550	5739	7847	5.03	1.54	0.07	4.41
Sand pools	21383	8006	4345	6.89	3.41	0.004	4.09
Seepage pools	403	254	202	25.31	7.19	0	2.23
Stream margin	4972	1501	805	0.88	0.24	0	12.42
Tank bed pools	70	7	25	0	0	0	2.85
Tank margin	14573	1597	1532	0.1	1.15	0.56	0.48
Tyre prints	678	654	308	5.3	21.82	0	0.73
Wells	39633	5715	3177	2.21	3.82	0	1.02

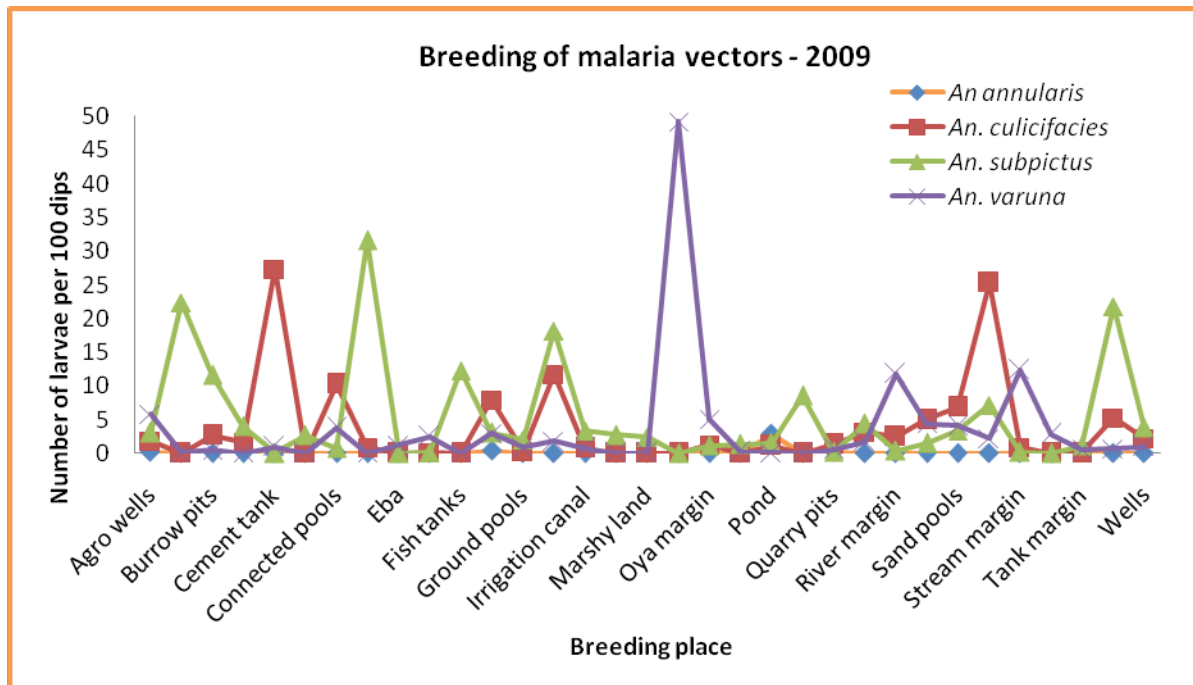


Figure 4. Breeding places of malaria vectors

The larval collection data obtained for major vector species *Anopheles culicifacies* and other three minor vector species are summarized in the Table 4 and Figure 4. Seepage pools, hoof prints, tyre prints, connected pools, sand pools, rock pools, gem pits were the main habitats for breeding of the major vector *Anopheles culicifacies*. Cement tank sampled which was an atypical breeding place of *Anopheles culicifacies* was found to be positive for *Anopheles culicifacies* larvae.

The indoor resting densities of major vector *Anopheles culicifacies* and other potential vector species were determined by the Indoor Hand Collections in localities sprayed with residual insecticides and in unsprayed areas. The results obtained are summarized in Table 5.

Table 5. Results of Indoor hand Collections carried out during 2009

Insecticid	Days after sprayi ed	No. of houses examin	Speci	Total No. of		No. of females house				No. per	
				Mal	Fema	UF	BF	SG	G	Mal	Femal
Bifenthrin	01-30	10	Neg.	0	0	0	0	0	0	0	0
	31-60	10	Neg.	0	0	0	0	0	0	0	0
Cyfluthrin	1-30	130	<i>An.su</i> <i>b</i>	9	67		60	1	6	0.06	0.51
	31-60	50	<i>An.su</i> <i>b</i>	1	5				5	0.02	0.1
	61-90	172	<i>An.cu</i> <i>l</i>	0	9		9			0	0.05
			<i>An.su</i> <i>b</i>	147	349	4	163	5	47	0.85	2.02
	91-120	260	<i>An.cu</i> <i>l</i>	0	15		6	6	3	0	0.05
			<i>An.su</i> <i>b</i>	367	970	2	55	7	6	1.41	3.73
	121-150	20	<i>An.su</i> <i>b</i>	0	29		4	24	1	0	1.45
	151-180	20	<i>An.su</i> <i>b</i>	2	10		6	4			0.5
	Deltamethrin	1-30	24	<i>An.cu</i> <i>l</i>	3	1				1	0.12
<i>An.su</i> <i>b</i>				2	2				2	0.08	0.08
31-60		62	<i>An.cu</i> <i>l</i>	0	2		2			0	0.03
	<i>An.su</i> <i>b</i>		39	155			15	3	2	0.62	2.5
91-120	20	<i>An.su</i> <i>b</i>	16	35	1	22	12		0.8	1.75	
Over due	665	<i>An.cu</i> <i>l</i>	4	27		25	2			0.00	0.04
		<i>An.su</i> <i>b</i>	28	216	9	68	5	14	0.04	0.32	
		<i>An.va</i>	0	2			1	1	0	0.003	

			<i>g</i>								
Unsprayed		1389	<i>An.cu</i>	0	8		4	4		0	0.000
			<i>l</i>								5
			<i>An.su</i>					43	11		
			<i>b</i>	498	635	58	28	4	5	0.35	0.45

Human Landing collections showed low rates of indoor human biting compared to outdoor biting of *Anopheles culicifacies* in sprayed areas. Outdoor biting of the potential vectors was also common in sprayed and unsprayed areas. Summarized results of partial night collections are shown in Table 6.

The susceptibility status of major malaria vector *Anopheles culicifacies* and other potential vectors to different insecticides was tested using standard WHO procedures. Results are given in Table 7.

Anopheles culicifacies was found to be resistant to Malathion 5% in Lunugamvehera, Kataragama and Buttala areas, in addition, Lunugamvehera population showed resistance to DDT 4%.

Table 6. Results of Human Landing collections – 2009

Insecticide Sprayed	Days after spraying	No. of Health areas	Anopheline species	Indoor						Outdoor					
				No. of baits	No. of mosquitoes				<i>An. cul</i> per bait per hr	No. of baits	No. of mosquitoes				<i>An. cul</i> per bait per hr
					6-7 pm	7-8 pm	8-9 pm	Total			6-7 pm	7-8 pm	8-9 pm	Total	
Bifenthrin	0-30	2	Neg	5						3					
Cyfluthrin	0-30	2	<i>An. cul</i>	6			1		0.02	6		1		1	0.02
Cyfluthrin	60-90	3	<i>An. ann</i>	19						20	1	1	1	3	
			<i>An. cul</i>		13	30	33	76	0.66		34	50	53	137	1.141
			<i>An. sub</i>			1		1			1	5	2	8	
Cyfluthrin	91-120	1	<i>An. cul</i>	11	6	22	14	42	0.63	11	19	27	17	63	0.954
			<i>An. sub</i>		1			1							
Cyfluthrin		3	<i>An. ann</i>	61						62	2		1	3	
			<i>An. cul</i>		1	2	2	5	0.013		28	64	56	148	0.397
Deltamethrin	0-30	1	<i>An. cul</i>	4						8	2	3	2	7	0.145
Deltamethrin	61-90	2	<i>An. sub</i>	6	3			3		12					
		3	<i>An. var</i>	9		2		2		9					
			<i>An. sub</i>				2	2			1	1	2	4	
Etofenprox	90-120	1	Neg	3						3					
Fenitrothion	31-60	1	Neg	2						3					

Lambda cyhalothrin	1	<i>An. var</i>	3	1			1		4	1			1	
Unsprayed	24	<i>An. ann</i>	360		1		1		613	9	5	3	17	
		<i>An. cul</i>		6	17	8	31	0.014		72	98	88	258	0.07
		<i>An. sub</i>		1	3	8	12			17	26	15	56	
		<i>An. var</i>								2	10	3	15	

Table 7. Results of Susceptibility testing -2009

The persistence of the insecticides used for Indoor Residual Spraying on various insecticides was determined using the standard WHO bioassay test procedures. The data obtained for susceptible female mosquitoes of *Anopheles culicifacies* and other three potential vector species are summarized in Tables 8.

Table 8. Results of the Bio Assay tests on sprayed surfaces using wild caught blood fed mosquitoes (30 minutes exposure period)

Mosquito species & Heath Area	Insecticide	Days after spraying	Type of Surface	Location	No. tested	Corrected mortality %				
<i>Anopheles culicifacies</i>										
Kinniya	Deltamethrin	1	Mud wall	Lower	10	100%				
				Middle	10	100%				
				Upper	10	100%				
				Roof - Cadjan Door - Wooden	10 10	100% 100%				
Muthur	Deltamethrin	5	Mud wall	Lower	10	100%				
				Middle	10	100%				
				Upper	10	100%				
				Roof - Cadjan Door - Wooden Furniture - Wooden	10 10 10	100% 100% 100%				
				Unnichchai	Deltamethrin	45	Mud wall	Lower	10	10%
								Middle	10	20%
Upper	10	10%								
Roof - Cadjan	10	20%								
Arachchikattuwa	Deltamethrin	62	Mud wall		8	75%				
				Door - Wooden	8	100%				
				Roof - Cadjan	8	100%				
<i>Anopheles subpictus</i>										
Kinniya	Bifenthrin	1	Brick wall	Lower	10	100%				
				Middle	10	100%				
				Upper	10	100%				
				Roof- Wooden	10	100%				
Eachchilampattai	Bifenthrin	11	Brick wall	Lower	10	100%				

Seruwila	Bifenthrin	14	Roof - Cadjan Door -Wooden Mud wall	Middle	10	100%
				Upper	10	100%
					10	100%
					10	100%
				Lower	10	10%
				Middle	10	0%
Kinniya	Bifenthrin	15	Roof - Cadjan Brick wall	Upper	10	10%
					10	0%
				Lower	10	100%
				Middle	10	100%
				Upper	10	100%
					10	100%
Seruwila	Bifenthrin	19	Roof- Wooden Door -Wooden Furniture- Wooden Brick plasted wall Door		10	100%
					10	100%
					10	100%
					10	100%
					10	100%
					10	100%
Vakarai	Cyfluthrin	65	Wall - Cement plasted	Upper	7	71.42%
				Lower	7	86.71%
					7	71.42%
Vakarai	Cyfluthrin	68	Wall - Cement plasted Wall - Cement plasted Wall - Cement plasted	Upper	8	75%
				Middle	8	87.50%
					8	50%

The bio efficacy of Long Lasting Insecticidal Nets was investigated using the standard cone bio assay test using *Anopheles culicifacies* and other vector mosquito species and they are summarized in Tables 9.

Table 9. Results of the Bio Assay tests carried on LLINs using wild caught blood fed mosquitoes (3 minutes exposure period)

Mosquito species & Heath Area	Insecticide	No. of washes	Days after wash	Location on surface	No. of replicates	No. of mosquitoes	Corrected mortality %
<i>Anopheles culicifacies</i>							
Kinniya	Deltamethrin	1	51	Lower	4	20	100

Kinnya	Deltamethrin	1	51	Middle	4	20	100
Kinnya	Deltamethrin	1	51	Top	4	20	100
Kinnya	Deltamethrin	1	51	Upper	4	20	100
Monaragala	Deltamethrin	1	1	Top	2	10	100
Monaragala	Deltamethrin	1	1	Upper	4	20	100
Monaragala	Deltamethrin	1	1	Middle	5	25	100
Monaragala	Deltamethrin	1	1	Lower	5	25	100
<i>Anopheles subpictus</i>							
Buttala	Deltamethrin	1	69	Upper	4	19	84
Buttala	Deltamethrin	1	69	Middle	3	15	100
Buttala	Deltamethrin	1	69	Lower	2	10	100
Nikawaratiya	Deltamethrin	1	30	Lower	2	10	50
Nikawaratiya	Deltamethrin	1	30	Middle	2	10	40
Nikawaratiya	Deltamethrin	1	30	Upper	2	10	0
Nikawaratiya	Deltamethrin	1	30	Top	2	10	20
Nikawaratiya	Deltamethrin	3	30	Lower	1	5	100
Nikawaratiya	Deltamethrin	3	30	Middle	1	5	40
Nikawaratiya	Deltamethrin	3	30	Upper	1	5	80
Nikawaratiya	Deltamethrin	3	30	Top	1	5	20
Nikawaratiya	Deltamethrin	1	20	Lower	1	5	80
Nikawaratiya	Deltamethrin	1	20	Middle	1	5	80
Nikawaratiya	Deltamethrin	1	20	Upper	1	5	80

Table 10. Results of Cattle baited cadjan hut collections – 2009

Insecticide sprayed	Cyfluthrin			Deltamethrin			Fenitrothion			Unsprayed			Unknown		
	Anopheline species	femalesNo. of	No per bait	catch%of total	femalesNo. of	No per bait	catch%of total	femalesNo. of	No per bait	catch%of total	No. of females	No per bait	catch%of total	femalesNo. of	No per bait
<i>An. cul</i>	160	6.15	26.6	413	22.94	42.45	14	3.5	53.85	2567	6.86	18.2	780	3.56	18.7
<i>An. sub</i>	437	16.8	72.7	544	30.22	55.91	10	2.5	38.46	10894	29.1	77.25	3055	13.9	73.3
<i>An. var</i>	4	0.15	0.67	16	0.889	1.644	2	0.5	7.692	529	1.41	3.751	232	1.06	5.58
<i>An. ann</i>	0	0	0	0	0	0	0	0	0	113	0.3	0.801	84	0.38	2.02
Total	601			973			26			14103			4151		
No.of huts	26			18			4			374			219		

In addition to vector surveillance programmes, the Entomology Unit of Anti malaria campaign distributed entomological equipment and consumables to the regional entomological teams during the year 2009.

Vector Control Activities

In Sri Lanka, malaria vectors are mainly controlled by a strategy of integrated vector management (IVM). Integral components of this strategy are the rational use of insecticides in rotation for indoor residual spraying (IRS), distributing long lasting insecticide treated nets (LLINs), breeding and introduction of larvivorous fish, environmental modulation and modification through the filling of abandoned gem pits, impregnation of mosquito nets with permethrin and space spraying for special occasions. Table 11 shows the insecticides that had been used for indoor residual spraying in different districts.

Larvivorous fish mainly "Guppi" (*Poecilia reticulata*) were introduced in to wells and abandoned gem-pits as a biological method of vector control.

Table 11. Insecticides that had been used in different districts for indoor residual spraying

District	Deltamethrin	Cyfluthrin	Etofenprox	Lambda-cyhalothrin	Fenithrithion
Matale	√		√		√
Hambantota	√				√
Jaffna	√				
Mannar	√				
Mullativu					√
Batticaloa	√	√		√	
Ampara	√				
Kalmune	√				√
Trincomalie	√				
Kurunegala	√	√			√
Maho				√	√
Puttalam	√				
Anuradhapura	√	√		√	
Polonnaruwa	√				
Moneragala	√	√	√	√	
Kegalle	√				

The total number of houses fully sprayed were 112002, partially sprayed 1907 during the year of 2009, and the total population covered was 409473. The total quantity of insecticides used for malaria vector control in year 2009 is shown in Table 12.

Table 12. Utilization of insecticides for malaria vector control operations in 2009

Insecticides	Usage during 2009
Indoor Residual Spraying	
Deltamethrin 5% wdp (1 barrel = 11.25kg)	4689.56 kg
Cyfluthrin 10% wdp (1 barrel = 9 kg)	2560.56 kg
Fenithrothion 40% wdp (1 barrel = 9.25 kg)	2042 kg
Lambdacyhalothrin 10% wdp (1 barrel = 20kg)	238.25 kg
Etofenprox 20% wdp(1 barrel = 9kg)	168.9 kg

Two hundred and fifty three thousand Permethrin impregnated long lasting insecticide impregnated nets, which were donated by the World Health Organization, were distributed among the malarious areas (Table 13).

Table 13. Distribution of Long Lasting insecticides treated nets for Malaria Control

District/Institution	No. of LLINs distributed during 2009
Kalmunai	4000
Trincomalee	15000
Killinochchi	11500
Mannar	11500
Pollonnaruwa	10000
Anuradhapura	12000
Mullathavi	11500
Puttalam	20000
Moneragala	20000
Kurunegala	21750
Maho	20000
Matale	20000
Batticaloa	9500
Hambantota	17500
Ratnapura	18150
Jaffna	26450

Vavuniya	11500
Ampara	3000
MOH	500
Total	26,3850

Infrastructure and Human resources

At the end of year 2009, AMC Headquarters had following category of staff. The below table shows the number of staff in each category as at the end of year 2009.

Table 14. Staff position at Anti Malaria campaign Headquarters - 2009

	Category of Staff	Approved cadre	In position	
			Male	Female
1	Administrative Grade MOO	02	01	-
2	Community Physicians	03	01	01
3	Parasitologist	01	-	01
4	Entomologist	02	-	02
5	MOO Gr I	01	-	-
6	MOO Gr II	05	03	02
7	MOO Preliminary	-	-	-
8	Accountant	01	-	01
9	Development Assistant	-	02	02
10	Management Assistant	-	-	-
11	Data Entry Operator	02	-	01
12	Public Management Assistant Services	-	-	01
13	Store keeper	03	-	-
14	Public Health inspectors	02	-	-
15	Entomological Assistant	05	04	02
16	Public Health Field Assistant	10	03	01
17	Public Health Laboratory Technicians	22	03	09
18	Cinema Operator	01	-	-
19	Driver	19	19	-
20	K.K.S.	01	01	-
21	Roneo Operator	01	01	-
22	Lab Orderly	03	-	01
23	Spray Machine Operator	19	12	-
24	Ordinary Labourer	-	07	03
25	Sanitary Labourer	-	35	02
26	Labourer (Casual)	-	01	-
27	Registered Medical officer	-	-	01
28	Ward Clerk	-	-	02
	Total	103	93	32

Vehicles

Adequate number of vehicles in good condition is an important factor in effective malaria control activities throughout the country including the north and east. At present AMC Headquarters has the following number of vehicles.

Table 15. Vehicles available at Anti Malaria Campaign Headquarters

Type	Reg. No.	Road Worthy	Available at HQ
Mitsubishi Fuso Lorry	42-1607	Yes	Yes
Mitsubishi Fuso Lorry	42-9399	Yes	Yes
Mitsubishi Fuso Lorry	LC-0249	Yes	Yes
Mitsubishi Pajero jeep	32-6520	Yes	Yes
Mitsubishi L200	42-1615	Yes	Yes
Mitsubishi L200	GP-2558	Yes	Yes
Mitsubishi L200	GP-2556	Yes	Yes
Mitsubishi Double-cab	JL 8129	Yes	Yes
Toyota D/Cab	GQ-2646	Yes	Yes
Nissan Caravan	NA-3117	Yes	Yes
Ford Ranger D/Cab	PA-4589	Yes	Yes
Micro D/Cab	PB 6537	Yes	Yes
Micro D/Cab	PB 6539	Yes	Yes

Drugs

A buffer stock of antimalarial drugs to face any emergency is available at the Headquarters. The Table 16 shows the stock position of anti malarial drugs during the year 2009. The table 17 shows the number of different types of tablets/injections distributed to the RMO regions in the year of 2009.

Table 16. Stock position of anti malarial drugs during 2009

District	Chloroquinine tablets	Primaquine tablets	Quinine tablets	Quinine injection
Amount in stores in January 2009	37,000	17,750	6,600	240
Amount received in 2009	150,000	150,000		100
Amount issued in the year 2009	141,000	89,500	5,200	340
Amount available at end of 2009	46,000	78,250	1,400	-

Table 17. Distribution of anti malarial drugs from Headquarters by recipient

Recipient	Chloroquinine tablets	Primaquine tablets	Quinine tablets	Quinine injection
Ampara		2,000	0	
Anuradhapura		8,000	1,000	
Baddulla		1,000	500	
Batticaloa	2,000	1,000		
Colombo	26,000	9,750	100	210
Embilipitiya		2,000		
Galle				
Gampaha	2,000	2,000		
Hambantota	45,000	8,500	100	40
Kalmune		1,000		
Kalutara				
Kandy		2,250	1,000	
Kegalle		4,000	100	
Kilinochchi				
Kurunegala	2,000	12,000	100	20
Jaffna		2,000		
Maho	10,000	1,000	1,000	
Mannar	1,000	1,000		

Matale				
Matara				
Moneragala	5,000	7,000	100	20
Mullaitivu	30,000	1,000		
Nuwara eliya				
Polonnaruwa		7,000		
Puttalam		2,000	1,200	
Trincomalee		3,000		
Vavuniya	18,000	12,000		50
Army				
TOTAL	141,000	89,500	5,200	340

Buildings

The Anti Malaria Campaign Headquarters is located at the Public Health Complex at 555/5, Elvitigala Mawatha, Colombo 5. The Director's room, the project director's room of GFATM, Consultant Community Physicians room, Medical officers room, Accounts division of GFATM project, the Public Health Inspectors room, The Library, The Computer room, the telephone exchange and the Auditorium are in the 3rd floor. The Administration branch, finance branch, the Accountants room and stores are located in the 5 th floor. The Central Parasitology Laboratory and Parasitologist's room, Entomology Laboratory and Entomologist's room and Record room are located in the 6th floor.

Foreign funded Projects

During the year 2009, GFATM and WHO assisted malaria control activities in Sri Lanka.

WHO technical assistance to the malaria control programme in 2009 was under the 2008/2009 biennium programme of the Country Budget and consisted of the following activities.

- **National Strategic Plan for Malaria Control Programme 2008-2012 was formulated and printed.**

- **Introduction of revised Malaria Control Strategies to district and provincial level health staff including COMBI strategy.**

Four programmes were conducted in 4 districts to introduce revised malaria control strategies

- **Training of one Medical Officer engaged in fulltime malaria control to participate in the “International Training Course on management of malaria” in Thailand.**

One officer was trained in Thailand on management of malaria

- **Training of clinicians in management of malaria patients including use of ACT.**

Five programmes were conducted in 5 malaria endemic districts on management of malaria

- **Procurement of S&E necessary for entomological surveillance and some drugs for management of malaria patients**

Critical equipment for entomological and parasitological laboratories were procured and distributed

- **Introduction and implementation of revised monitoring and evaluation tools to district**

Ten programmes were conducted to introduce revised M&E tools at province level

Assistance from the Global Fund to fight AIDS, Tuberculosis and Malaria (GFATM)

During the year 2009, National Malaria Control Programme continued to receive support from the GFATM in the form of one grant for malaria control under the Round 8. This project is jointly implemented through a partnership between the Ministry of Health, Lanka Jathika

Sarvodaya Shramadana Sangamaya of Sri Lanka and Tropical Environment Disease Health Associates (TEDHA). This project funds malaria elimination activities in all districts in Sri Lanka.

The following activities were carried out during the year 2009 under this project by the Anti Malaria Campaign, Ministry of Health (Principal Recipient 1).

- **Conducting malaria mobile clinics in high risk areas.**

Five hundred and seventy four malaria mobile clinics were conducted to reduce malaria transmission among vulnerable and mobile populations through early detection and treatment. A total of 44,086 blood smears examined from all project districts and three positive cases(all *P.vivax*) were detected from mobile clinics in Hambantota district.

In general, the criteria for selection of a site to conduct mobile malaria clinics were

- malaria case/s reported from the locality
- remote areas with poor access to health care institutions (>10 kms from an institution)
- traditionally malarious areas
- mobile high risk occupational groups – eg. forces, chena cultivators, gem miners, people working in quarry pits
- developmental project areas
- new settlers

- **Distribution of Rapid Diagnostic Test-kits (RDTs) to improve diagnostic facilities.**

A total of 15,000 Rapid Diagnostic Test kits were purchased & distributed among project districts in 2009 to enhance malaria diagnosis. These RDTs were mainly distributed to medical institutions without a Public Health Laboratory Technician to carry out microscopy. In addition other government medical institutions in project districts were also provided with RDTs to strengthen diagnosis and management of malaria patients.

- **Enhanced entomological surveillance.**

Fourteen additional days of entomological surveillance were funded through the project to augment the entomology component of the Provincial Malaria Control Programme

with a view to forecasting and preventing malaria outbreaks and epidemics. Accordingly 592 additional entomological surveillance days were funded by the project.

Sites for entomological surveillance are

- sentinel sites in each district
- random sites based on case load, fever cases and other development activities.

- **Strengthening of entomological & parasitological laboratories at district level by providing necessary equipment & consumables**

Dissecting microscopes, hand lenses, digital hygrometers, dissecting sets, forceps, larval vial tubes and chemicals for entomological investigations were purchased during this period for strengthening of regional laboratories. Binocular microscopes, laboratory reagents, lancets, glass slides were purchased and distributed among regional parasitological laboratories.

- **District level in-service training programmes.**

Eighty six field staff were (PHII, PHFOO, PHLTs, PHFO & SMOO) received refresher training for updating knowledge and skills in environment friendly malaria control methods and new strategies for malaria elimination.

- Twelve monthly reviews on GFATM activities in project districts with the participation of Regional Malaria Officers, Technical Staff of AMC Headquarters and representatives of Sarvodaya / Lions, were conducted at Anti Malaria Campaign Headquarters to assess the progress of work qualitatively and quantitatively.