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(2012-2013)



DESERT MEDICINE RESEARCH CENTRE
(Indian Council of Medical Research)
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डॉ विश्व मोहन कटोच
एम डी. एफ एन ए एससी, एफ ए एम एस, एफ ए एससी, एफ एन ए
सचिव, भारत सरकार
(स्वास्थ्य अनुसंधान विभाग)
स्वास्थ्य एवं परिवार कल्याण मंत्रालय एवं
महानिदेशक, आई सी एम आर
Dr. Vishwa Mohan Katoch
MD, FNASc, FAMS, FASc, FNA
Secretary to the Government of India
(Department of Health Research)
Ministry of Health & Family Welfare &
Director-General, ICMR



FOREWORD

It is a matter of great pleasure that Desert Medicine Research Centre (DMRC) is bringing out its Annual Report for the year 2012-13 containing its scientific activities. The report covers research activities on communicable and non-communicable diseases and on nutritional status of the arid population. Mapping of mosquito breeding habitats in the areas prone for emergence of Japanese Encephalitis virus is being carried out using Remote Sensing and Geographical Information System. The findings would be useful in prevention and control of spread of Japanese Encephalitis. Synergistic larvicidal efficacies of extracts of desert plants *Solanum xanthocarpum* and *Withania somnifera* have been studied when they were used in different binary combinations.

A new unit of National Nutrition Monitoring Bureau has been set up at DMRC which would be useful to generate periodical data on nutritional profile of population of Rajasthan. New initiatives for strengthening the linkages with state health department, medical colleges and universities are laudable steps which would help in better utilization of infrastructure facilities as well as broaden the horizon of research for DMRC.

I hope the research being pursued on different aspects of communicable, non-communicable diseases and nutritional deficiency disorders and new initiative taken would help DMRC to widen its horizon of participatory research.


(V. M. Katoch)

PREFACE

Desert Medicine Research Centre (DMRC) has strived for its research endeavor, since its inception in 1984, towards fulfilling its mandate of addressing the diverse health related issues in the areas of communicable and non-communicable diseases along with the problems of nutritional deficiencies in the arid population.

During the year DMRC has taken initiatives to promote biomedical research in the region through collaborations with medical colleges and Universities. In this direction, the Centre has organized “Jodhpur conclave” in December 2012 and developed joint projects with local medical college/institute and University. Continuing with these efforts a “Brain storming session” of stake holders was organized in February 2013 for identifying research areas for collaboration.

One of the six new units of National Nutrition Monitoring Bureau (NNMB) has been established at the DMRC as an expansion to existing ten centres of NNMB. Dr. V.M. Katoch Secretary DHR and DG, ICMR inaugurated the Centre’s bilingual i.e. English and Hindi website in October 2012 which was earlier in English only. Ethics committee was reconstituted keeping in view newer developments in the field with respect to regulatory aspects. Further, efforts have also been made towards NABL accreditation of the Centre’s laboratories by getting Centre’s scientists trained, organizing lectures by NABL experts and creation of a NABL Cell.

‘Chetna’, a quarterly magazine, is being published by the Centre regularly both in Hindi and English to disseminate the scientific knowledge and activities of the centre. Parliamentary committee on official languages assessed the work, being done in Hindi, of many institutes in Jodhpur including DMRC in October 2012. DMRC’s work was very much appreciated. Unicode training programmes for doing the work in Hindi have been conducted in the Centre not only for its staff but also for employees of other institutes in the city.

The Centre is relentlessly marching ahead to achieve its mandate in the field of basic, clinical and translational research by infrastructure and human resource development and also by promoting collaborative research.



Dr. G. S. Toteja
Director

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1.1 Translational Research for development and testing of ICMR-DMRC module of Dengue control for Rajasthan-

Principal Investigator: Dr. Vinod Joshi, Scientist 'F'

Commencement: March, 2011

Duration: Three Years

Status: Ongoing

Funding agency: Indian Council of Medical Research (Extramural)

PROGRESS

A. Observations on breeding of Aedes mosquitoes and extrinsic and virus activity in the study areas:

During reported period the surveillance of breeding of larval Aedes has been undertaken in 14 district headquarters and 6 rural areas. (Fig.1). The areas namely Jalore, Pali, Sirohi, Barmer, Jaisalmer, Jodhpur, Jaipur, Alwar, Dausa, Sikar, Jhunjhunu, Bikaner and Churu have been surveyed taking representative samples from all the municipal wards of these towns. Rural areas covered are Bhinmal, Sojat city, Shivganj, Balotra, Pokaran and Balesar. Work is in progress in two districts of Ganganagar and Nagaur. In all, 10,568 houses were searched which included 193 households in Jalore, 302 in Pali, 492 in Sirohi, 335 in Barmer, 307 houses in Jaisalmer, 1886 in Jodhpur, 1566 in Jaipur, 403 in Alwar, 306 in Dausa, 591 in Sikar, 429 in Jhunjhunu, 996 in Bikaner, 246 in Churu, 555 in Ganganagar, 307 in Bhinmal,

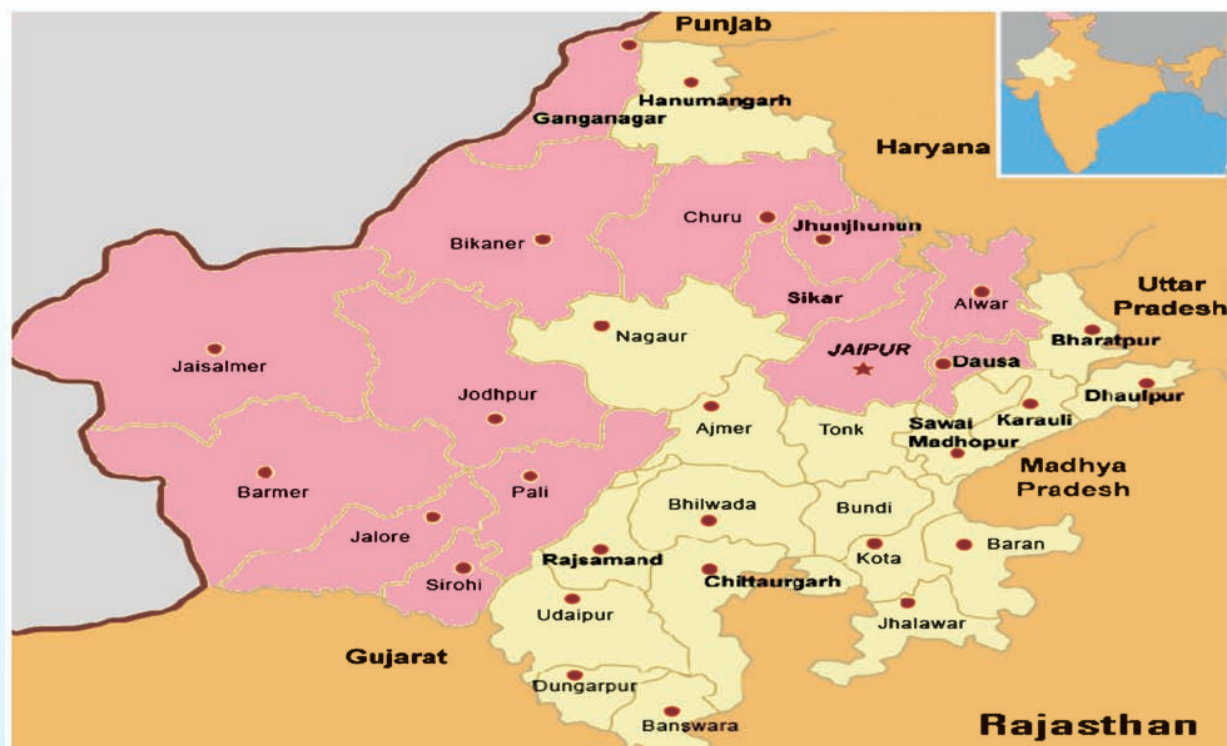


Fig. 1. Map of Rajasthan showing the areas (Pink shaded) studied during reported period.

325 in Sojat city, 410 in Shivganj, 417 in Ballot, 294 in Pokaran and 208 in Balesar for dengue vector breeding. Maximum breeding was observed in Sojat city (32.3%). In Jalore town, out of 193 houses searched, 15 (7.7 %) were positive for Aedes breeding which included 0.84% of containers positive for presence of dengue viral antigen. In Pali, 302 houses included 1.0% containers showing virus activity; in Sirohi town 492 houses showing 1.4% containers infectivity; in Barmer 335 houses with 1.3% container infectivity; in Jaisalmer 307 houses with 0.5% infectivity; in Jodhpur 1886 houses with 2.7% containers infectivity; in Jaipur town 1566 houses showing 3.2% containers infectivity; in Alwar 403 houses showing 2.0% containers infected; in Dausa of 306 houses studied, 1.1% containers showed virus positivity; in Sikar 591 houses with 2.07% infectivity; in Jhunjhunu 429 houses with 2.4% containers infectivity; in Bikaner town 996 houses showing 0.98% containers infectivity; in Churu 246 houses showing 0.49% infectivity; in Ganganagar 555 houses with 1.76% infectivity; in Bhinmal 307 houses showing 0.85% containers infectivity, in Sojat city 325 houses with 3.97% container infectivity, in Shivganj 410 houses showing 0.80% infectivity, in Balotra 417 houses with 0.42% containers infected and in Balesar 208 houses showing 2.43% virus activity in laboratory reared Aedes mosquitoes (Table 1).

Table 2 depicts details of containers examined and virus detected in each of the study towns. In Jalore town, 193 houses studied included 1301 containers examined for Aedes breeding, of which 51 were positive for vector breeding. Out of these 51 containers, only 11 (0.8%) were positive for dengue virus. In Pali town, of 2355 containers examined, 3.4% were positive for breeding and of these only 1.0% showed virus activity. In all, 61,423 containers in 10,568 houses of 20 studies have been searched out of which only 1153 (1.87%) containers were virus positive.

B. Development of early warning system of virus activity in study areas:

The larvae of Aedes mosquitoes collected from different study settings were reared into adults in laboratory conditions and were subjected to virus isolations using Indirect Fluoresce Antibody Test (IFAT) in individual mosquito head squashes (Fig. 2). The positive and negative mosquitoes were subjected to Real Time PCR for confirmation of IFAT positive results (Fig. 3).

C. Interventions suggested:

Based on the observations generated on the extrinsic virus activities within dengue vectors, in 20 district towns and rural areas, we have communicated to the district Chief Medical & Health Officer (CMHOs) of all the 20 districts about new knowledge generated by us. The full details of household, key containers in which virus activity was observed and suggestion to apply larvicide in different type of containers were intimated to respective district CMHO.

Table 1. Household level details of breeding positive containers and virus activities detected in 14 district towns and 6 rural areas

Study Area	No. of Houses surveyed	No. Breeding +ve	% Breeding +ve	Containers for Virus +ve	% Virus +ve	Total mosquitoes assayed	Positive for Dengue Virus	% +ve
Jalore	193	15	7.7	11	0.84	168	27	16.07
Pali	302	40	13.2	25	1.06	209	40	19.13
Sirohi	492	53	10.7	45	1.46	335	88	26.26
Barmer	335	29	8.6	21	1.38	82	44	53.65
Jaisalmer	307	12	3.9	9	0.58	44	16	36.36
Jodhpur	1886	363	19.2	283	2.76	876	214	24.42
Jaipur	1566	373	23.8	256	3.29	916	195	21.28
Alwar	403	52	12.9	42	2.05	98	27	27.55
Dausa	306	30	9.8	23	1.19	80	24	30.00
Sikar	591	98	16.5	72	2.07	190	48	25.26
Jhunjhunu	429	92	21.4	68	2.40	150	34	22.66
Bikaner	996	97	9.7	59	0.98	200	41	20.5
Churu	246	7	2.8	7	0.49	40	12	30
Ganganagar	555	70	12.6	56	1.76	145	34	23.44
Bhinmal (R)	307	29	9.4	20	0.85	60	12	20
Sojat City (R)	325	105	32.3	94	3.97	205	56	27.31
Shivganj (R)	410	26	6.34	20	0.80	75	23	30.66
Balotra (R)	417	13	3.11	11	0.42	50	9	18
Pokaran (R)	294	6	2.04	0	0	20	0	0
Balesar (R)	208	37	17.7	31	2.43	85	23	27.05
Total	10,568	1547	14.6	1153	1.87	4028	967	24

R- (Rural areas)

Table 2. Details of containers positive for breeding and virus in 14 district towns and 6 rural areas

Study areas	Total Household surveyed	Total containers examined	Total containers positive for breeding	% of +ve	Containers +ve for virus	% +ve for virus
Jalore	193	1301	51	3.92	11	0.84
Pali	302	2355	82	3.48	25	1.06
Sirohi	492	3065	82	2.67	45	1.46
Barmer	335	1521	56	3.68	21	1.38
Jaisalmer	307	1539	37	2.40	9	0.58
Jodhpur	1886	10241	493	4.81	283	2.76
Jaipur	1566	7775	484	6.22	256	3.29
Alwar	403	2044	51	2.49	42	2.05
Dausa	306	1931	31	1.60	23	1.19
Sikar	591	3474	104	2.99	72	2.07
Jhunjhunu	429	2830	105	3.71	68	2.40
Bikaner	996	5999	106	1.76	59	0.98
Churu	246	1417	7	0.49	7	0.49
Ganganagar	555	3180	73	2.29	56	1.76
Bhinmal (R)	307	2346	40	1.70	20	0.85
Sojat City (R)	325	2365	147	6.21	94	3.97
Shivganj (R)	410	2487	25	1	20	0.80
Balotra (R)	417	2568	16	0.62	11	0.42
Pokaran (R)	294	1711	7	0.40	0	0
Balesar (R)	208	1274	53	4.16	31	2.43
Total	10,568	61,423	2050	3.33	1153	1.87

R- (Rural areas)

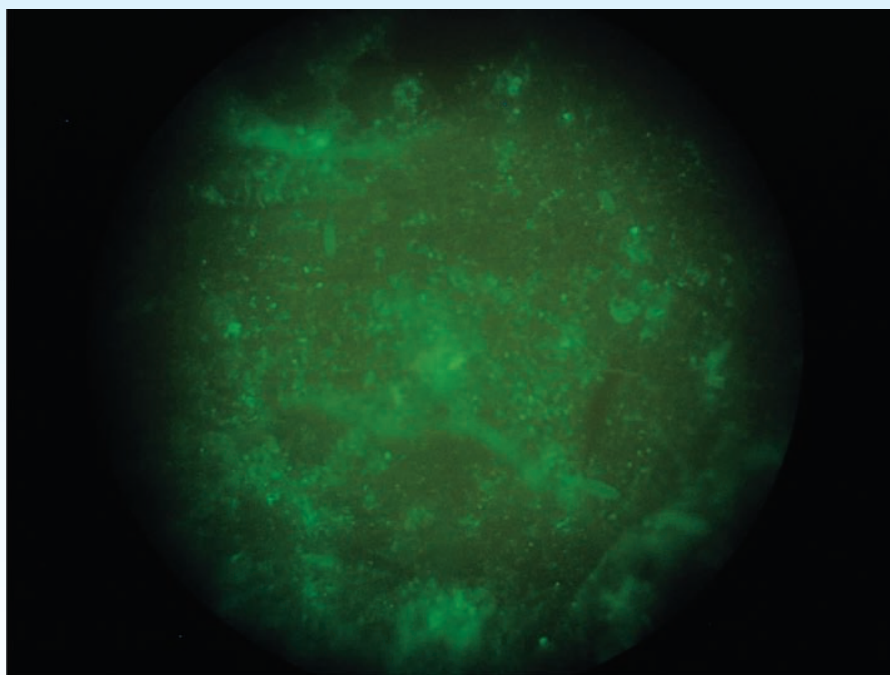


Fig. 2. A micro photograph of mosquito head squash showing positive IFAT

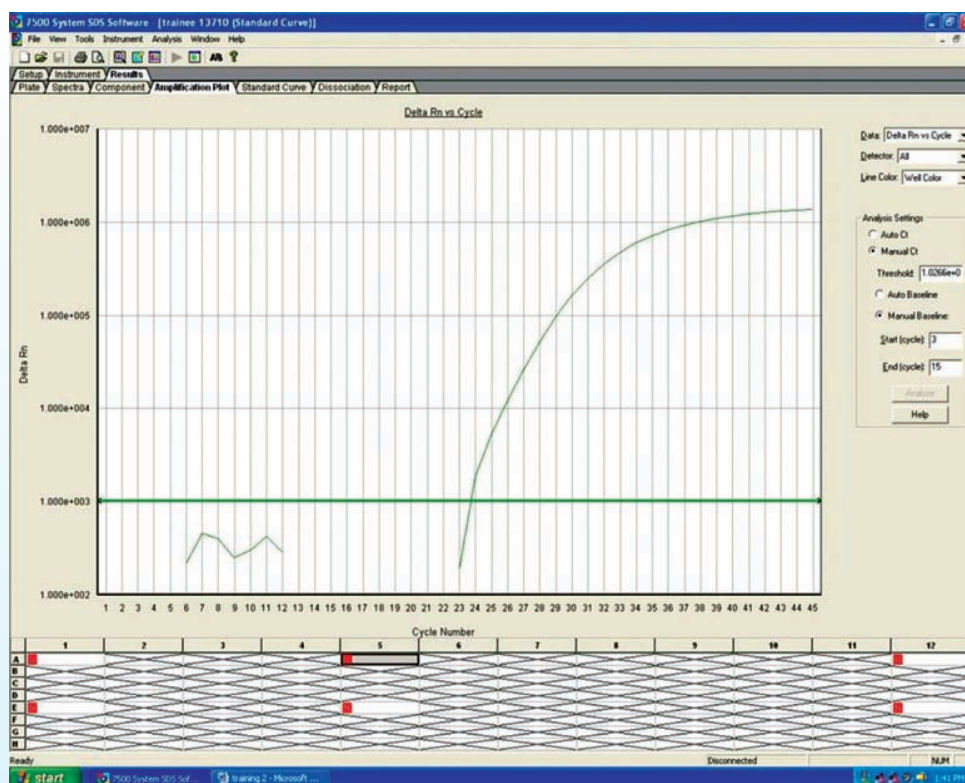


Fig. 3. RT-PCR curve showing presence of virus in mosquito samples

1.2 Mapping of risk of Dengue Hemorrhagic Fever (DHF) through dengue virus typing in *Aedes* mosquitoes of different settings of Rajasthan-

Principal Investigator: Dr. Vinod Joshi, Scientist 'F'

Commencement: May, 2012

Duration: Two Years

Status: Ongoing

Funding agency: Indian Council of Medical Research (Extramural)

PROGRESS

1.1. Field work undertaken:

During the reported period of 10 months (from May, 2012 till March, 2013), total number of 12 different districts have been covered for the collection of mosquito immatures. The districts of Jalore, Pali, Barmer, Sirohi, Jaisalmer, Bikaner, Churu, Ganganagar, Hanumangarh, Nagaur, Ajmer and Udaipur have been covered (Fig. 1).

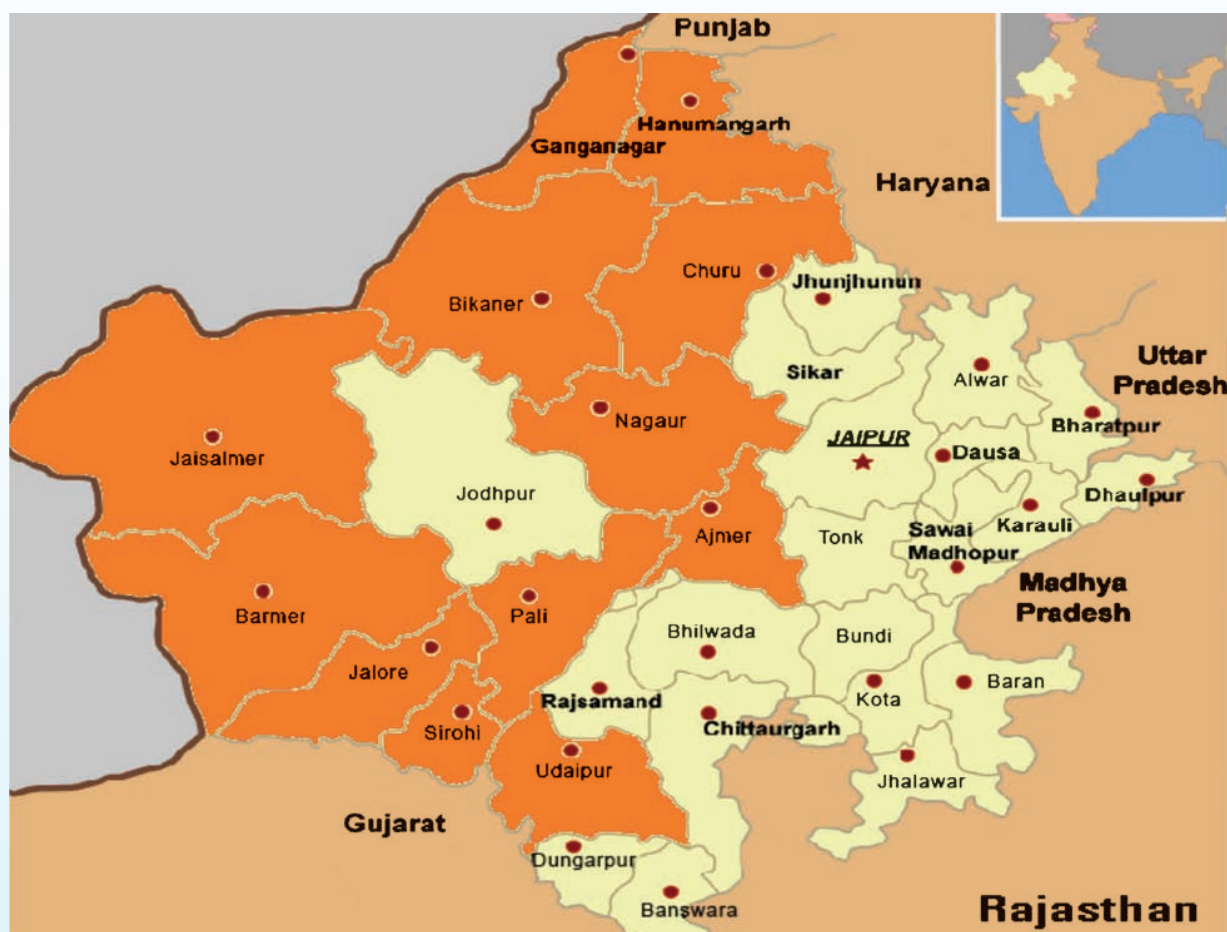


Fig. 1. Study villages covered during reported period

All the domestic as well as peri-domestic containers available in a selected house were searched for *Aedes* breeding. Total number of systematically sampled 6275 houses were screened in these districts of which 7.44% were positive for the breeding of *Aedes* mosquitoes. *Aedes* larvae were collected from containers found positive for breeding which were then brought to the laboratory for virus isolation studies. Of the total 38,199 containers surveyed, 552 containers were found to be positive. The key containers observed positive for *Aedes* breeding were cemented tanks and clay pots. The details of entomological observations are depicted in Table 1.

Table 1. Details of entomological investigations in study villages

Districts covered	Total houses surveyed	Total houses +ve for breeding	% +ve	Total containers examined	Total containers +ve for breeding
Jalore	307	29	9.4	2346	40
Pali	325	105	32.3	2365	147
Sirohi	410	26	6.34	2487	25
Barmer	417	13	3.11	2568	16
Jaisalmer	294	6	2.04	1711	7
Bikaner	996	97	9.7	5999	106
Churu	246	7	2.8	1417	7
Ganganagar	555	70	12.6	3180	73
Hanumangarh	343	21	6.12	1677	21
Nagaur	1017	62	6.09	7234	79
Ajmer	676	31	4.58	4523	31
Udaipur	689	0	0	2692	0
Total	6275	467	7.44	38199	552

1.2. Virus isolations from field collected and laboratory reared larvae:

The field collected larvae were reared into adult mosquitoes at DMRC laboratory. Adults were subjected to Indirect Fluorescence Antibody Test (IFAT) to detect presence of dengue virus. Of 6275 houses surveyed in 12 districts, 467 were found positive for breeding of *Aedes* mosquitoes. Of these, 307 (4.89%) houses were positive for dengue virus presence. Percentage of houses positive for dengue virus ranged from 25.8% in Pali district to 1.1% in Hanumangarh district. In 6275 houses, 38199 containers were examined for breeding of which 329 (0.86%) were positive for the presence of dengue virus. The percentage of virus positive containers was 0.2% in Hanumangarh district to 3.9% in Pali district (Table 2).

From 6275 houses surveyed and 38199 containers examined, 1053 larvae were collected and reared into adult mosquitoes. Maximum mosquito infections were observed in Ajmer district, where 38.6% laboratory reared adults showed presence of virus where as least mosquito infectivity was observed in Hanumangarh district where 0.2 % infectivity was observed. No mosquito infections were observed in Udaipur, and Jaisalmer districts (Table 3).

Table 2. Details of virus isolations from laboratory reared *Aedes* mosquitoes in study villages

Districts covered	Total houses surveyed	Total houses +ve for breeding	Total houses +ve for virus	% of virus +ve Houses	Total containers examined	Containers +ve for virus	% virus +ve containers
Jalore	307	29	19	6.18	2346	20	0.85
Pali	325	105	84	25.84	2365	94	3.97
Sirohi	410	26	20	4.87	2487	20	0.80
Barmer	417	13	10	2.39	2568	11	0.42
Jaisalmer	294	6	0	0	1711	0	0
Bikaner	996	97	57	5.72	5999	59	0.98
Churu	246	7	7	2.84	1417	7	0.49
Ganganagar	555	70	52	9.36	3180	56	1.76
Hanumangarh	343	21	4	1.16	1677	4	0.23
Nagaur	1017	62	39	3.83	7234	43	0.59
Ajmer	676	31	15	2.21	4523	15	0.33
Udaipur	689	0	0	0	2692	0	0
Total	6275	467	307	4.89	38199	329	0.86

Table 3. Details of virus isolations from individual adult mosquitoes

Districts covered	Total mosquitoes assayed	Mosquitoes +ve for dengue virus	% +ve
Jalore	60	12	20
Pali	205	56	27.31
Sirohi	75	23	30.66
Barmer	50	9	18
Jaisalmer	20	0	0
Bikaner	200	41	20.5
Churu	40	12	30
Ganganagar	145	34	23.44
Hanumangarh	43	3	6.97
Nagaur	140	34	24.28
Ajmer	75	29	38.66
Udaipur	0	0	0
Total	1053	253	24.02

The mosquitoes observed positive for IFAT (Fig. 1) were subjected to Real Time PCR (RT-PCR) (Fig. 2) to confirm the virus isolations as observed through IFAT. Type specific virus isolations were made from the field collected and laboratory reared mosquitoes collected from Pali, Bikaner and Barmer districts. The pilot run of type specific virus isolations from sub samples of mosquitoes, has been done using monoclonal antibodies employing IFAT.

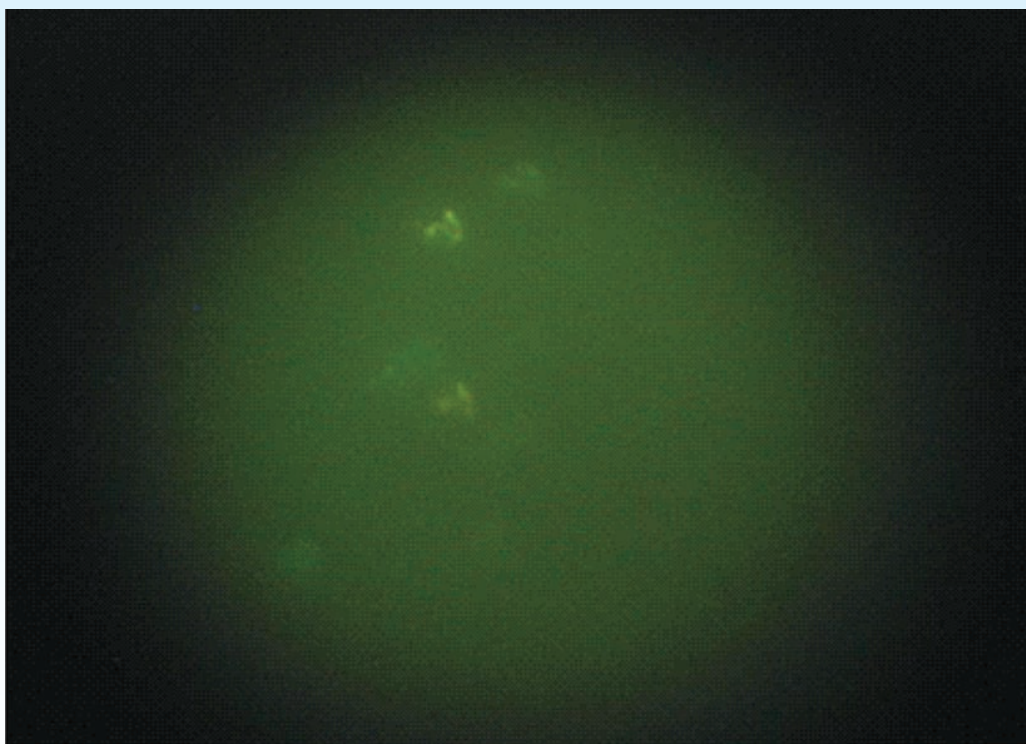


Fig. 1. Virus positivity as viewed employing IFAT

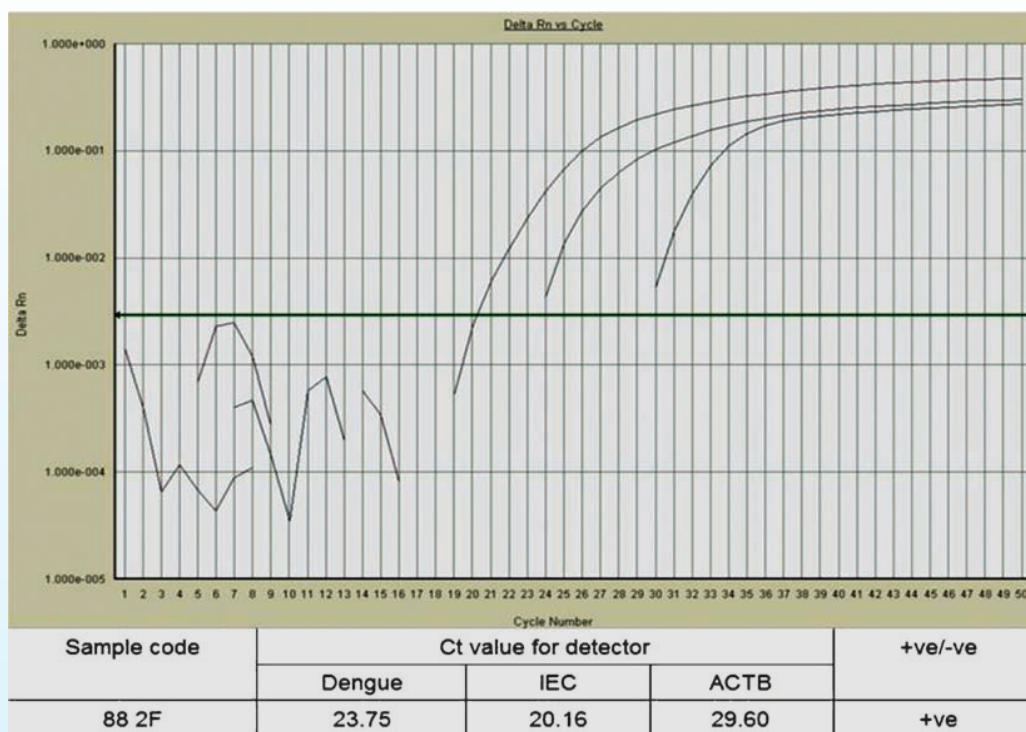


Fig. 2. Virus positivity as confirmed employing Real Time PCR (RT-PCR)

All the samples consisted of two *Aedes* species viz; *Aedes aegypti* and *Aedes vittatus*. DEN-1, DEN-2, DEN-3 and DEN-4 virus strains were detected in individual mosquitoes as trial run of type specific virus isolations. *Aedes aegypti* showed 17.9% DEN-1, 23.2% DEN-2, 40.2% DEN-3 and 19.4% DEN-4. DEN-3 strain was observed maximum in *Aedes aegypti*. Among *Aedes vittatus* subjected to IFAT, maximum presence (37.7%) of DEN-2 was observed (Table 4).

Table 4. DEN type specific virus isolations from mosquito samples in Pali, Barmer and Bikaner districts

Species	Total tested	Total positive	% positive	Positive for DEN-1 (%)	Positive for DEN-2 (%)	Positive for DEN-3 (%)	Positive for DEN-4 (%)
<i>Aedes aegypti</i>	299	67	22.40	12 (17.9)	15 (22.4)	27 (40.3)	13 (19.4)
<i>Aedes vittatus</i>	151	45	29.80	9 (20.0)	17 (37.8)	14 (31.1)	5 (11.1)
Total	450	112	24.88	21 (18.8)	32 (28.6)	41 (36.6)	18 (16.1)

All the mosquito samples reared in laboratory have been pooled district-wise and stored at -75°C. The samples have been subjected for molecular isolation using Real Time PCR.

1.3. Summary of work:

1. Of the 32 districts selected for study, 12 districts have been covered during reported period. Field collected larvae have been reared into adults, mosquitoes have been subjected to IFAT and screening of virus positive mosquitoes has been made.
2. Typing of mosquito samples has been standardized using monoclonal antibodies employing IFAT.
3. Selected samples of all the IFAT positive mosquitoes have been subjected to virus isolation through Real Time PCR and positive samples have been stored at -75°C.
4. Serum samples have been collected from suspected cases of dengue from hospitals and to confirm the positivity of samples, all have been tested employing Mac-ELISA. The samples have been stored at -75°C for DEN type specific Real Time PCR.
5. Mosquito samples of 12 districts have been processed for virus isolations employing RT-PCR.
6. After RNA extractions samples have been stored for further assay of DEN type specific isolation using RT-PCR.

1.3 Field efficacy trials of extracted latex of *Calotropis procera* for its public use as bio-larvicide against dengue vectors-

Principal Investigator: Dr. Manju Singhi, Scientist 'C'

Co-Investigators: Dr. Vinod Joshi, Scientist 'F' and Mr. Anil Purohit, Research Assistant

Commencement: January, 2011 **Duration:** Two year **Status:** Completed

Funding agency: Indian Council of Medical Research - Translational Research Project (Extrmural)

AIMS

Present work involves testing of efficacy and feasibility of small scale application of chemically extracted latex of *Calotropis procera* in +ve breeding habitats of different socio-economic areas of Jodhpur city for the control of dengue vectors.

OBJECTIVES

1. Studies on comparative efficacy of extracted latex against dengue vectors
2. Efficacy of latex in clear and polluted water against dengue vectors
3. Feasibility studies

RATIONALE

The present study is a translational research programme wherein the basic research conducted by us has been attempted to translate into public health by testing the efficacy and feasibility of a herbal composition for the control of dengue vectors. We have reported 'A herbal composition' as new bio larvicide useful for the control of dengue vectors from latex of *Calotropis procera*. Since dengue fever associated with Dengue Hemorrhagic Fever (DHF) is endemic in many state of India and we do not have any specific chemotherapy or vaccine yet developed against dengue and also report of development of resistance by *Ae. aegypti*, there is a need to apply a safe and easily available plant product to control breeding of dengue vectors.

PROGRESS

Our earlier work report of translational research has shown that extracted latex as bio larvicide is effective in field conditions in all + breeding containers of different socio-economic areas of Jodhpur. During the reported year a study has been undertaken to know the comparative efficacy of latex collected from different parts of Arid Rajasthan and neighboring state. To accomplish this objective latex has been collected from *C. procera* grown in the field of Jaisalmer, Bikaner, and Ganganagar and near Sabarmati Lake of Gujarat. The collected latex has been extracted by methanol as per the protocol. A field survey has been made in selected areas and marked +ve breeding containers have been applied the extracted latex collected

from Jaisalmer, Bikaner, Sri- Ganganagar and Sabarmati areas of Gujarat. The result has shown that latex collected from any part of arid Rajasthan has shown same efficacy in field conditions against dengue vectors (Tables 1-5).

Since mosquito vectors also breed in polluted water, Experiments have been undertaken to compare efficacy of latex in clear and polluted water for its optimum use in control of mosquito (Table 1). The polluted water such as biological, industrial, textile and sewerage water has been collected from different places of Salawas area and susceptibility tests have been undertaken. The experiments have been undertaken in polluted water with the application of crude latex, methanol extracted latex and acetonitrile extracted latex. 100 ppm concentration of extracted latex was applied to each polluted water containing larvae of mosquito along with control and mortality was observed after 24hr.

The results have shown that efficacy of extracted latex in polluted water was found low as compared to clean water and methanol and acetonitrile extracts (Tables 1-3) have shown comparable efficacy while latex in water has shown very low efficacy as shown in tables.

Frequency of latex application:

Series of experiments have been undertaken to study frequency of latex application in + breeding container. 20 third instar larvae were put into clay containers (5 replicates) with separate control containing measured quantity of water and after acclimatization for 3 hrs larvae have been treated by optimized dose. Containers were monitored in 24 hrs to record mortality. After 24 hours all the dead larvae were removed from the water using glass droppers and a new batch of 20 third instar larvae were added. This batch was kept in the same water having extracted latex up to 5 days (Table 4). Larval mortality was recorded in every 24 hr period in treated and control. Results have shown that latex is effective up to 24 hours causing 100 % mortality .After 24 hours latex has shown growth inhibitory effect.

Average yield of latex /plant of *C. procera* (Table 5) has been calculated by measuring the volume of latex collected and amount of extract obtained by the extraction. Latex has been collected from 40 twigs/plant for 50 days in the morning from 9-10 AM and measured the quantity of latex collection in summer as well as in post rainy season. The collected latex from each plant was extracted with methanol and developed into herbal composition and this was measured in grams for each collection as shown in table-5.

The result has shown that volume of latex produced by the plant is more in post rainy season as compared to summer (Table 5). This difference in latex volume can be attributed to the fact that in summers the plant growing in arid areas is under stress due to high temperature and unavailability of sufficient water causing the latex to be more concentrated.

Table 1. Comparative efficacy of methanol extracted latex in clear and polluted water

Type of water	Dose applied (100 ppm)	Replicates of larvae exposed															% mor- tality
		t ₁			t ₂			t ₃			t ₄			t ₅			
		D	L	P	D	L	P	D	L	P	D	L	P	D	L	P	
Biological	Control	0	20	0	0	20	0	1	19	0	0	20	0	1	19	0	2
	treated	16	3	1	17	3	0	17	3	0	19	1	0	19	1	0	88
Industrial	Control	1	19	0	1	19	0	1	19	0	0	20	0	0	20	0	3
	treated	17	3	0	17	3	0	18	2	0	17	3	0	18	2	0	87
Sewerage	Control	1	19	0	1	19	0	2	18	0	1	19	0	0	20	0	5
	treated	6	14	0	7	13	0	7	13	0	7	13	0	6	14	0	34
Clear	Control	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0
	treated	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0	100
Textile	Control	1	19	0	11	9	0	20	0	0	20	0	0	20	0	0	2
	treated	16	4	0	17	3	0	16	4	0	16	4	0	15	5	0	80

D- No. of dead larvae., L- No. of live larvae., P-pupae emerged

Table 2. Comparative efficacy of Acetonitrile extracted latex in clear and polluted water

Type of water	Dose applied (100 ppm)	Replicates of larvae exposed															
		t ₁			t ₂			t ₃			t ₄			t ₅			% mor-tality
		D	L	P	D	L	P	D	L	P	D	L	P	D	L	P	
Biological	Control	0	20	0	1	19	0	1	19	0	0	20	0	0	20	0	2
	treated	17	2	1	18	2	0	18	2	0	19	1	0	19	1	0	92
Industrial	Control	1	19	0	1	19	0	0	20	0	0	20	0	0	20	0	2
	treated	18	2	0	18	2	0	18	2	0	17	3	0	18	2	0	91
Sewerage	Control	1	19	0	1	19	0	1	19	0	1	19	0	0	20	0	4
	treated	8	12	0	9	11	0	7	13	0	7	13	0	8	14	0	40
Clear	Control	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0
	treated	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0	100
Textile	Control	1	19	0	1	19	0	1	19	0	2	18	0	0	20	0	5
	treated	18	2	0	17	3	0	18	2	0	16	4	0	17	3	0	86

D- No. of dead larvae., L- No. of live larvae., P-pupae emerged

Table 3. Comparative efficacy of crude latex in clear and polluted water

Type of water	Dose applied (100 ppm)	Replicates of larvae exposed															% mortality
		t ₁			t ₂			t ₃			t ₄			t ₅			
		D	L	P	D	L	P	D	L	P	D	L	P	D	L	P	
Biological	Control	1	19	0	1	19	0	1	19	0	0	20	0	0	20	0	3
	treated	5	15	0	5	15	0	2	18	0	3	17	0	5	15	0	20
Industrial	Control	1	19	0	1	19	0	0	20	0	0	20	0	0	20	0	2
	treated	4	16	0	3	17	0	3	17	0	3	17	0	4	16	0	17
Sewerage	Control	1	19	0	1	19	0	1	19	0	0	20	0	0	20	0	3
	treated	1	18	1	3	17	0	1	17	2	2	17	1	1	18	1	8
Clear	Control	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0
	treated	5	15	0	4	16	0	4	16	0	5	15	0	5	15	0	23
Textile	Control	1	19	0	1	19	0	1	19	0	0	20	0	0	20	0	3
	treated	1	18	1	1	19	0	2	18	0	2	18	0	5	15	0	11

D- No. of dead larvae., L- No. of live larvae., P-pupae emerged

Table 4. Average yield of latex obtained in summer and rainy season collection

Time (hrs)	Replicates											
	Control						Treated					
	R1	R2	R3	R4	R5	Total	R1	R2	R3	R4	R5	Total
24	20	20	20	20	20	100	0	0	0	0	0	0
%mortality	0	0	0	0	0	0 %	100	100	100	100	100	100%
48	20	20	20	20	20	100	17	17	20	17	19	97
%mortality	0	0	0	0	0	0%	5	5	0	0	0	3%
72	20	20	20	20	20	100	19	19	20	19	20	98
%mortality	0	0	0	0	0	0%	5	5	0	5	0	3%
96	20	20	20	20	20	100	19	19	20	20	20	98
%mortality	0	0	0	0	0	0%	5	5	0	0	0	2%
120	20	20	20	20	20	100	19	19	20	20	20	98
%mortality	0	0	0	0	0	0%	5	5	0	0	0	2%

Table 5. Average yield of latex collected during summer and rainy season

Season	collection /plant	Average latex obtained (ml)	Average amount of extract (g)	Extract(g)/ 100ml latex
Summer	40	24.5	1.53	6.24
Rainy	40	38.2	2.52	6.60

IMPORTANT FINDINGS

- Developed herbal composition has been found effective in all natural breeding containers of different socio-economic areas of Jodhpur.
- No major difference was observed in the feasibility studies of application of latex in the study settings.
- Cement tanks, coolers and clay pots were observed to be key breeding containers in the study areas.
- The efficacy of latex against mosquito vectors is more in clear water as compared to polluted water.
- Application of larvicide in key containers during interphase of the disease will reduce larval breeding responsible for disease occurrence.

INFERENCES

- Developed herbal composition against dengue vectors can be used as an effective bio-larvicide which along with larval control would also eliminate virus foci possibly transmitted through vertical transmission.

1.4 Current status of susceptibility of *Aedes aegypti* and *Anopheles stephensi* against larvicides/insecticides being used in National Programme in Rajasthan -

Principal Investigator: Dr. Karam V. Singh, Scientist 'F'

Co-Investigators: Dr. S. K. Bansal, Scientist 'F' and Dr. Himmat Singh, Research Assistant

Commencement: October, 2010

Duration: Two Year

Status: Completed

Funding : Desert Medicine Research Centre (Intramural)

OBJECTIVES

1. To determine the current status of susceptibility of *Ae. aegypti* and *An. stephensi* in rural areas, with particular reference to arid situations, and urban areas of Rajasthan against conventional insecticides being used under national control programme
2. Determination of biochemical mechanisms involved in the development of insecticide resistance, if any

PROGRESS

The studies were carried-out in 9 districts of Rajasthan state viz., Ajmer, Alwar, Barmer, Bikaner, Jaipur, Jaisalmer, Jodhpur, Pali and Udaipur and in all the districts only urban localities were considered during the report period. During the field investigations, the collection of larval forms of *Ae. aegypti* species in different habitats potential for its breeding was made.

Susceptibility tests were carried out with the larvae of *Ae. aegypti*, collected from the field or reared in the insectary under controlled conditions of temperature (28–2°C) and humidity (75–5%). Third or early fourth instar larvae were tested as per standard WHO methods for the determination of the baseline data on their susceptibility status using diagnostic doses of temephos. Four to five replicates of each observation were made and the data was subjected to log probit regression analysis for the determination of lethal concentrations at 50 and 90 percent levels. WHO criteria was followed for the determination of the susceptibility status of individual species.

The susceptibility status of *Ae. aegypti* larvae, collected from urban areas of Alwar, Barmer, Bikaner, Kota, Udaipur, Jaipur, Jodhpur, Pali and Udaipur was determined against technical grade of temephos (Table 1). The results of the experiments revealed that the species has developed resistance to temephos in Alwar, Bikaner, and Udaipur, and intermediate resistant in Jodhpur, Kota, Jaipur and Pali districts. In Ajmer and Barmer districts *Ae. aegypti* was found susceptible.

Table 1. Susceptibility status of *Ae. aegypti* against Temephos (Technical)

Study Districts	Diagnostic Dose (ppm)	No. exposed	No. Dead	Mortality %	Susceptibility status*
Ajmer	0.02	225	221	98.2	S
Alwar	0.02	200	152	76.0	R
Barmer	0.02	125	125	100.0	S
Bikaner	0.02	100	23	23.0	R
Jaipur	0.02	175	170	97.4	IR
Jodhpur	0.02	350	341	97.4	IR
Pali	0.02	100	96	96.0	IR
Kota	0.02	200	187	93.5	IR
Udaipur	0.02	100	52	52.0	R

*S- Susceptible, R- Resistant, IR- Intermediate Resistant

The lethal concentrations of temephos were also determined at 50 and 90 percent levels against *Ae. aegypti* in seven districts and it was found that at 50 percent level, temephos was maximum effective in Jodhpur ($LC_{50} = 0.0040$), followed by Alwar ($LC_{50} = 0.0044$), Jaisalmer ($LC_{50} = 0.0060$), Ajmer ($LC_{50} = 0.0063$), Jaipur ($LC_{50} = 0.0071$), Udaipur ($LC_{50} = 0.0169$) and Bikaner ($LC_{50} = 0.0271$ mg/l). The Chi-square values revealed that heterogeneity of the response of *Ae. aegypti* populations in Ajmer, Jaipur, Alwar, Bikaner and Jodhpur cities were found statistically significant, However, at 90 per cent level it exhibited maximum efficacy ($LC_{90} = 0.0144$) in Alwar and minimum ($LC_{90} = 0.2979$) in Udaipur (Table 2).

The enzymatic assays were conducted on the resistant *Ae. aegypti* showed that the percent reduction in Acetyl cholinesterase enzyme (AChE) was significantly higher ($60.21 \pm 17.12\%$) in DDT resistant individuals in comparison to susceptible ones (10.29 ± 0.40). The values of α and β esterase activities ($\alpha = 0.008 \pm 0.008$ od/min/mg protein; $\beta = 0.059 \pm 0.015$ od/min/mg protein) in DDT resistant individuals than susceptible mosquitoes ($\alpha = 0.0049 \pm 0.00007$ od/min/mg protein; $\beta = 0.006 \pm 0.0004$ od/min/mg protein) were recorded higher. The above observations indicate the involvement of AChE and esterases in the development of DDT resistance in *Ae. aegypti*.

Table 2. Determination of lethal concentrations of Temephos (Technical) at 50 and 90 percent levels against *Ae. aegypti*

Study Districts	Regression Equation	LC ₅₀ with Fiducial limits (ppm)	LC ₉₀ with Fiducial limits (ppm)	Chi square (df)
Ajmer	$Y = -6.101 + 8.710x$	0.0063	0.0167	87.80* (4)
Alwar	$Y = -5.055 + 10.14x$	0.0044	0.0144	42.67* (4)
Bikaner	$Y = -7.814 + 7.417x$	0.0271	0.0525	35.31* (4)
Jaipur	$Y = -7.086 + 7.361x$	0.0071	0.1385	51.83* (2)
Jaisalmer	$Y = 0.6087 + 1.778x$	0.0060	0.018	1.17 (4)
Jodhpur	$Y = 0.663 + 10.57x$	0.0040	0.0860	26.12* (4)
Udaipur	$Y = 2.371 + 3.311x$	0.0169	0.2979	1.903 (4)

*Heterogeneity of the response was found statistically significant

Table 3. Biochemical assays of *Ae. aegypti* against DDT and Malathion

Insecticide	Status (No. exposed)	Enzyme activity (value in od/min/mg protein)		
		Ach E (%)± SE(σ)	α Esterase ± SE(σ)	β Esterase ± SE(σ)
DDT (4.0%)	R (n=39)	60.21±17.12	0.008±0.008	0.059±0.015
	S (n=16)	10.29±0.40	0.00490.00007	0.006±0.0004
Malathion (5.0%)	R (n=22)	21.48±3.99	0.075±0.012	0.059±0.010
	S (n=33)	18.77±11.26	0.0008±0.008	0.014±0.010

However, against Malathion resistance, though the experiments exhibited the involvement of Acetyl cholinesterase enzyme (AchE) but the difference of percent inhibition in resistant and susceptible individuals was not very high (Table 3). The higher values of α and β esterase activities (α = 0.075±0.012 od/min/mg protein; β = 0.059±0.01 od/min/mg protein) in DDT resistant individuals than susceptible ones (α = 0.0008±0.008 od/min/mg protein; β = 0.014±0.010 od/min/mg protein) showed involvement of esterases.

1.5 Surveillance of pyrethroid resistance in important malaria vectors of western Rajasthan and studies on genetic and biochemical mechanisms of pyrethroid resistance in *An. stephensi* -

Principal Investigator : Dr. Karam V. Singh, Scientist 'F'

Co-Investigators: Dr. S. K. Bansal, Scientist 'F' and Dr. Himmat Singh, Research Assistant

Research Staff: Mr. Robin Marwal, Research Assistant, Mr. Prashant, Insect Collector and Mr. Deva Ram, Insect Collector

Commencement: June 1, 2012

Duration: Two Year

Status: New Project

Funding Agency: Indian Council of Medical Research - Vector Science Forum (Extramural)

OBJECTIVES

1. Periodic monitoring of insecticide susceptibility of *An. stephensi* and *An. culicifacies* to synthetic pyrethroids in the areas of their use to assess the development of insecticide resistance
2. Development of pyrethroid resistant strain of *An. stephensi* in the laboratory and investigation of the inheritance pattern of pyrethroid
3. Elucidation of the biochemical mechanism of pyrethroid resistance in *An. stephensi* using laboratory selected strain and field collected resistant strains

PROGRESS

Three desert districts i.e. Barmer, Bikaner and Jaisalmer, where synthetic pyrethroids have already been introduced as indoor residual spray under national control programme, have been selected for the study. From each district ten villages, having different spray histories of last three years, were selected for the study.

Vector prevalence studies on *An. stephensi* and *An. culicifacies* have been carried-out in the selected villages using standard methods of entomological surveys to collect information on important aspects of vector bionomics such as adult mosquito density and breeding habitats, in post-monsoon, winter and pre-monsoon seasons. The adult collection of vector species has been done using WHO method, by sucking tubes and torch light.

The insecticide susceptibility status of adults of *An. stephensi* and *An. culicifacies* was determined against synthetic pyrethroids, DDT and Malathion and of larvae against temephos. For determination of current susceptibility status of field collected and laboratory reared individuals of both the species, WHO Standard Test Procedures were followed and diagnostic doses of test compounds were used. The status of resistance, if any, was recorded using WHO criteria:

Susceptible	: Mortality $\geq 98.0\%$
Resistant	: Mortality $80.0 - <98.0\%$
Intermediate Resistant	: Mortality $<80.0\%$

For the susceptibility status of larvae, the WHO larval test method was used to determine the susceptibility status of *An. stephensi* and *An. culicifacies* larvae using diagnostic dose of temephos, as temephos application is being undertaken in the desert areas for the control of malaria vectors under national control programme, as per WHO criteria.

Selection studies to establish a synthetic pyrethroid resistant strain of *An. stephensi* has been initiated. *An. stephensi* strain, collected from Kakku village of Bikaner district, has been selected for the purpose, as village Kakku, since last 3 years has no history of any insecticide spray and the strain of the village is susceptible to synthetic pyrethroids.

The base line data of the strain has been determined and the LT_{50} and LT_{90} values have been calculated using log-probit analysis. The selection studies using LT_{80} (selection pressure) value is in progress to develop a synthetic pyrethroid resistant strain which will be used for the biochemical and genetic studies next year.

Species Prevalence:

Season-wise prevalence of two important malaria vector species *viz.*, *An. stephensi* and *An. culicifacies* has been studied in 30 villages, 10 villages from each study district *viz.* Barmer, Bikaner and Jaisalmer. The district-wise details on the vector prevalence are as below:

Barmer district:

The field studies in this district have been carried-out during three seasons, i.e. post-monsoon, winter and pre-monsoon (Table 1). In post-monsoon, the survey was conducted in 10 villages, namely Kalyanpura, Jasol, Thob, Baitu, Rani, Gunga, Goliya, Parlu, Kawas and Nimbla. The study villages have insecticide spray history of only DDT since last three years. Villages like Kalyanpura, Jasol, Baitu, Goliya and Parlu have regular DDT spray, whereas, other villages have only two years DDT spray history i.e. during 2011 and 2012. *An. stephensi* was recorded from all the study villages during post-monsoon season, whereas, *An. culicifacies* was reported only from Thob, Gunga, Golia, Kawas and Nimbla. The per man hour (PMH) density of *An. stephensi* was recorded highest in village Gunga (PMH: 49.1) and minimum (PMH: 1.0) in village Golia (Table 1). *An. culicifacies* was also recorded maximum (PMH: 181.1) in village Gunga, but the minimum (PMH: 2.0) in village Golia.

In pre-monsoon season the entomological survey was conducted only in four villages *viz.*, Kalyanpura, Jasol, Thob and Parlu and among surveyed villages, in Jasol and Parlu villages no malaria vector species was recorded during this season, however, in village

Kalyanpur both *An. stephensi* (PMH: 7.3) and *An. culicifacies* (PMH: 3.3) were recorded. In winter, only Goliya village was surveyed and in this village no malaria vector species was recorded during this season (Table 1).

Table 1. Village-wise details of malaria vector species collected in Barmer district in different seasons

Name of Village	Insecticide Spray History			Season of Survey	Anopheles Species Collected	PMHD*
	2010	2011	2012			
Kalyan pura	DDT	DDT	DDT	Post-monsoon	<i>An. stephensi</i>	3.1
				Pre- monsoon	<i>An. stephensi</i>	7.3
					<i>An. culicifacies</i>	3.3
Jasol	DDT	DDT	DDT	Post- monsoon	<i>An. stephensi</i>	10.8
				Pre- Monsoon	Nil	0.0
Thob	No Spray	DDT	DDT	Post- monsoon	<i>An. stephensi</i>	11.0
					<i>An. culicifacies</i>	3.5
				Pre- monsoon	<i>An. stephensi</i>	1.3
Baitu	DDT	DDT	DDT	Post- monsoon	<i>An. stephensi</i>	3.6
Rani	No Spray	DDT	DDT	Post- monsoon	<i>An. stephensi</i>	2.3
Gunga	No Spray	DDT	DDT	Post- monsoon	<i>An. stephensi</i>	49.1
					<i>An. culicifacies</i>	181.1
Goliya	DDT	DDT	DDT	Post- monsoon	<i>An. stephensi</i>	1.0
					<i>An. culicifacies</i>	2.0
				Winter	Nil	-
Parlu	DDT	DDT	DDT	Post- monsoon	<i>An. stephensi</i>	1.2
				Pre- Monsoon	Nil	-
Kawas	No Spray	DDT	DDT	Post- monsoon	<i>An. stephensi</i>	12.9
					<i>An. culicifacies</i>	9.0
Nimbla	No Spray	DDT	DDT	Post- monsoon	<i>An. stephensi</i>	3.3
					<i>An. culicifacies</i>	7.7

*PMHD – Per Man Hour Density

The breeding of *An. stephensi* in Barmer district was detected in all the study villages in the habitats like indoor cemented ground tanks, indoor plastic, cemented and clay containers, village ponds and ditches, whereas of *An. culicifacies* was found breeding only in the village ponds of two villages i.e. Thob & Gunga. The detection of breeding of both *An. stephensi* and *An. culicifacies* species in village ponds, indicate that this habitat is being shared by both the malaria vectors species in the study area.

Bikaner district:

The field studies in this district have been carried-out during two seasons, i.e. post-monsoon and pre-monsoon (Table 2). In post-monsoon, the survey was conducted in 8 villages,

namely Khara, Shobhasar, Kodamdesar, Jagdewala Naal, Uttamdesar, Bhanipura and Kakku. The study villages have insecticide spray history of DDT and alpha-cypermethrin since last three years. Three villages namely Khara, Shobhasar and Jagdewala have the spray history of alpha-cypermethrin and DDT during 2011 and 2012 respectively, whereas, villages like Uttamdesar and Diyatra have DDT-alpha-cypermethrin-DDT spray history during last three years. Naal is a village where DDT has been sprayed only in 2012, and Kakku has not been sprayed since last two years.

An. stephensi was recorded from all the study villages during post-monsoon season, whereas, *An. culicifacies* only from three villages i.e. Shobhasar, Kodamdesar and Jagdewala. The per man hour (PMH) density of *An. stephensi* was recorded highest in village Shobhasar (PMH: 9.3) and minimum (PMH: 0.6%) in village Uttamdesar (Table 2). *An. culicifacies* was also recorded maximum (PMH: 6.0) in village Shobhasar, but the minimum (PMH: 4.0) in village Kodamdesar.

In pre-monsoon season the entomological survey was conducted only in six villages viz., Khara, Jagdewala, Naal, Bhanipura, Diyatra and Napasar. Diyatra and Napasar have been surveyed only in pre-monsoon season. In this season the highest density of *An. stephensi* was recorded from Naal village (PMH: 11.1) and lowest (PMH: 0.7) in Napasar village (Table 2). In this season, *An. culicifacies* was recorded only from three villages with highest density (PMH: 5.2) from village Bhanipura.

The breeding of both *An. stephensi* and *An. culicifacies* was detected in the study villages of this district. *An. stephensi* breeding was reported from all ten villages selected for the study, however, *An. culicifacies* was found breeding in only in two villages i.e. Kodamdesar and Jagdewala. The breeding of *An. stephensi* was found in indoor cemented containers/tanks, ground cemented open tanks, cattle tanks, village ponds and ditches, whereas, *An. culicifacies*, like Barmer district, only in village ponds. The village ponds were found shared by both *An. stephensi* and *An. culicifacies* species for breeding. In all study villages only larval forms were found in the breeding sites, whereas, in two villages, Diyatra and Napasar, besides larval forms, pupae were also detected.

Jaisalmer district:

The field studies in this district have been carried-out during two seasons, i.e. post-monsoon and pre-monsoon (Table 3). In post-monsoon, the survey was conducted in 5 villages, namely Awaya, Satyaya, Chinnu, Gomath and Indra Nagar. The study villages have insecticide spray history of DDT and alpha-cypermethrin since last three years. Two villages namely Satyaya and Chinnu have DDT spray history during 2010 and 2011 and no spray in 2012, whereas, other two villages, Gomath and Indra Nagar have spray history of alpha-cypermethrin and DDT during 2011 and 2012 respectively and no spray during

2010. *An. stephensi* was recorded from all the study villages during post-monsoon season, whereas, *An. culicifacies* only from four villages (Table 5). The per man hour (PMH) density of *An. stephensi* was recorded highest in village Chinnu (PMH: 12.6) and minimum (PMH: 2.3) in village Satyaya (Table 3). *An. culicifacies* was also recorded maximum (PMH: 29.8) in village Chinnu, but the minimum (PMH: 0.8) in village Gomath.

Table 2. Village-wise details of malaria vector species collected in Bikaner district in different seasons

Name of Village	Insecticide Spray History			Season of Survey	Anopheles Species Collected	PMHD*
	2010	2011	2012			
Khara	No Spray	Alpha-cypermethrin	DDT	Post-monsoon	<i>An. stephensi</i>	4.4
				Pre-monsoon	<i>An. stephensi</i>	8.4
Shobhasar	No Spray	Alpha-cypermethrin	DDT	Post-monsoon	<i>An. stephensi</i>	9.3
					<i>An. culicifacies</i>	6.0
Kodamdesar	DDT	No Spray	DDT	Post-monsoon	<i>An. stephensi</i>	1.6
					<i>An. culicifacies</i>	4.0
Jagdewala	No Spray	Alpha-cypermethrin	DDT	Post-monsoon	<i>An. stephensi</i>	2.0
					<i>An. culicifacies</i>	4.4
				Pre-monsoon	<i>An. stephensi</i>	2.2
					<i>An. culicifacies</i>	2.2
Naal	No Spray	No Spray	DDT	Post-monsoon	<i>An. stephensi</i>	3.2
				Pre-monsoon	<i>An. stephensi</i>	11.1
Uttamdesar	DDT	Alpha-cypermethrin	DDT	Post-monsoon	<i>An. stephensi</i>	0.6
Bhanipura	No Spray	Alpha-cypermethrin	No Spray	Post-monsoon	<i>An. stephensi</i>	0.8
				Pre-monsoon	<i>An. stephensi</i>	4.4
					<i>An. culicifacies</i>	5.2
Kakku	DDT	No Spray	No Spray	Post-monsoon	<i>An. stephensi</i>	6.0
Diyatra	DDT	Alpha-cypermethrin	DDT	Pre-monsoon	<i>An. stephensi</i>	1.8
					<i>An. culicifacies</i>	2.2
Napasar	DDT	DDT	No Spray	Pre-Monsoon	<i>An. stephensi</i>	0.7

*PMHD – Per Man Hour Density

In pre-monsoon season the entomological survey was conducted in nine villages viz., Awaya, Chinnu, Gomath, Indra Nagar, Tejpala, Sultana, Raimala, Hamira and Thaat (Table 3). Five newly added villages also have the insecticide spray history of DDT and alpha-cypermethrin. Three villages out of five had only DDT spray during 2012 and no spray in 2010 & 2011, whereas, village Thaat had DDT-alpha-cypermethrin-DDT spray history. In this season of *An. stephensi* was recorded from all the study villages with highest density (PMH: 72.0) in Tejpala village and lowest (PMH: 1.3) in Gomath village (Table 3), however, *An. culicifacies* was recorded only from five villages with highest density (PMH: 48.4) in village Tejpala only and lowest (PMH: 5.4) in village Hamira. The density of *An. culicifacies* was recorded comparatively high during this season. The density of both *An. stephensi* and *An. culicifacies* was recorded low in the villages where alpha-cypermethrin has been replaced by DDT in the following year.

The breeding of both *An. stephensi* and *An. culicifacies* was detected in the study villages of this district. *An. stephensi* breeding was reported from all ten villages selected for the study, however, *An. culicifacies* was found breeding in only in four villages. *An. stephensi* was found breeding in indoor underground (UG) & cemented tanks, metallic outdoor tanks, open ground tanks, coolers, ground cemented cattle tanks and ditches near canal, whereas, *An. culicifacies* in open ground tanks, cattle tanks and ditches near canal, which were also found sharing by *An. stephensi*. All aquatic stages i.e. eggs, larvae and pupae were recorded in the villages.

Current susceptibility status of malaria vector species:

In Barmer district, the current susceptibility status of *An. stephensi*, was determined against DDT, malathion and permethrin (Table 4). In village Gunga, *An. culicifacies* was found resistant to DDT, however, susceptible to both malathion and permethrin. In Kalyanpura village, *An. stephensi* was found resistant to DDT, intermediate resistant to malathion and susceptible to permethrin, whereas, in village Kawas and Baitu against DDT, the species was found intermediate resistant and resistant respectively, but in village Baitu against malathion exhibited intermediate resistance.

In Bikaner district, the current susceptibility status of *An. stephensi* was detected against DDT, malathion and cyfluthrin (Table 4). In village Khara, the species was found resistant to both DDT and malathion. Similarly in Naal village too this species exhibited resistance to DDT and malathion, however, against cyfluthrin the species was found totally susceptible. In village Kakku the species was found resistant to DDT and intermediate resistant to malathion.

In Jaisalmer district, the studies on the current susceptibility status revealed that *An. stephensi* in Raimala village is susceptible to DDT and permethrin; in Satyaya, susceptible to DDT and malathion; in Tejpala, susceptible to permethrin, intermediate resistant to malathion and resistant to DDT, and in village Thaat susceptible to permethrin and intermediate resistant to DDT and malathion. To DDT *An. culicifacies* exhibited resistance in Awaya village, intermediate resistant in Tejpala, and found susceptible in village Raimala. Against malathion and permethrin, *An. culicifacies* was found susceptible in village Awaya and village Tejpala, respectively.

Table 3. Village-wise details of malaria vector species collected in Jaisalmer district in different seasons

Name of Village	Insecticide Spray History			Season of Survey	<i>Anopheles</i> species collected	PMHD*
	2010	2011	2012			
Awaya	DDT	DDT	DDT	Post- monsoon	<i>An. stephensi</i>	2.8
					<i>An. culicifacies</i>	4.3
				Pre- monsoon	<i>An. stephensi</i>	11.7
					<i>An. culicifacies</i>	36.1
Satyaya	DDT	DDT	No Spray	Post- monsoon	<i>An. stephensi</i>	2.3
					<i>An. culicifacies</i>	2.9
Chinnu	DDT	DDT	No Spray	Post- monsoon	<i>An. stephensi</i>	12.6
					<i>An. culicifacies</i>	29.8
				Pre- monsoon	<i>An. stephensi</i>	9.1
					<i>An. culicifacies</i>	40.9
Gomath	No Spray	Alpha-Cyper-methrin	DDT	Post- monsoon	<i>An. stephensi</i>	6.2
					<i>An. culicifacies</i>	0.8
				Pre- monsoon	<i>An. stephensi</i>	1.3
Indira Nagar	No Spray	Alpha-Cyper-methrin	DDT	Post- monsoon	<i>An. stephensi</i>	10.2
				Pre- monsoon	<i>An. stephensi</i>	6.7
Tejpala	No Spray	No Spray	DDT	Pre- monsoon	<i>An. stephensi</i>	72.0
					<i>An. culicifacies</i>	48.4
Sultana	No Spray	No Spray	DDT	Pre -monsoon	<i>An. stephensi</i>	29.3
					<i>An. culicifacies</i>	7.3
Raimala	No Spray	DDT	DDT	Pre- monsoon	<i>An. stephensi</i>	11.1
					<i>An. culicifacies</i>	45.4
Hamira	No Spray	No Spray	DDT	Pre-monsoon	<i>An. stephensi</i>	8.9
					<i>An. culicifacies</i>	5.4
Thaat	DDT	Alpha-cyper-methrin	DDT	Pre- monsoon	<i>An. stephensi</i>	2.7

*PMHD – Per Man Hour Density

Current susceptibility status of *An. stephensi* determined against temephos larvicide revealed that this species is susceptible to this larvicide in all the study districts, however, *An. culicifacies* in village Raimala of Jaisalmer district exhibited intermediate resistance against this larvicide, which needs further verification.

Table 4. Susceptibility status of malaria vector specie collected from study villages against different insecticides

District	Village	Species	Insecticide & diagnostic Dose	Exposure Time (in Hrs)	Percent Mortality	Susceptibility Status*
Bikaner	Khara	<i>An. stephensi</i>	DDT 4%	1.0	50.0	R
			Malathion 5%	1.0	20.0	R
	Kakku	<i>An. stephensi</i>	DDT 4%	1.0	80.0	R
			Malathion 5%	1.0	92.0	I R
			Permethrin 0.75 %	1.0	100.0	S
	Naal	<i>An. stephensi</i>	DDT 4%	1.0	12.5	R
			Malathion 5%	1.0	08.3	R
			Cyfluthrin 0.15 %	1.0	100.0	S
Barmer	Gunga	<i>An. culicifacies</i>	DDT 4%	1.0	50.0	R
			Malathion 5%	1.0	100.0	S
			Permethrin 0.75 %	1.0	100.0	S
	Kalyan-pur	<i>An. stephensi</i>	DDT 4%	1.0	72.0	R
			Malathion 5%	1.0	88.0	IR
			Permethrin 0.75 %	1.0	100.0	S
	Kawas	<i>An. stephensi</i>	DDT 4%	1.0	91.0	IR
	Baitu	<i>An. stephensi</i>	DDT 4%	1.0	59.7	R
			Malathion 5%	1.0	96.7	IR
Jaisalmer	Raimala	<i>An. culicifacies</i>	DDT 4%	1.0	100.0	S
		<i>An. stephensi</i>	DDT 4%	1.0	100.0	S
			Permethrin 0.75 %	1.0	100.0	S
	Satyaya	<i>An. stephensi</i>	DDT 4%	1.0	100.0	S
			Malathion 5%	1.0	100.0	S
	Tejpala	<i>An. culicifacies</i>	DDT 4%	1.0	95.0	IR
			Permethrin 0.75 %	1.0	100.0	S
		<i>An. stephensi</i>	DDT 4%	1.0	68.0	R
			Malathion 5%	1.0	88.0	IR
			Permethrin 0.75 %	1.0	100.0	S
			DDT 4%	1.0	92.0	IR
	Thaat	<i>An. stephensi</i>	Malathion 5%	1.0	88.0	IR
			Permethrin 0.75 %	1.0	100.0	S
			DDT 4%	1.0	92.0	IR
	Awaya	<i>An. culicifacies</i>	DDT 4%	1.0	50.0	R
			Malathion 5%	1.0	100.0	S

*S- Susceptible, R- Resistant, IR- Intermediate Resistant

Laboratory selection studies to establish a synthetic pyrethroid resistant strain:

Laboratory selection studies to establish a permethrin resistant strain of *An. stephensi* has been initiated. *An. stephensi* strain, collected from Kakku village of Bikaner district, has been selected for the purpose, as village Kakku since last 3 years has no history of any insecticide spray and the strain of the village is susceptible to permethrin (Table 4). The base line data of the strain has been determined and the LT_{50} and LT_{90} values have been calculated using log-probit analysis (Table 5).

Table 5. Determination of lethal time at 50 and 90 per cent mortality levels of *An. stephensi* of Kakku village against permethrin

Name of Insecticide	Diagnostic Dose (%)	Time of exposure (minutes)	Mortality %	LT_{50} and LT_{90}
Control	0.0	25	0.0	$LT_{50} = 10.5$ $LT_{90} = 20.6$ $Df = 2$ $\chi^2 = 5.98$
Permethrin	0.75	05	40.0	
Permethrin	0.75	10	68.0	
Permethrin	0.75	25	96.0	

The selection studies using LT_{80} (selection pressure) values are in progress to develop a permethrin resistant strain which will be used for the biochemical and genetic studies next year.

1.6 Development of molecular markers for the identification of Biological forms of *Anopheles stephensi* prevalent in arid areas of Rajasthan-

Principal Investigator: Dr. Karam V. Singh, Scientist 'F',

Co-Investigators: Dr S. K. Bansal, Scientist 'F', Dr. Himmat Singh, Research Assistant

Research Staff: Mr. Robin Marwal, Junior Research Fellow and Ms. Anusha Mishra, Research Assistant

Commencement: February 1, 2010

Duration: Three Years

Status: Completed

Funding Agency: Ministry of Environment & Forest (MOEF) (Extra Mural)

OBJECTIVES

1. Identification of biological forms of *Anopheles stephensi* using molecular tools and studies on their bionomics and distribution in different arid environs.

PROGRESS

The studies during the report period have been carried out in Jodhpur, Jaisalmer and Barmer districts, as per project protocol and the main emphasis has been given on the investigations related to the distribution of different bio-forms of *An. stephensi* present in the study areas. Besides 'type' and variety *mysorensis*, during the studies, an 'intermediate' form was also found having egg ridges 14-15, whereas, the 'type' form and var. *mysorensis* were identified on the basis of egg ridge ≥ 16 and <14 ridge count, respectively.

Table 1. Observations on the morphological details of eggs of different bio-forms of *An. stephensi*

Egg details	Type	Intermediate	Mysorensis
Shape of egg-clutch	Rosette	Linear	Linear
No of ridges	>15	14-15	<14
Ridge type	Overlapped & Notched	Overlapped & Notched	No overlapping & without notch

The arrangement of the eggs on the water surface in case of 'intermediate' form, like var. *mysorensis* was observed in linear fashion, in contrast to 'type' form, where it was found in rosette fashion, however, the ridge type in 'intermediate' form was found to be overlapped and notched, like 'type' form, which in var. *mysorensis* exhibited no overlapping and without any notch (Table 1). It indicates that in 'intermediate' form some of the morphological characters resemble with 'type' form and others to var. *mysorensis*.

The measurements of length and width of about 1602 eggs of three bioforms have been taken to calculate the area of the individual egg and record difference in the length and

width in case of individual bio-form (Table 2). The morphometry of eggs exhibited that the average length and width of the eggs of type form was found more in comparison to both 'intermediate' and *mysorensis* forms and the average area of eggs, calculated of all the three forms also followed the same pattern.

Table 2. Observations on the length and width of eggs of individual bio-form of *An. stephensi*

Egg Measure-ments	<i>Mysorensis</i>		Intermediate		Type	
	Average	Standard deviation	Average	Standard deviation	Average	Standard deviation
Length (mm)	0.504	0.020	0.522	0.022	0.535	0.024
Width (mm)	0.171	0.0114	0.176	0.011	0.181	0.013
Area (mm ²)	0.068	0.006	0.072	0.006	0.076	0.008

The measurement of length of the spiracles of different bio-forms revealed that mean length of the spiracles of 'intermediate' form ranged between the mean lengths of 'type' form and var. *mysorensis* (Table 3). The values of spiracular index of 'intermediate' form, was found lower in comparison to 'type' form, but higher than var. *mysorensis*, which indicates that the 'intermediate' form can withstand more extreme conditions than type form, but lesser in comparison to var. *mysorensis*.

Table 3. Spiracular index of *An. stephensi* bioforms

Bio-forms	Length of spiracle (mm) Mean + SD	Spiracular Index Mean + SD
Type	0.119 ± 0.008	8.250± 0.627
Intermediate	0.0904± 0.004	6.232 ±0.960
Mysorensis	0.079 ± 0.005	6.037 ± 1.23

During the report period, the 'type' form, in Jaisalmer and Barmer districts, was collected from both urban and rural areas, whereas, in Jodhpur district from urban and peri-urban localities (Table 4). The var. *mysorensis* and 'intermediate' form, both in Jaisalmer and Barmer districts, were collected only from rural areas, however, in Jodhpur district, it was collected from urban and peri-urban localities. The breeding of 'type' form was detected from indoor containers, ground cemented tanks, fountains and ditches, of 'intermediate' form from over-head and ground cattle tanks, and the var. *mysorensis* was found breeding in indoor containers, coolers, ground cemented tanks, clay pots, fountains and cattle tanks (Table 4).

Table 4. Distribution of different bio-forms of *An. stephensi* in study areas and their breeding habitats

Districts & breeding habitats	Urban localities/Villages		
	Type	Intermediate	<i>Mysorensis</i>
Jaisalmer	Jaisalmer urban, Tejpala , Raimala, Indra nagar, Hameera & Gomath	Raghwa, Satyaya & That	Satyaya, Chinnu & That
Barmer	Barmer Urban, Kawas, Jasol & Goliya	Baitu, Kalyanpura & Jasol	Kawas, Jasol & Baitu.
Jodhpur	Jodhpur urban: Kheme ka kuan, Fidusar, Public park.	Jodhpur urban: Kheme ka kuan, Public park & Bamba. Jhalamand & Mandore	Jodhpur urban: Kheme ka kuan, Public park & Shastri Nagar. Jhalamand & Mandore,
Breeding habitats	Indoor containers, ground cemented tanks, fountains, & ditches.	Over head and ground cattle tanks	Indoor containers, coolers, ground cemented tanks, clay pot, fountains & cattle tanks

The total protein contents of individuals of different bioforms were estimated to determine the difference among them. For estimation of protein content 10 mosquitoes of each bioforms of same age (one day old) were assayed with total protein assay kit (Bio-Rad). Among the females, the protein content was recorded higher in 'type' form (4.689 ± 0.344 od/min/mg protein) and lowest in 'intermediate' form (4.400 ± 0.199 od/min/mg protein), whereas, among the males highest in *mysorensis* (4.546 ± 0.424 od/min/mg protein) and least in males of 'type' form (4.189 ± 0.216 od/min/mg protein) (Table 5).

Table 5. Estimated total protein contents of different bio-forms of *An. stephensi*

Bio-forms	Sex	Estimated Protein Contents (OD/min/microgram protein)	
		Average $\pm$ SD	Range
Type	Male	4.189 ± 0.216	4.561-3.804
	Female	4.689 ± 0.344	5.287-4.167
Intermediate	Male	4.321 ± 0.234	4.817-3.923
	Female	4.400 ± 0.199	4.742- 4.167
<i>Mysorensis</i>	Male	4.546 ± 0.424	5.049- 3.991
	Female	4.519 ± 0.267	5.017- 4.154

The studies on the molecular assays for the identification of different bio-forms are in progress.

1.7 Synergistic efficacies of some plant extracts with and without some insecticidal formulations against vectors of malaria and dengue in North-Western Rajasthan –

Principal Investigator: Dr. S. K. Bansal, Scientist‘F’

Co-Investigator: Dr. Karam V. Singh, Scientist‘F’

Commencement: April, 2009

Duration: Three Years

Status: New Project

Funding: Desert Medicine Research Centre (Intramural)

OBJECTIVES

1. Determination of the larvicidal activity of different parts of the plant *Withania somnifera* against urban mosquito vector species
2. Determination of joint actions, synergistic/antagonistic of *W. somnifera* with both synthetic and plant-origin insecticides in view to develop the most promising combination(s) for inclusion in the IDVC programmes

RATIONALE

Mosquito-borne diseases, such as malaria, filariasis, dengue, yellow fever, and Japanese encephalitis, contribute significantly to disease load in tropical countries. Among these diseases, malaria and dengue continues to be the major public health problem in most tropical countries. However, over and injudicious application of synthetic insecticides in controlling the vectors of above diseases has resulted in to development of insecticide resistance among vector species, environmental hazards through persistence and accumulation of non-biodegradable chemicals in ecosystem, biological magnification through the food chains and toxic effects on human health. These developments demand that a renewed effort be made to register alternative insecticidal agents with high bio-control potentiality but causes little or no harmful effect to environment and human health. One possible strategy is the exploitation of bioactive products from phytochemicals by systematically exploring the local desert medicinal plants. There is an ever-increasing demand for plant-based insecticides as they are non-toxic, easily available at affordable prices, biodegradable and show broad-spectrum target-specific activities against different species of vector mosquitoes. Furthermore, unlike conventional commercial insecticides that are based on single active ingredient, plant-derived insecticides comprise botanical blends of secondary metabolites, which act jointly on both behavioural and physiological processes. Thus, the chances of pests developing resistance to such substances are meager. However, efficacy observed for botanicals over 24hr, render many of them unusable by economic standards.

Individual plant extracts are active only at higher concentration, which makes them uneconomical for field use. Therefore, in the present study synergistic, antagonistic

and additive toxic effects of binary mixtures involving phytochemicals alone and in combination with other synthetic insecticides and microbial control agents would be tried in order to find suitable synergists or additives which can be used for vector control.

PROGRESS

Studies are being carried out on *W. somnifera*, also known as Ashwagandha, a plant in Solanaceae or nightshade family. Fruits, leaves and seeds of this plant have been traditionally used for the Ayurvedic system as aphrodisiacs, diuretics and for treating memory loss. We have already evaluated the insecticidal properties of *Solanum xanthocarpum*, the Indian nightshade commonly known as 'baigan kateli'. It is found throughout the country but more abundantly in the arid areas and used widely for a variety of ailments in public health. Extracts prepared from fruits of these plant species have been screened for their synergistic larvicidal potential against larvae of different mosquito vectors present in this area.

Susceptibility tests were carried out for the larvae of three mosquito species viz. *Anopheles stephensi*, *Aedes aegypti* and *Culex quinquefasciatus*. For this purpose larvae of all the three mosquito species were collected from different areas of Jodhpur city and reared in the laboratory for further generations under controlled conditions. The different parts of the plant differ in their active constituents when extracted in different solvents. Ripe fruits of *S. xanthocarpum* and *W. somnifera* were shade dried between 30-40°C for 10-15 days. Dried plant material was powdered separately and dissolved in methanol and stock solutions and serial dilutions were made as per requirement. Third or early fourth instar larvae of these mosquito species were tested as per standard WHO method for determining the baseline data on their susceptibility status. Experiments were carried out in 500 ml beakers containing 249 ml of water by using 20-25 larvae of each mosquito species. Mortality was noted after 24 hr and corrected by using Abbott's formula. Average of four observations was taken and data subjected to log probit regression analysis.

Observations on the results of the larval susceptibility to methanol extracts of yellow ripe fruits of *S. xanthocarpum* are given in Table 1. 24 and 48 hr LC₅₀ and LC₉₀ values along with their 95% fiducial limits, regression equation and chi-square were calculated. 24 and 48h LC₅₀ values as observed for *An. stephensi*, *Ae. aegypti* and *Cx. quinquefasciatus* were 77.7, 121.6 & 142.8 and 48.4, 71.1 & 115.4 mg/l while the corresponding 24 and 48h LC₉₀ values were 465.6, 1261.5 & 759.5 and 218.2, 687.3 & 844.0 mg/l respectively. The results of the larval susceptibility to methanol extracts of red fruits of *W. somnifera* are given in Table 2. 24 and 48h LC₅₀ values as observed for *An. stephensi*, *Ae. aegypti* and *Cx. quinquefasciatus* were 108.4, 135.1 & 1092.1 and 66.3, 79.0 & 456.0 mg/l while the corresponding 24 and 48h LC₉₀ values were 523.1, 710.7 & 2159.4 and 226.4, 455.0 & 1850.0 mg/l respectively.

The results of the synergistic studies on larvae of *An. stephensi* to the methanol extracts from yellow ripe fruits of *S. xanthocarpum* and red fruits of *W. somnifera* are given in tables 3 and 4. In the first test series the volume of *W. somnifera* was fixed

Table 1. Efficacy of methanol extracts of *S. xanthocarpum* (Yellow ripe fruits) on larvae of different mosquito vectors

Mosquito Species/ Conc. (mg ⁻¹)	(%) Corrected Mortality		Regression Equation	Chi-Sq. (df)	24 hr LC ₅₀ & LC ₉₀ (Fiducial limits) mg ⁻¹	48 hr LC ₅₀ & LC ₉₀ (Fiducial limits) mg ⁻¹
	24h	48h				
<i>An. stephensi</i>						
Control	-	-	Y=1.65x+1.89 ^a	0.90 ^a (3)	77.7± 1.17* (56.9-106.0)	48.4± 1.16* (36.1-65.0)
25	18.4	28.6	Y=1.96x+1.70 ^b	0.10 ^b (3)	465.6± 1.48** (216.5-1001.3)	218.2±1.41** (110.7-430.0)
50	40.4	49.5				
100	62.5	75.0				
200	73.2	86.6				
400	83.7	96.9				
<i>Ae. aegypti</i>						
Control	-	-	Y=1.26x+2.37	0.11 (3)	121.6±1.22 (81.7-180.9)	71.1±1.22 (48.4-104.4)
25	18.4	28.6	Y=1.30x+2.59	0.11 (3)	1261.5±1.80 (396.6-4012.4)	687.3±1.76 (226.4-2086.3)
50	33.0	41.2				
100	45.5	55.6				
200	60.6	72.7				
400	73.2	84.5				
<i>Cx. quinque-fasciatus</i>						
Control	0.0	0.0	Y=1.76x+1.20	1.91 (3)	142.8±1.19 (101.4-201.0)	115.4±1.21 (79.1-168.3)
25	11.2	20.4	Y=1.48x+1.94	2.30 (3)	1003.9±1.55 (319.7-3804.1)	948.4±1.75 (282.9-2517.9)
50	20.6	28.9				
100	36.0	41.2				
200	57.3	62.5				
400	93.8	86.7				

*Values are 24 and 48h LC₅₀ respectively; ** -Values are 24 and 48h LC₉₀ respectively

a-The values of Slope, Reg. Equation, Chi-Sq. and Intercept are for 24hr

b- The values of Slope, Reg. Equation, Chi-Sq. and Intercept are for 48hr

and the proportion of *S. xanthocarpum* was increased and three different binary combinations were prepared. These pairs were WS: SX (1:1), WS: SX (1:2) and WS: SX (1:3) and tests were carried out at concentrations of 5, 10, 25, 50, 100 and 200 mg/l for *An. stephensi* (Table-3). A dose response curve was established to determine the 24 and 48h LC₅₀ and LC₉₀ values along with their 95% confidence limits, regression equation, chi-square (χ^2) / heterogeneity of the response by log probit regression analysis. In the second test series the volume of *S. xanthocarpum* was fixed and the proportion of the *W. somnifera* was increased and three different binary combinations were prepared. These pairs were SX: WS (1:1), SX: WS (1:2) and SX: WS (1:3) and tests were carried out at concentrations of 10, 25, 50, 100 and 200 mg/l for *An. stephensi* (Table-4).

The 24h LC₅₀ values as determined for three binary mixtures viz. WS: SX (1:1), WS: SX (1:2) and WS: SX (1:3) were 32.7, 30.6 & 22.2 mg/l and the 48h LC₅₀ were 22.9, 16.3 & 12.9 mg/l respectively for this mosquito vector species. The 24h and 48h LC₉₀ values were also determined which were 149.4, 152.6, & 136.8 mg/l and 109.8, 110.0, & 64.0 mg/l respectively for this mosquito species (Table 3). From the results it is clear that *An. stephensi* was very much susceptible to the binary mixture WS: SX (1:3) (24h LC₅₀,

22.2 mg/l) as compared to the binary pairs WS: SX (1:2) (24h LC_{50} , 30.6 mg/l) and WS: SX (1:1) (24h LC_{50} , 32.7 mg/l) or in other words the efficacy goes up with the increase in the proportion of *S. xanthocarpum* extract.

Table 2. Efficacy of methanol extracts of *W. somnifera* (Red fruits) on larvae of different mosquito vectors

Mosquito Species/ Conc. (mg ⁻¹)	(%) Corrected Mortality		Regression Equation	Chi-Sq. (df)	24 hr LC_{50} & LC_{90} (Fiducial limits) mg ⁻¹	48 hr LC_{50} & LC_{90} (Fiducial limits) mg ⁻¹
	24h	48h				
<i>An. stephensi</i>	-	-	Y= 1.87x +1.19 ^a	0.15 ^a (3)	108.4 ± 1.16* (80.7-45.5)	66.3±1.13* (52.2-84.2)
Control	11.2	12.8				
25	28.3	45.0	Y= 2.40x+0.63 ^b	0.87 ^b (3)	523.1±1.42** (263.1-1040.1)	226.4±1.29** (137.7-372.3)
50	45.5	66.4				
100	71.8	84.8				
200	84.4	95.5				
400						
<i>Ae. aegypti</i>	-	-	Y= 1.78x+1.22	0.35 (3)	135.1±1.17 (98.9 - 184.5)	79.0±1.17 (57.8 - 107.9)
Control	8.3	20.8				
25	25.0	37.5	Y=1.68x+1.81	0.66 (3)	710.7±1.46 (339.2-1489.2)	455.0±1.15 (202.3 - 1023.3)
50	41.2	51.5				
100	61.2	75.5				
200	79.2	93.8				
400						
<i>Cx. quinque-fasciatus</i>	-	-	Y=1.22x+1.28	1.36 (3)	1092.1±1.54 (470.0-2537.2)	456.0±1.23 (306.5 - 679.5)
Control	3.3	3.4				
50	14.1	17.7	Y=1.61x+0.72	2.46 (3)	2159.4±2.78 (1640.5-9012.0)	1850.0±1.68 (1031.8-4872.9)
100	19.8	35.0				
200	27.0	43.4				
400	34.1	49.6				
500						

*Values are 24 and 48h LC_{50} respectively; ** -Values are 24 and 48h LC_{90} respectively

a-The values of Slope, Reg. Equation, Chi-Sq. and Intercept are for 24hr

b- The values of Slope, Reg. Equation, Chi-Sq. and Intercept are for 48hr

The 24h LC_{50} values as determined for the other three binary mixtures viz. SX:WS (1:1), SX:WS (1:2) and SX:WS (1:3) were 32.7, 47.5 & 63.8 mg/l and the 48h LC_{50} were 22.9, 29.1 & 50.2 mg/l respectively for this mosquito vector species i.e. *An. stephensi*. The 24h and 48h LC_{90} values were also determined which were 149.4, 316.8, & 471.7 mg/l and 109.8, 203.2, & 361.9 mg/l respectively for this mosquito species (Table 4). From the results it is clear that *An. stephensi* was very much susceptible to the binary mixture SX:WS (1:1) (24h LC_{50} , 32.7 mg/l) as compared to the binary pairs SX:WS (1:2) (24h LC_{50} , 47.5 mg/l) and SX:WS (1:3) (24h LC_{50} , 63.8 mg/l) or in other words the efficacy goes down with the increase in the proportion of *W. somnifera* extract.

Synergistic Factor (SF) and Co-toxicity Coefficient (CTC) were also determined and it was observed that when the concentration of WS was fixed and the conc. of SX was increased from

1:1 to 1:3, the Binary pair 1:3 was found most effective synergist pair (Table 5 & Fig. 1). However, a mixture of 1:1 was found most effective when the conc. of SX was fixed and the conc. of WS was increased from 1:1 to 1:3 (Table 6 & Fig. 2). Experiments have also been done on different fractions *viz.* 1/2, 1/3, 1/4th of the LC_{50} values of SX and WS and it was observed that synergistic effect was observed even up to 1/4th of the LC_{50} of these two plant extracts (Table 7 & Fig.3)

Table 3. Efficacy of combined methanol extracts of *W. somnifera* (WS) and *S. xanthocarpum* (SX) on larvae of *An. stephensi*

Mosquito Species/ Conc. (mg^{-1})	(%) Corrected Mortality		Regression Equation	Chi-Sq. (df)	24 hr LC_{50} & LC_{90} (Fiducial limits) mg^{-1}	48 hr LC_{50} & LC_{90} (Fiducial limits) mg^{-1}
	24h	48h				
(WS:SX) 1:1						
Control	-	-	$Y=1.94x + 2.06^a$	0.22 ^a (3)	32.7±1.16* (24.5-43.6)	22.9±1.17* (16.8-31.4)
10	17.1	28.2				
25	40.4	46.5	$Y=1.88x + 2.44^b$	0.98 ^b (3)	149.4±1.40** (77.6-287.8)	109.8±1.43** (54.2-222.6)
50	61.9	74.2				
100	83.5	92.8				
200	95.9	97.9				
(WS:SX) 1:2						
Control	-	-	$Y = 1.48x + 2.80$	2.26 (3)	30.6 ± 1.20 (21.3 – 43.8)	16.3 ± 1.20 (11.5 – 23.1)
5	8.0	19.0				
10	30.3	42.4	$Y = 1.54x + 3.13$	0.64 (3)	152.6 ± 1.56 (93.4 – 530.3)	110.0 ± 1.54 (47.2 – 256.4)
25	45.5	61.6				
50	66.0	74.0				
100	72.4	90.5				
(WS:SX) 1:3						
Control	-	-	$Y = 1.62x + 2.81$	1.34 (3)	22.2 ± 1.18 (16.1 -30.8)	12.9± 1.17 (9.4 – 17.6)
5	12.2	21.4				
10	30.9	44.3	$Y = 1.84x + 2.96$	0.29 (3)	136.8 ± 1.45 (66.0 – 283.4)	64.0 ± 1.43 (31.9 – 128.4)
25	60.6	71.7				
50	70.7	85.9				
100	79.6	91.8				

*Values are 24 and 48h LC_{50} respectively; ** -Values are 24 and 48h LC_{90} respectively

a-The values of Slope, Reg. Equation, Chi-Sq. and Intercept are for 24hr

b- The values of Slope, Reg. Equation, Chi-Sq. and Intercept are for 48hr

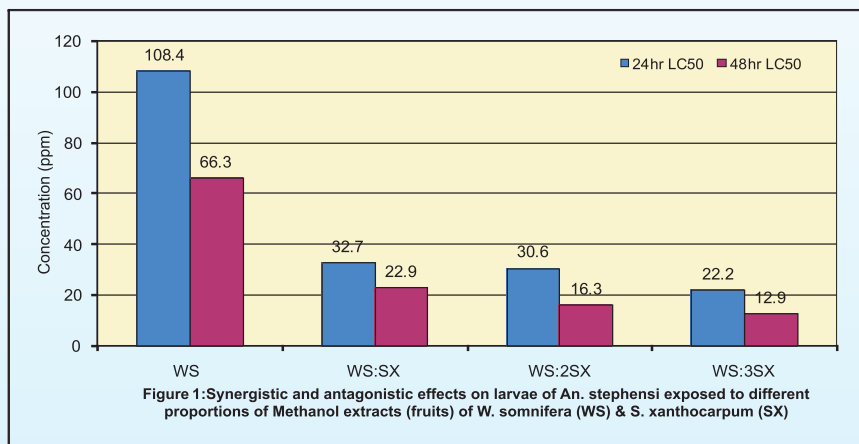


Table 4. Efficacy of combined methanol extracts of *S. xanthocarpum* (SX) and *W. somnifera* (WS) on larvae of *An. stephensi*

Mosquito Species/ Conc. (mg ⁻¹)	(%) Corrected Mortality		Regression Equation	Chi-Sq. (df)	24 hr LC ₅₀ & LC ₉₀ (Fiducial limits) mg ⁻¹	48 hr LC ₅₀ & LC ₉₀ (Fiducial limits) mg ⁻¹
	24h	48h				
(SX:WS) 1:1 Control 10 25 50 100 200	-	-	Y=1.94x + 2.06 ^a	0.22 ^a (3)	32.7±1.16* (24.5-43.6)	22.9±1.17** (16.8-31.4)
	17.1	28.2				
	40.4	46.5	Y=1.88x + 2.44 ^a	0.98 ^b (3)	149.4±1.40* (77.6-287.8)	109.8±1.43** (54.2-222.6)
	61.9	74.2				
	83.5	92.8				
	95.9	97.9				
(SX:WS) 1:2 Control 10 25 50 100 200	-	-	Y= 1.55x + 2.40	0.57 (3)	47.5± 1.20 (33.4 - 67.6)	29.1±1.20 (20.3 - 41.5)
	16.0	28.0	Y =1.51x + 2.76	1.48 (3)	316.8±1.59 (128.1 - 783.57)	203.2±1.63 (77.9 - 529.8)
	30.0	41.0				
	49.5	61.6				
	73.5	87.8				
	82.8	92.9				
(SX:WS) 1:3 Control 10 25 50 100 200	-	-	Y = 1.47x + 2.34	0.25 (3)	63.8 ± 1.21 (44.2 -92.1)	50.2 ± 1.21 (34.5 - 73.1)
	12.0	16.8	Y =1.49x + 2.46	1.73 (3)	471.7 ± 1.65 (175.8 - 1258.4)	361.9 ± 1.74 (122.6 - 1068.1)
	27.6	32.3				
	40.8	43.0				
	60.6	72.3				
	80.4	90.2				

*Values are 24 and 48h LC₅₀ respectively; ** -Values are 24 and 48h LC₉₀ respectively

a-The values of Slope, Reg. Equation, Chi-Sq. and Intercept are for 24hr

b- The values of Slope, Reg. Equation, Chi-Sq. and Intercept are for 48hr

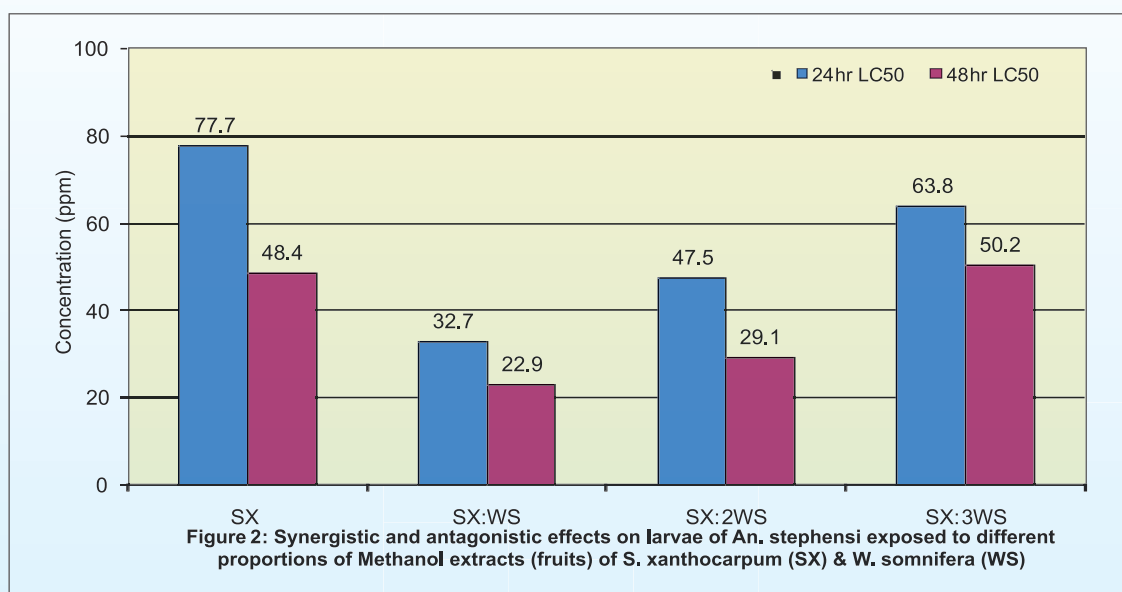


Table 5. Synergistic and antagonistic effects on larvae of *An. stephensi* when exposed to different proportions of methanol extracts (Fruits) of *W. somnifera* (WS) and *S. xanthocarpum* (SX)

Treatment Ratios	Exp. time	Regression Equation	Chi Sq. (χ^2)	LC ₅₀ ± SE Fiducial limits (mg ⁻¹)	CTC	SF	Type of Response	LC ₉₀ ± SE Fiducial limits (mg ⁻¹)	CTC	SF	Type of Response
WS	24	Y = 1.87x + 1.19	0.15	108.4 ± 1.16 (80.7-45.5)	-	-	-	523.1 ± 1.42 (263.1-940.1)	-	-	-
	48	Y = 2.40x + 0.63	0.87	66.3 ± 1.13 (52.2-84.2)	-	-	-	226.4 ± 1.29 (137.7-372.3)	-	-	-
WS:SX (1:1)	24	Y = 1.94x + 2.06	0.22	32.7 ± 1.16 (24.5-43.6)	331.5	3.31	Syn	149.4 ± 1.40 (77.6-287.8)	350.1	3.50	Syn
	48	Y = 1.88x + 2.44	0.98	22.9 ± 1.17 (16.8-31.4)	289.5	2.90	Syn	109.8 ± 1.43 (54.2-222.6)	206.2	2.06	Syn
WS:SX (1:2)	24	Y = 1.48x + 2.80	2.26	30.6 ± 1.20 (21.3 - 43.8)	354.2	3.54	Syn	152.6 ± 1.56 (93.4 - 530.3)	342.8	3.43	Syn
	48	Y = 1.54x + 3.13	0.64	16.3 ± 1.20 (11.5-23.1)	406.7	4.07	Syn	110.0 ± 1.54 (47.2 - 256.4)	205.8	2.06	Syn
WS:SX (1:3)	24	Y = 1.62x + 2.81	1.34	22.2 ± 1.18 (16.1 -30.8)	488.3	4.88	Syn	136.8 ± 1.45 (66.0 - 283.4)	382.4	3.82	Syn
	48	Y = 1.84x + 2.96	0.29	12.9 ± 1.17 (9.4 - 17.6)	514.0	5.14	Syn	64.0 ± 1.43 (31.9 - 128.4)	353.8	3.54	Syn

SF – Synergistic Factor; CTC - Co-Toxicity Coefficient

All values of LC₅₀ and LC₉₀ are in mg⁻¹

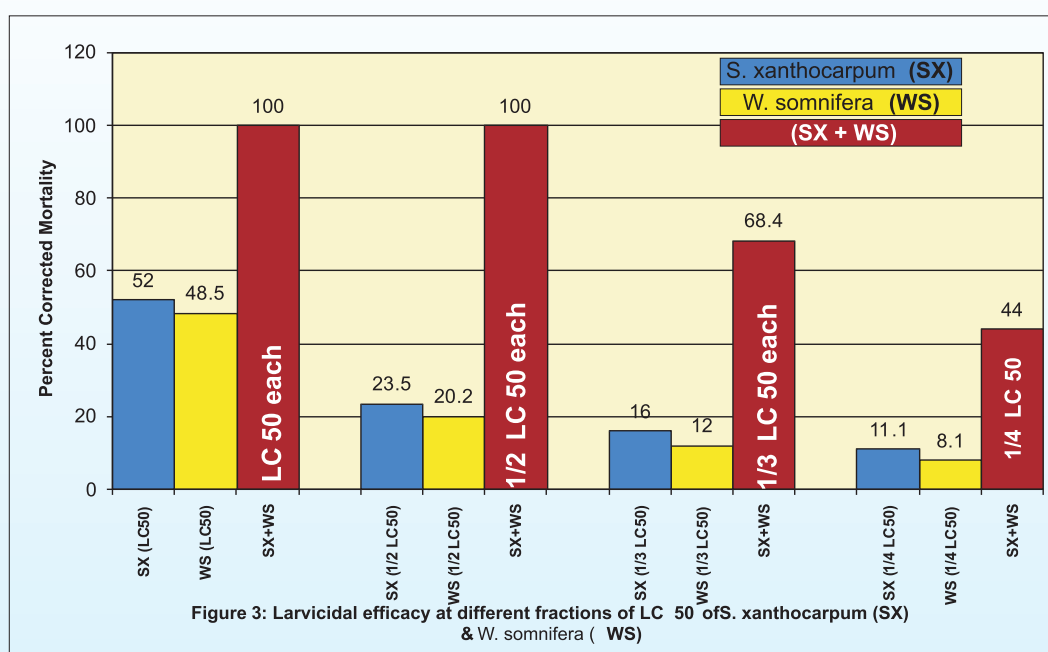
Table 6. Synergistic and antagonistic effects on larvae of *An. stephensi* when exposed to different proportions of methanol extracts (Fruits) of *S. xanthocarpum* (SX) and *W. somnifera* (WS)

Treatment Ratios	Exp. time	Regression Equation	Chi Sq. (χ^2)	LC ₅₀ $\pm$ SE Fiducial limits (mg ⁻¹)	CTC	SF	Type of Response	LC ₉₀ $\pm$ SE Fiducial limits (mg ⁻¹)	CTC	SF	Type of Response
SX	24	Y=1.65x+0.90	0.90	77.7 $\pm$ 1.1 (56.9-106.0)	-	-	-	465.6 $\pm$ 1.48 (216.5-1001.3)	-	-	-
	48	Y=1.96x+1.70	0.10	48.4 $\pm$ 1.16 (36.1-65.0)	-	-	-	218.2 $\pm$ 1.41 (110.7-430.0)	-	-	-
SX:WS (1:1)	24	Y=1.94x + 2.06	0.22	32.7 $\pm$ 1.16 (24.5-43.6)	237.6	2.38	Synergistic	149.4 $\pm$ 1.40 (77.6-287.8)	311.6	3.12	Synergistic
	48	Y=1.88x +2.44	0.98	22.9 $\pm$ 1.17 (16.8-31.4)	211.4	2.11	Synergistic	109.8 $\pm$ 1.43 (54.2-222.6)	198.7	1.99	Synergistic
SX:WS (1:2)	24	Y= 1.55x + 2.40	0.57	47.5 $\pm$ 1.20 (33.4 - 67.6)	163.6	1.64	Synergistic	316.8 $\pm$ 1.59 (128.1 - 783.57)	147.0	1.47	Synergistic
	48	Y =1.51x + 2.78	1.48	29.1 $\pm$ 1.20 (20.3 - 41.5)	166.3	1.66	Synergistic	203.2 $\pm$ 1.63 (77.9 - 529.8)	107.4	1.07	Synergistic
SX:WS (1:3)	24	Y = 1.47x + 2.34	0.25	63.8 $\pm$ 1.21 (44.2 -92.1)	121.8	1.22	Synergistic	471.7 $\pm$ 1.65 (175.8 - 1258.4)	99.7	0.99	Antagonistic
	48	Y =1.49x + 2.46	1.73	50.2 $\pm$ 1.21 (34.5 - 73.1)	96.4	0.96	Antagonistic	361.9 $\pm$ 1.74 (122.6 - 1068.1)	60.3	0.60	Antagonistic

SF - Synergistic Factor; CTC - Co-Toxicity Coefficient
All values of LC₅₀ and LC₉₀ are in mg⁻¹

Table 7. Efficacy of methanol extracts of fruit of *S. xanthocarpum* and *W. somnifera* tested at different fractions of LC_{50} each against *An. stephensi*

Treatment Combinations	No. Exp.	No. Dead after		% Experimental Mortality after		% Corrected Mortality after	
		24h	48h	24h	48h	24h	48h
Control	100	1	5	1.0	5.0	-	-
SX (LC_{50})	98	51	79	52.0	80.6	52.0	79.6
WS (LC_{50})	99	48	68	48.5	68.7	48.5	45.8
SX+WS (LC_{50} each)	100	100	100	100.0	100.0	100.0	100.0
Control	98	1	2	1.0	2.1	-	-
SX ($1/2 LC_{50}$)	98	23	48	23.5	49.0	23.5	49.0
WS ($1/2 LC_{50}$)	99	20	41	20.2	41.4	20.2	41.4
SX+WS ($1/2 LC_{50}$ each)	97	97	97	100.0	100.0	100.0	100.0
Control	100	0	0	0.0	0.0	-	-
SX ($1/3 LC_{50}$)	100	16	28	16.0	28.0	16.0	28.0
WS ($1/3 LC_{50}$)	100	12	22	12.0	22.0	12.0	22.0
SX+WS ($1/3 LC_{50}$ each)	98	67	80	68.4	81.6	68.4	81.6
Control	97	2	2	2.1	2.1	-	-
SX ($1/4 LC_{50}$)	99	11	19	11.1	19.2	11.1	19.2
WS ($1/4 LC_{50}$)	99	8	16	8.1	16.2	8.1	16.2
SX+WS ($1/4 LC_{50}$ each)	100	44	56	44.0	56.0	44.0	56.0



1.8 A study of treatment seeking behaviour for malaria and its management in children in desert part of Rajasthan, India-

Principal Investigator: Dr. S. P. Yadav, Scientist 'F'

Co-Investigators: Dr. A. K. dixit, Scientist 'E' and R. K. Kalundha, Technical Officer

Commencement: November, 2009

Duration: Three years

Status: Completed

Funding: Desert Medicine Research Centre (Intramural)

AIMS AND OBJECTIVES

1. To assess the ability of mothers in a rural area of the desert part of Rajasthan to identify fever in their children less than five years of age
2. To estimate the proportion of children who received antimalarial drugs as recommended by WHO
3. To know the treatment seeking behaviour for malaria and its management

RATIONALE

The global data reveal that nearly 10.5 million children die annually before attending their fifth birth day in the developing countries. Out of five top most diseases, malaria is one of them by which highest morbidity and mortality occurs in these countries. These children are unable to express the severity of suffering as well as effect of medicines. It is the mother who is first to recognize that child is ill by observing dullness or not able to do routine activities such as sucking the mother milk. She identifies feverish child by touching his body and it is her ability to take prompt action for treating the child. Therefore, this study was planned to know the current status with the above objectives in the desert part of Rajasthan.

PROGRESS

The desert part of Rajasthan comprises 12 districts. Jaisalmer is one of them which had highest API among all these districts and out of 18 PHCs within the district Ramgarh PHC had the similar status. Considering this factor as one of the most leading factor, the above PHC was selected for the study area. All the villages of PHC were divided into two categories i.e. Command Villages (CVs) and Non-Command villages (NCVs) (CVs are the villages where the water was used since last 20 years or more for the irrigation and drinking purposes through IGNP and NCVs where same water is yet to reach). Random sampling method was used for the selection of the study villages. 15 villages were selected from each category of the villages. A total of 900 households from both categories (450CVs +450NCVs) of villages were selected for the study, which had at least one child less than five years of age in the household. All the head of the households were contacted and explained the aims and objectives of the study and requested for the co-operation and

participation of the family members in the study. They consented verbally for the same. Simultaneously local authorities such as Saran, Patwari, village teacher, community heads were also informed about the study. Door to door survey was carried out to collect the data. For every child of the household the mother was asked 'is this child sick today? If the mother answered yes, she was asked to describe the symptoms and their duration and to name the disease. The mothers were also asked 'by which symptoms and signs do you identify malaria?' and 'How did you treat your child?' All the children had their axillary temperature taken for 5 minutes with a mercury thermometer and the arm held firmly. They all had a complete physical examination by a PHC staff, including palpation of the spleen and blood taken by finger prick for thick and thin blood smears.

Fever was used as a proxy of malaria. Out of 900 households 863 mothers were interviewed and they have given information for a total of 1049 children whose age was less than five years. Table 1 depicts socio-demographic characteristics of the respondents. Majority (41.6%) of the mothers belonged to 29-39 years of age group followed by 39.2% in the age group 20-29, and 13.5% >39 and 5.7% <20 years of age group respectively. About one third (35.2%) do not have any formal education but they have learnt how to read and write under the Government of India scheme 'Sarv Shiksha Abhiyan' and one fourth (22.5%) were still illiterate. Nearly nineteen percent (18.9%) have studied up to primary, 10.2% up to middle, 7.2% up to secondary and 5.9% up to senior secondary or its above level in the family. More than two third (69.3%) mothers were engaged in agriculture and its related work and animal husbandry along with the household work. Rest (42.7%) of the mother were engaged with other occupations such as service, labour, business etc. Majority (81.1%) of the mothers were Hindus and among the Hindus 59.9% were of General Caste, 25.0% Other Backward Caste and 15.1% Scheduled Caste/Scheduled Tribes.

Table 1. Socio- demographic characteristics of the study subjects

Characteristics	Number	Percentage
Age (Yrs)		
<20	49	5.7
20-29	338	39.2
29-39	359	41.6
>39	117	13.5
Education		
Illiterate	195	22.6
Literate	304	35.2
Primary	163	18.9
Middle	88	10.2
Secondary	62	7.2
Senior Secondary & above	51	5.9
Occupation		

Agriculture & its related work	413	47.9
Animal husbandry	185	21.4
Service	28	3.2
Business	31	3.6
Labour	166	19.2
Others	40	4.6
Religion		
Hindus	700	81.1
Non-Hindus	163	18.9
Caste among Hindus		
G C	419	59.9
OBC	175	25.0
SC/ST	106	15.1

GC= General Caste

OBC= Other Backward Caste

SC/ST= Schedule Caste/Schedule Tribe

Majority (71.3%) of the mothers have defined fever as *Tav* and malaria as *Hitav* (fever with shivering) or *Ekantrata* (fever on alternate days) in their local dialect *i.e.* Marwari. Further very few of them (2.1%) stated *Dhujani ri chhutan ro tav* (shaking body with fever) and *Hilnoritav* (moving body with fever). About thirteen percent (12.7%) mothers had misconceptions regarding causation of malaria. They stated poor nutrition, drinking dirty water, poor sanitation, unfavourable (hot and cold) environment, being in the rain, dirty surroundings as a cause of malaria. This data clearly indicate that misconceptions about the causation of the malaria were affecting the behavioural practices of the community for the preventive and curative measures of the disease.

Table 2. Perceptions and knowledge on the management of childhood malaria (n=863)

Variables	Results	No (%)	Association with age/educational level
Perceived symptoms	Fever	750 (86.9)	Mentioning fever alone or in combination with other symptoms was significantly associated with having primary education and above
	Enteric symptoms	547 (63.4)	
	Prostration/lethargy/inactivity	391 (45.3)	
	Restlessness/excessive cries	110 (12.7)	
	Coldness/shivering & sweating	126 (14.6)	
	Respiratory symptoms	57 (6.6)	
	Convulsions	44 (5.1)	

	Others (yellow urine, etc.)	19 (2.2)	
Knowledge on the risk of persistent high fever	Leads the child's condition to convulsions/worsening of	659 (76.4)	Mentioning convulsions/worsening of the child's condition was significantly associated with age ≥ 30 years, and having primary education or above.
	Others (leads to measles eruption, etc.)	204 (23.6)	
Home remedies for fever	Sponging/bath & antipyretics	802 (92.9)	Not significant
	Chloroquine alone	47 (5.4)	
	Chloroquine & aspirin/paracetamol	59 (6.8)	
Subsequent action after the home remedy	Go to a dispensary/health centre	724 (83.9)	Not significant
	Others (wait and see, etc.)	139 (16.1)	
Perceived importance of laboratory tests	Necessary and important	547 (63.4)	Significant association with primary or better education.
	Unimportant	316 (36.6)	
Perceived reasons for needing laboratory tests	To know the type of disease/ get correct/effective drug	589 (68.3)	Significant association with primary or better education
	Others	274 (31.7)	
Perceived reasons for treatment failure	Incorrect diagnosis & treatment, non compliance & ineffective drugs	488 (56.5)	Significant association with age ≥ 30 years and primary or better education
	Don't know	375 (43.5)	

Mothers' perception and knowledge on the management and outcome of treatment for childhood malaria fever are shown in Table 2. More than two third (86.9%) mothers considered fever as top most symptoms of the malaria and fever with loss of appetite, vomiting and diarrhoea as the important symptoms by 63.4%. Physiological and behavioural symptoms such as prostration/ lethargy/ inactivity (45.3%), coldness, shivering and sweating (14.6%), restlessness and excessive cries (12.7%) of malaria were considered during the study. Convulsions and respiratory symptoms were stated by the 5.5% and 6.6%. Mentioning fever alone or in combination with other symptoms were significantly associated with primary education and above. More than three fourth

(76.4%) mothers were very sure about the risk of convulsions and worsening of the child's condition day by day if, high fever persists for a period of seven or more days. About ninety three (92.9%) mothers used home remedies to treat their child. All the mothers stated that they assessed low, moderate and high category of fever based on their experience and knowledge by touching the body of child. For reducing the high temperature of the child they used wet cloth one by one by putting on forehead till the fever reduced from high to the low category. Few of them mentioned that feet and palms were rubbed with cloth from heel to toe.

Common practice was found among the studied mothers to treat febrile child herself at home. Treatment seeking practices of these mothers was based on their full confidence on health practices and beliefs that they were able to get rid off from the suffering within or before the time period of reaching health facility. Non-availability of public transport from the *Dhanies* to the health facilities was costly for them. Some mothers expressed non-availability of transport facility in and around their dhanies and very few mothers told that health personnel were not available at health facility at the time of urgency due to off time of the health staff. In some cases, mothers were not sure about the febrile child suffered from malaria and they consulted the elderly people in the community, if they agreed that the sickness of the child was malaria they administered antimalarial drugs. They used chloroquine, aspirin and paracetamol to treat the child. These medicines were purchased from the nearest medical shops. The antimalarial dosages were given based on the experience of the mothers or on advice of the elderly people of the community and conditions of the child.

Table 3. Distribution of children according to age and sex

Children age (Months)	Male		Female		Total	
	No.	%	No.	%	No.	%
<12	66	11.6	45	9.4	111	10.6
12-24	144	25.2	114	23.8	258	24.6
24-36	152	26.6	129	27.0	281	26.8
36-48	105	18.4	101	21.1	206	19.6
48-59	104	18.2	89	18.6	193	18.4
Total	571	100.0	478	100.0	1049	100.0

Table 3 depicts age and sex distribution of children. Majority (26.8%) of the children were in the age group of 24-36 months followed by 12-24 months i.e. 24.6%. Out of 1049 children 571 (54.6%) were male and 478 (45.4%) female. Comparison between fever reported by mothers and axillary temperature under the clinical examinations of the children less than five years of age is shown in table 4. This table depicts that according to the mothers,

out of 1049 children, a total of 311 (29.6%) children were sick. Further these sick children were divided into two categories by them based on their perception and knowledge, one as sick and feverish 245 (78.8%) and other as sick but not feverish 66 (21.2%).

Table 4. Comparison between fever reported by mothers and body temperature at clinical examination

Mother's perception	Children with temperature						
	Children No. (%)	<37.5 ^{0C}		37.5-38.4 ^{0C}		≥ 38.5 ^{0C}	
		No.	%	No.	%	No.	%
Sick and feverish	245 (100.0)	123	50.2	81	33.1	41	16.7
Sick but not feverish	66 (100.0)	31	47.0	23	34.9	12	18.1
Healthy	738 (100.0)	437	49.2	219	29.7	82	11.1
Total	1049 (100.0)	591	56.3	323	30.8	135	12.9

Same number of 458 children (43.7%) were clinically examined and were found with fever. A statistically significant difference was observed between the mothers' perception and clinical examination.

The mothers were informed that out of 311 children, which were either sick with fever or sick without fever, 135 (43.4%) had the malaria. The results of the clinical examination of the same children reveal that only 91 (29.3%) had +ve slides for the malarial parasites. An other important observation noted was that out of 176 children whose mothers stated that they were sick but not had malaria for 34 (19.3%) blood slides were found +ve for malarial parasites. Not only this, mothers of 738 children told that they were healthy but after clinical examinations 56 (7.6%) children were also +ve for malarial parasite (Table 5). These parameters of the comparison are showing significant difference between the perceptions of the mothers towards diagnosis of malaria and clinical examination.

Table 5. Comparison of the diagnosis of malaria by mothers with the presence of a temperature ≥ 37.5^{0C} and positive thick smear result

Mother's diagnosis	Children No. (%)	Temperature ≥ 37.5 ^{0C} and positive thick smear result			
		positive		negative	
		No.	%	No.	%
Positive for malaria	135 (100.0)	57	42.2	78	57.7
Sick but no malaria	176 (100.0)	34	19.3	142	80.7
Healthy	738 (100.0)	56	7.6	682	92.4
Total	1049 (100.0)	147	14.0	902	86.0

INFERENCES

This study clearly indicates that children less than five years of age suffered more and malarial infection was continuing in the community. Statistically significant difference was noticed between the mothers' perceptions, knowledge, diagnosis and clinical examinations. Majority of the mothers were using home remedy to treat their children whether sick with fever or sick without fever based on their knowledge, perception and diagnosis. As a result children were not getting appropriate treatment. Without great efforts to improve home care, it is unlikely that the morbidity and mortality due to malaria in young children will be reduced. Intervention is required to the mothers for correct diagnosis and appropriate treatment of malaria in time.

WORK REMAINS TO BE DONE

The project is completed. Data of the study may be useful to the researchers, planners, evaluators, administrators and malaria control programme.

1.9 Polymorphisms in Duffy blood group genes of *Plasmodium vivax* malaria patients and control population-

Principal Investigator: Dr. S. S. Mohanty, Scientist 'C'

Co-Investigators: Dr. Karam V. Singh, Scientist 'F', Dr. Ranjana Fotedar, Scientist. 'C' and Mr. Pankaj Kumar, Research Assistant

Commencement: September, 2010

Duration: Two Years

Status: Ongoing

Funding: Desert Medicine Research Centre (Intramural)

OBJECTIVES

1. The four phenotypic variants of Duffy blood group [Fy:(a+b+), Fy(a+b-), Fy(a-b+) and Fy(a-b-)] will be calculated within the *Plasmodium vivax* malaria patients and control population
2. Duffy blood group genotyping in *P. vivax* malaria patients and control population from the endemic areas of Rajasthan

PROGRESS

The present study was undertaken to know the polymorphisms of Duffy blood group genes of the malaria patients of the desert population of Rajasthan and its correlation with malaria infectivity. Both males and females were included in the study between the age 1 to 60 years. All the subjects were taken from different families. Fever cases reported to Pokaran CHC were screened for malaria positivity. Blood samples of all the subjects were screened for the presence of malaria parasite. For the diagnosis of malaria a thick and thin film was prepared in the same slide from the peripheral blood. Thin films of the slides were fixed with methanol before staining. The blood films were stained with Jaswant Singh Bhattacharjee (JSB) stain and microscopically examined under an oil-immersion lens. A thick smear was regarded as negative on initial examination if no parasites were seen in 100 high power fields. All the *P. vivax* and *P. falciparum* malaria cases were confirmed by the additional rapid malaria diagnostic test. Those found to be positive were included in the study. Blood samples of 2 ml were taken in vacutainer for the genomic and phenotypic study. A total of 49 fever cases were screened for malaria and out of them 26 were found to be malaria positive. The whole genomic DNA was isolated by the use of the Qiagen Mid prep kit. The extracted DNA was confirmed by running in 1% agarose gel. All the malaria cases were treated as per the national drug policy.

1.10 Mapping of mosquito breeding habitats and location of vertebrate hosts in North and Southern parts of Rajasthan state prone for emergence of JE virus using space technology (RS & GIS) -

Principal Investigator: Dr. P.C. Kanojia, Scientist 'E'

Co-Investigators: Dr. Rakesh Paliwal* and Dr. Himmat Singh, Research Assistant

*National Remote Sensing Centre, ISRO, Dept. of Space, Govt. of India, Jodhpur

Commencement: August, 2012

Duration: 3 years

Status: Ongoing

Funding agency: Indian Council of Medical Research - Vector Science Forum (Extramural)

OBJECTIVES

1. Mapping of mosquito larval habitats, particularly *Culex tritaeniorhynchus* and *Cx. vishnui* sub-group of mosquitoes and location of vertebrate hosts (pigs) which play major role in transmission of Japanese encephalitis (JE) virus using RS and GIS technologies
2. To identify JE prone areas with the help of RS and GIS in conjugation with eco-entomological studies in the proposed study sites
3. To develop early warning system of JE occurrence

PROGRESS

To initiate the study, field visits were made to three villages viz., Jetana (Udaipur district, Bichhiwara (Dungarpur district) and Shivpur (Banswara district) of Rajasthan state to collect immature stages of mosquitoes from different breeding habitats and adult specimens from various resting places. In addition to this, observations were made on types of vegetation being grown, types of water bodies situated and location of vertebrate hosts in the aforementioned areas. Data on geo-coordinates of selected study sites were recorded using GPS receiver.

Mosquitoes:

A total of 181 adults & 207 immature stages of mosquitoes belonging to 14 species were sampled from cattle sheds and different breeding habitats respectively in order to determine presence of JE vectors. As many as 7 JE vectors viz., *Cx. tritaeniorhynchus*, *Cx. bitaeniorhynchus*, *Cx. fuscocephala*, *Cx. quinquefasciatus*, *Cx. pseudovishnui*, *An. subpictus* and *Ma. uniformis* were collected.

Vegetation types:

Information was gathered on types of vegetation grown in Udaipur, Dungarpur & Banswara district during monsoon season. It was noted that paddy is being cultivated

in these areas with maximum coverage in Banswara (0.28 lakh hectares) followed by Dungarpur (0.19 lakh hectares) and Udaipur district (0.02 to 0.07 lakh hectares). Selected paddy fields and other perennial water bodies will be searched for presence of mosquito larvae, particularly JE vectors and simultaneously they will be mapped using space technology during the further course of study.

Location of vertebrate hosts:

During field visits, Udaipur, Dungarpur & Banswara district were searched for location of pig sties and roosting places of ardie birds which play important role in JE epidemiology. More data, on this aspect, will be collected during subsequent field visits.

Meteorological data:

Meteorology data pertaining to rainfall, number of rainy days, maximum/minimum temperature were recorded in respect of Udaipur, Dungarpur & Banswara district. These data will be utilised in analysing mosquitogenic conditions in aforementioned three study sites.

Recoding of Geo-coordinates of study sites:

Geo-coordinates of mosquito breeding habitats, including ponds, trenches, large water bodies (water reservoir) and the area which is likely to remain under paddy cultivation during monsoon season in Udaipur, Dungarpur & Banswara district were recorded. These data will help us in mapping down the breeding habitats of mosquitoes, including JE vectors using remote sensing technology during different months of the year.

1.10 Mapping of mosquito breeding habitats and location of vertebrate hosts in North and Southern parts of Rajasthan state prone for emergence of JE virus using space technology (RS & GIS) -

Principal Investigator: Dr. P.C. Kanojia, Scientist 'E'

Co-Investigators: Dr. Rakesh Paliwal* and Dr. Himmat Singh, Research Assistant

*National Remote Sensing Centre, ISRO, Dept. of Space, Govt. of India, Jodhpur

Commencement: August, 2012

Duration: 3 years

Status: Ongoing

Funding agency: Indian Council of Medical Research - Vector Science Forum (Extramural)

OBJECTIVES

1. Mapping of mosquito larval habitats, particularly *Culex tritaeniorhynchus* and *Cx. vishnui* sub-group of mosquitoes and location of vertebrate hosts (pigs) which play major role in transmission of Japanese encephalitis (JE) virus using RS and GIS technologies
2. To identify JE prone areas with the help of RS and GIS in conjugation with eco-entomological studies in the proposed study sites
3. To develop early warning system of JE occurrence

PROGRESS

To initiate the study, field visits were made to three villages viz., Jetana (Udaipur district, Bichhiwara (Dungarpur district) and Shivpur (Banswara district) of Rajasthan state to collect immature stages of mosquitoes from different breeding habitats and adult specimens from various resting places. In addition to this, observations were made on types of vegetation being grown, types of water bodies situated and location of vertebrate hosts in the aforementioned areas. Data on geo-coordinates of selected study sites were recorded using GPS receiver.

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Location of vertebrate hosts:

During field visits, Udaipur, Dungarpur & Banswara district were searched for location of pig sties and roosting places of ardie birds which play important role in JE epidemiology. More data, on this aspect, will be collected during subsequent field visits.

Meteorological data:

Meteorology data pertaining to rainfall, number of rainy days, maximum/minimum temperature were recorded in respect of Udaipur, Dungarpur & Banswara district. These data will be utilised in analysing mosquitogenic conditions in aforementioned three study sites.

Recoding of Geo-coordinates of study sites:

Geo-coordinates of mosquito breeding habitats, including ponds, trenches, large water bodies (water reservoir) and the area which is likely to remain under paddy cultivation during monsoon season in Udaipur, Dungarpur & Banswara district were recorded. These data will help us in mapping down the breeding habitats of mosquitoes, including JE vectors using remote sensing technology during different months of the year.

1.11 A Case Control study of opium addiction and recurrence of pulmonary tuberculosis -

Principal Investigator: Dr. Murli Lal Mathur, Scientist 'F'

Co-Investigator: Dr. N. K. Choudhary, District Tuberculosis Officer, Jodhpur

Commencement: March 1, 2013 **Duration:** 03 months **Status:** Completed

Funding: Desert Medicine Research Centre (Intramural)

OBJECTIVES

1. To find out if opium addiction increases risk of default in DOTS
2. To find out if opium addiction increases risk of recurrence of pulmonary tuberculosis

PROGRESS OF WORK

Addresses and details of male patients who were registered for DOTS therapy under RNTCP at tuberculosis unit, Balesar from 2007 to 2011, were noted from TB Registers and entered in excel. These were then sorted for village of residence.

Home visits to residences of these patients were started. Those found at home were contacted. Rapport was established with them and their written informed consent was obtained for participation in the study. They were then interviewed. History of treatment and past history of treatment was elicited. Whether they completed the DOTS therapy or defaulted. Whether they again developed TB and were again registered for DOTS therapy. How many courses of DOTS therapy they have taken and after how much lapse of time? Their history of personal habits was elicited carefully. It included their smoking status. Leading questions were also asked if they had ever consumed crude opium, if yes, did they use it daily, if yes for how long? How many tolas (or grams) of opium they used per month. Total duration of regular use of opium in their life time was elicited. Leading questions were also asked if they forget to use opium on some day, does it lead to development of specific withdrawal symptoms. Leading questions were also asked if they had ever worked in stone quarries or construction sites, if yes for how many years. Data will be entered in excel and will be analyzed.

Study Part-I:

- To find out if opium addiction increases risk of default in DOTS

Selection of cases: Cases were selected from list of cases registered for DOTS who defaulted. Only those rural males with age group of 20 years or more were selected.

Selection of Controls: Controls were rural male cases who completed DOTS successfully in Jodhpur district in age group of 20 years or more.

Criteria for matching of cases and controls: Age, Sex, Literacy, Alcoholism.

So far seven patients who had defaulted have been interviewed. In addition, nine patients who had completed treatment have also been interviewed:

Out of seven patients who had defaulted, matched controls have been selected for four. These controls had completed the treatment. One to one matching was carried out between cases and controls. Cases and controls were matched for age, literacy and habit of alcohol use.

Table 1. Analysis of matched cases and controls

Opium addiction	Cases who defaulted	Controls who did not default and completed treatment	Total
Opium addiction present	2	2	4
Opium Addiction not observed	2	2	4
Total	4	4	8

Odds Ratio = $ad/bc = (2 \times 2) / (2 \times 2) = 1.0$

Study Part-II:

- To find out if opium addiction increases risk of recurrence of pulmonary tuberculosis

Selection of cases: Patients who were registered for DOTS between 2007 and 2011 were followed by home visits. Those who gave history of developing recurrence were again registered for DOTS therapy as cases of recurrence.

Selection of Controls: Controls were selected from list of cases cured or treatment completed in Jodhpur district obtained from records of DTC, Jodhpur and have not still developed recurrence.

Matching of cases and controls: Cases of relapse were matched with controls. One to one matching was carried out. Each case was matched with its control for following criteria:

1. Age
2. Sex
3. Category of treatment received

4. Time after completion of treatment
5. Smoking status and
6. Habit of Alcohol use
7. Occupational history of working in stone quarries or construction sites

Houses of patients registered for DOTS under RNTCP between 2007 and 2011, in area of TB unit Balesar (District Jodhpur) are being visited. Those available at home were contacted. Their written informed consent was taken. They were then interviewed.

So far residences of 129 patients have been visited out of which 29 had died, 42 were not available and 61 gave consent to be interviewed. So far 61 patients who had completed treatment have been interviewed. Striking observation is that 31 out of 61 have given history of recurrence and 30 told that they have not developed recurrence so far. Those who had developed recurrence were taken as cases and those who did not develop recurrence were taken as controls.

One to one matching between cases and controls was carried out. So far only 12 such pairs of matched case and control have been made. It will be possible to make more pairs when some more patients will be interviewed. Then case control analysis of matched cases and controls will be carried out and Odds Ratio will be calculated. The study is continuing.

Table 2. Analysis of matched cases and controls

Opium addiction	Cases (who developed recurrence)	Controls (who did not develop recurrence)	Total
Opium addiction (Yes)	4	4	8
Opium addiction (No)	8	8	16
Total	12	12	24

$$\text{Odds Ratio} = ad/bc = (4 \times 8)/(4 \times 8) = 1.0$$

2.1 Prevalence of Diabetes mellitus and impaired glucose tolerance in the Raika and other communities with similar life style in Rajasthan-

Principal Investigator: Dr. Bela Shah

Co-Investigator: Dr. K. R. Haldiya, Scientist 'F'

Commencement: August, 2009 **Date of completion:** June 2013 **Status:** Ongoing

Funding Agency: Indian Council of Medical Research-Task Force (Extramural)

OBJECTIVES

1. To estimate the prevalence of diabetes mellitus and impaired glucose tolerance in Raika community of Rajasthan
2. To compare prevalence of diabetes mellitus and impaired glucose tolerance in other communities with similar life style
3. To find out the association of diabetes and impaired glucose tolerance with camel milk consumption, if any

PROGRESS

A total of 5042 households were covered from 135 villages of Jodhpur, Barmer, Ajmer and Pali districts of Rajasthan and 1110 individuals were interviewed and examined. Data of 5042 households and 10,000 raika and non-raika individuals were entered in the computer and have been analyzed.

Highlights of Socio Demographic Surveyed of Households of Raika and non raika Community: The total family members in selected households were 25,654, of which males and females were 13,147 and 12,507 respectively. Out of 25,654 individuals, 21,440 and 4,214 individuals were raika and non-raika respectively.

The average family size of households of Raika community was 5.3 ± 2.3 members (Range 1-19 members) while 5.9 ± 2.5 members in households of non-Raika community (Range 1-14 members). The average monthly income of households of Raika community was 7580.1 ± 4614.4 rupees which was lower than monthly income of the households of non-raika ($Rs.8954.2 \pm 6320.1$). The majority of the raika and non-raika households have land and their houses were kuccha and mixed type (Table-1).

Highlights of Socio Demographic and clinical profile of 8500 Raika individuals and 1750 non-raika individuals surveyed:

The average age of surveyed population was higher (39.5 ± 17.0 yrs) as compared to non-raika population (38.7 ± 17.5 yrs). Similarly, the males and females of raika population were higher than non-raika population.

The personal addiction of smoking and tobacco chewing in male raika individuals was 43.9 and 25.2% respectively while in male non-raika individuals it was 30.0 and 29.1% respectively. The majority of Raika individuals were vegetarian (98.1%) as compared to non-raika individuals (79.9%) and their staple diet was bajra and wheat. The majority of Raika individuals use Soya been oil for cooking vegetables (92.6%) and pure ghee on chapattis (99.1%) whereas non-raika individuals, it was 96.9 and 97.4% respectively. The majority of Raika drunk camel milk in their life time (70.1%) and in last 12 months was only 9.2% while non raika individuals, it was 10.2 and 0.9% respectively. The majority of individuals drunk camel milk occasionally. Only 24.9% of Raika individuals drunk 500 ml. or more camel milk at a time. (Table-2)

The average weight of non-raika population was higher (50.7 ± 10.3) than raika population (50.3 ± 9.5). The average height of raika population was higher (160.1 ± 8.6) than non-raika population (158.9 ± 8.6). The average body mass index of non-raika population was higher (20.0 ± 3.5) than raika population (19.6 ± 3.3). The average systolic blood pressure was similar in raika and non raika but diastolic blood pressure was higher in non-raika (73.1 ± 11.8) than raika population (71.3 ± 11.5). The average fasting blood sugar level was higher in non-raika (87.5 ± 18.3) than raika population (86.2 ± 20.6) (Table-3)

Table 1. Households characteristics according to community

HH Characteristics	Raika	Non Raika	Total
No. of HH	4318	724	5042
Total population of HH	21440	4214	25654
Males	10978	2185	13147
Females	10478	2029	12507
Average Family Size	5.3 ± 2.3	5.9 ± 2.5	5.4 ± 2.4
Average Family Income	7580.1 ± 4616.4	8954.2 ± 6320.1	7777.4 ± 4920.5
Land	66.5%	79.1%	68.3%
Type of House-Kuccha and Mixed	63.5%	69.8%	64.4%

Table 2. Personal habits according to sex and community

Characteristics	Raika			Non Raika		
	Male N=3500	Female N=5000	Total N=8500	Male N=750	Female N=1000	Total N=1750
Personal Habits	1535	34	1569	225	3	228
Smoking	(43.9)	(0.7)	(18.1)	(30.0)	(0.3)	(13.0)
Tobacco Chewing	879	149	1028	219	112	331
	(25.1)	(3.0)	(12.1)	(29.2)	(11.2)	(18.9)
Diet-vegetarian	3413	4923	8336	562	837	1399
	(97.5)	(98.5)	(98.1)	(74.9)	(83.7)	(79.9)
Oil Used-soyabeen	3217	4657	7874	725	970	1695
	(91.9)	(93.1)	(92.6)	(96.7)	(97.0)	(96.9)
Pure Ghee used	3467	4956	8423	735	970	1705
	(99.1)	(99.1)	(99.1)	(98.0)	(97.0)	(97.4)

Camel Milk drink	2907 (83.1)	3133 (62.7)	6040 (71.1)	125 (16.7)	54 (5.4)	179 (10.2)
Last 12 Months	493 (14.1)	293 (5.9)	786 (9.2)	10 (1.3)	5 (0.5)	15 (0.9)
Quantity ≥ 500 ml	1311 (37.5)	808 (16.2)	2119 (24.9)	19 (2.5)	6 (0.6)	25 (1.4)

The prevalence of diabetes in raika community (0.9%) is lower than non-raika community (1.5%) while prevalence of impaired fasting blood glucose level (1.9%) and impaired glucose tolerance test (0.8%) in raika was higher than non-raika community i.e. (1.1%) and (0.6%). A total of 20 (25.0%) known diabetics among 80 diagnosed diabetics in raika while 8(30.8%) known diabetics in 26 diagnosed diabetics in non-raika community (Table-4)

Table 3. Average of different characteristics according to sex and community

Characteristics	Raika			Non Raika		
	Male N=3500	Female N=5000	Total N=8500	Male N=750	Female N=1000	Total N=1750
Average Age (Yrs.)	40.9±16.9	38.6±17.1	39.5±17.0	39.6±17.5	38.1±17.4	38.7±17.5
Average Weight (Kg.)	53.4±9.9	48.1±8.6	50.3±9.5	54.7±10.8	47.7±8.8	50.7±10.3
Average Height (cm.)	167.2±6.7	155.2±6.1	160.1±8.6	165.7±6.7	153.8±5.9	158.9±8.6
Average BMI	19.1±3.2	20.0±3.4	19.6±3.3	19.8±3.5	20.2±3.5	20.0±3.5
Average SBP(mm.)	126.0±16.8	125.1±17.9	125.4±17.5	126.2±16.3	125.1±17.8	125.6±17.2
Average DBP(mm.)	71.5±11.6	71.1±11.4	71.3±11.5	72.9±12.0	73.3±11.7	73.1±11.8
Average Fasting Blood Sugar (mg/dl)	86.6±21.9	86.0±19.7	86.2±20.6	86.4±15.4	88.2±20.2	87.5±18.3

Table 4. Prevalence of diabetes according to sex and community

Characteristics	Raika			Non Raika		
	Male N=3500	Female N=5000	Total N=8500	Male N=750	Female N=1000	Total N=1750
Impaired Fasting Glucose	78 (2.2)	87 (1.7)	165 (1.9)	13 (1.7)	7 (0.7)	20 (1.1)
Impaired Glucose Tolerance test	37 (1.1)	28 (0.6)	65 (0.8)	7 (0.9)	3 (0.3)	10 (0.6)
Diabetes	42 (1.2)	38 (0.8)	80 (0.9)	10 (1.3)	16 (1.6)	26 (1.5)
Known Diabetics	12 (0.3)	8 (0.2)	20 (0.2)	3 (0.4)	5 (0.5)	8 (0.5)

Parentheses provide the percentages

3.1 Nutrition Monitoring Survey on NNMB pattern in Jodhpur district of Rajasthan –

Principal Investigator: *Dr. Madhu B. Singh, Scientist 'F'*

Co- investigators: *Dr. Ranjana Fotedar, Scientist 'C', Dr. M.S. Chalga, Technical Officer and Mr. Pankaj Kumar, Research Assistant*

Commencement: January, 2005

Duration: Long Term

Status: Ongoing

Funding: Desert Medicine Research Centre (Intramural)

OBJECTIVES

1. To develop continuous monitoring service to study the nutritional status, dietary habits, food availability and the effect of changing social and environmental factors on the health status of the population
2. Comparisons with other states data so as to assess the percentage of variations among the states

PROGRESS

Project prelude activities included working on sampling plan in detail. Similar sampling design and protocol was adopted for the Nutrition Monitoring type of survey carried out in Rajasthan, as it is being done in other states where NNMB is in operation. The sampling adopted here was two stage stratified random sampling method in which the villages in selected district formed the first stage units (FSU's) while in the village households (HH's) formed the second stage units. For the study purpose the district has been divided into different strata in rural areas as per the tehsils with agro-economic regions and based on the population size of the village i.e. <2000 and ≥2000 populated villages. A total of five clusters of four households each were selected from each village. Generally, the households in a village can be divided into natural "groups/areas" by geographical location such as streets/mohallas/areas. The SC/ST population often lives in a separate group/area in the villages. One cluster was selected from SC/ST group/area while the remaining 4 clusters were selected by random sampling procedure. In each cluster, by selecting a random start, 4 contiguous households were covered. For logistic reasons Jodhpur district was decided to be covered first and later on to expand horizontally in other districts of the state in the similar pattern, is planned

Now NNMB surveys have been initiated in Pali district. Sampling has been done on similar sample design and 30 villages have been selected from 9 tehsils of Pali district. Field work has been started and data has been collected from 560 household belonging to twenty eight villages of nine tehsils Sumerpur, Rohat, Bali, Pali, Desuri, Raipur, Sojat, Marwar and Jaitaran) of Pali district. All the selected households were examined for Socio-demographic and Socio- economic aspects. All the members in the household have been examined for nutritional deficiency signs, anthropometric measurements

(Height, weight, arm circumference and FFT), Dietary intake (24 hours recall method) and examination of nutritional morbidities in preceding 15 days. Dietary intakes of the individuals information were recorded in alternate houses i.e. 10 households from each village are covered. Project is going on.

Analysis of 315 households covering 1414 individuals has been done. Table 1 showed age and sex wise distribution of population (718 males and 696 females). Analysis revealed that 95.5 percent of population was Hindus. Nuclear families were significantly more (91.1 %) as compare to 2.2 % joint families (Tables 2). Table 3 revealed that illiteracy is significantly high in females (52.7 %) than males (34.8 %). Higher education is very low in this area i.e. 2.1 percent.

Table 1. Age and sex wise distribution of population covered

Age group	Males	%	Females	%	Total	%
0-5	166	23.1	140	20.1	306	21.6
6-9	70	9.7	81	11.6	151	10.7
10-14	78	10.9	78	11.2	156	11.0
15-17	40	5.6	36	5.2	76	5.4
18- 29	161	22.4	175	25.1	336	23.8
30 - 39	101	14.1	92	13.2	193	13.6
40-49	52	7.2	41	5.9	93	6.6
50 -59	25	3.5	26	3.7	51	3.6
>=60	25	3.5	27	3.9	52	3.7
Total	718	100	696	100	1414	100

Table 2. Distribution of households according to type of family

Type of family	N	%
Nuclear	287	91.1
Extended Nuclear	21	6.7
Joint	7	2.2
Total	315	100.0

Main morbidities observed in population were, fever (21.5%), acute respiratory infection (43.7%), and diarrhoea (2.8 %). Regarding nutritional deficiency signs, it is observed that discoloration of hair, a sign of protein calorie malnutrition was observed to be high i.e. 15.5 percent which was significantly higher in males than females (Table 4). Marasmus was observed only in females (0.2 %). Angular stomatitis and glossitis were 3.4 and 0.2 percent. Vitamin A deficiency i.e. Bitot spot were 0.2 percent. Dental caries (59.7%) and dental fluorosis (50.0%) observed high in this area. Koilonychia, a sign of anaemia, was observed only in females i.e. 0.2 percent.

Table 3. Distribution of population according to educational status

Educational status	Males	%	Female	%	Total	%
Illiterate	250	34.8	367	52.7	617	43.6
Read & Write	28	3.9	8	1.1	36	2.5
1-4 Standard	137	19.1	110	15.8	247	17.5
5-8 Standard	134	18.7	106	15.2	240	17.0
9-12 Standard	80	11.1	28	4.0	108	7.6
College	25	3.5	4	0.6	29	2.1
N. A.	64	8.9	73	10.5	137	9.7
Total	718	100.0	696	100.0	1414	100.0

Table 4. Distribution of population according to nutritional deficiency signs

Deficiency Signs	Males	%	Females	%	Total	%
	N=198		N=440		N=638	
N.A.D.	71	35.9	76	17.3	147	23.0
Hair Discoloured	49	24.7	50	11.4	99	15.5
Marasmus	0	0.0	1	0.2	1	0.2
Bitot Spot	0	0.0	1	0.2	1	0.2
Angular stomatitis	3	1.5	19	4.3	22	3.4
Cheilosis	7	3.5	51	11.6	58	9.1
Glossitis	0	0.0	1	0.2	1	0.2
Koilonychia	0	0.0	1	0.2	1	0.2
Gums-Spongy bleeding	18	9.1	146	33.2	164	25.7
Dental Caries	70	35.4	311	70.7	381	59.7
Dental Fluorosis	52	26.3	267	60.7	319	50.0
Thyroid gland palpable	0	0.0	1	0.2	1	0.2

The weights of pre-school children were expressed as percent of NCHS standards and categorized into different nutritional grades, based on Gomez classification. The overall prevalence of under nutrition was very high i.e. 80.9 percent. The overall prevalence of severe under nutrition was high i.e. 9.0 percent (Table 5).

The extent of different types of malnutrition viz. stunting (Height for age) and under nutrition (Weight for age) were computed by adopting standard deviation classification using NCHS as well as WHO standards. All the children with any of the above anthropometric measurement less than Median-2SD of NCHS values were considered as undernourished. Prevalence of under nutrition computed using Gomez classification and SD classification differ as the cut off values are different.

Table 5. Distribution of 1-5 years children according to Gomez distribution and type of house

Type of House	N	Nutritional Grades			
		Normal	Mild	Moderate	Severe
Kutchha	94	20	34	32	8
	100	21.3	36.2	34.0	8.5
Semi Pucca	41	5	17	14	5
	100	12.2	41.5	34.1	12.2
Pucca	43	9	16	15	3
	100	20.9	37.2	34.9	7.0
Pooled	178	34	67	61	16
	100	19.1	37.6	34.3	9.0

Underweight (Weight for age) in preschoolers observed was 65.2 %, higher than NFHS III (44.0 %). The proportion of severe underweight was high (34.3 %). Underweight were observed higher in males than females though statistically insignificant. Declining trend has been observed in underweight in comparison to DMRC Phase one (71.6%), but higher than Phase II (59.5%), Phase III (58.3 %), and Phase IV (49.8 %) and Phase V study (59.3%) in Jodhpur district. Underweight in preschoolers observed was 64.1 percent using WHO standards.

Stunting (Height for age) was 58.4 percent in preschoolers with the prevalence of severe stunting 37.0 %, which needs attention. It's lower than DMRC Phase I (71.6 %), DMRC Phase II (62.1 %), and DMRC Phase IV (59.5%) but higher than NFHS III (33.7 % - up to 3 years), NNMB (49.3 %), and DMRC Phase III (57.1%). Stunting computed by adopting standard deviation classification using WHO standards was 41.0 percent in preschoolers with the prevalence of severe stunting 39.8 percent. Wasting (Weight for Height) computed by adopting standard deviation classification using WHO standards was 35.4 percent in preschoolers with the prevalence of severe wasting 13.1 percent.

The distribution of adults according to BMI grades has been shown in Tables 8. At the aggregate level, 28.3 percent had normal BMI (20-25.0), while 46.6 percent had chronic energy deficiency (Fig. 4). Severe chronic energy deficiency was observed to be 16.5 percent.

Dietary Factors: Dietary intake from 280 households was collected. Trends revealed that stunting and underweight in preschoolers and chronic energy deficiency in adults was more in Pali district in comparison to Jodhpur district as covered earlier in DMRC Phase II and DMRC Phase III, DMRC Phase IV and DMRC Phase V studies (Fig. 5 & 6). Project is going on. Data will be collected from 40 households from 2 villages from Marwar tehsil of Pali district in first phase. Comparison of results of different Phases will be done in order to develop continuous monitoring service to study the nutritional status, dietary habits, food availability and the effect of changing social and environmental factors on the health status of the population and will continue year wise

Fig 1. SD classification for weight for Age in Preschoolers

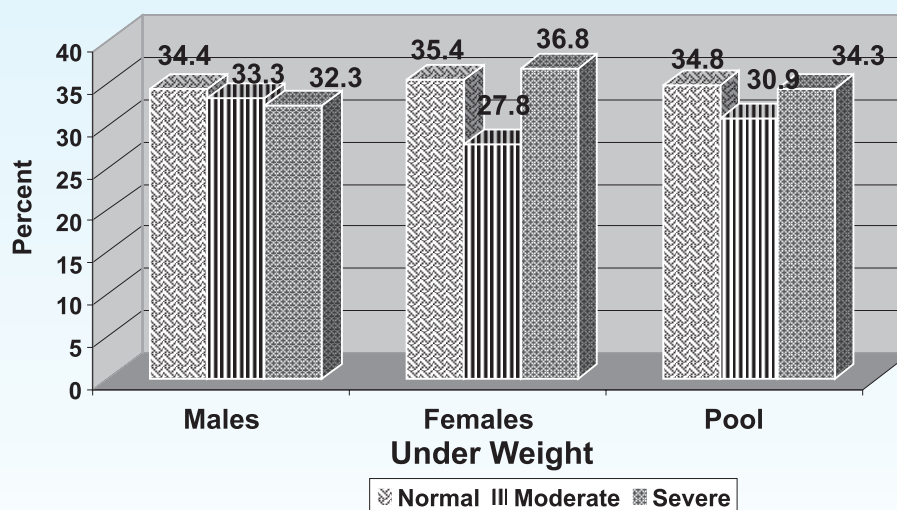


Fig 2. SD Classification for Height for Age in Preschoolers

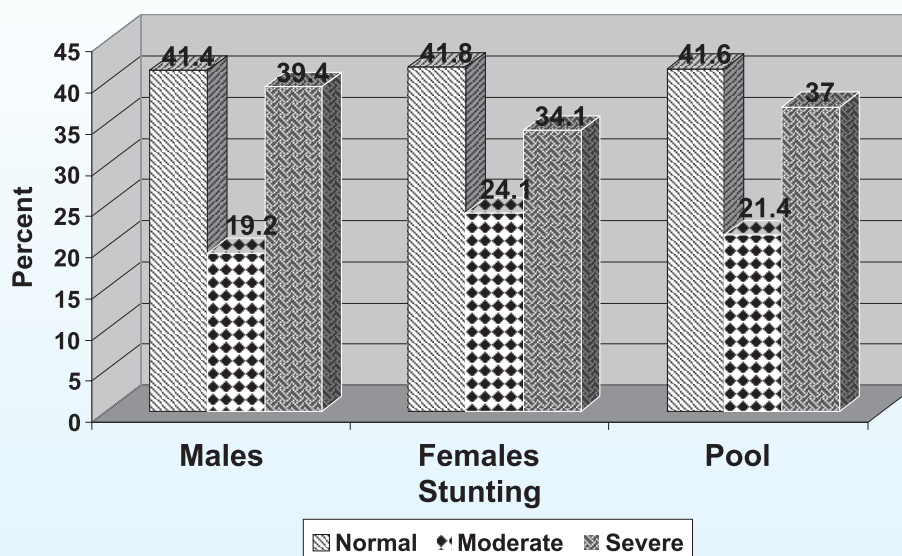


Fig 3. SD classification for Weight for Height in Preschoolers

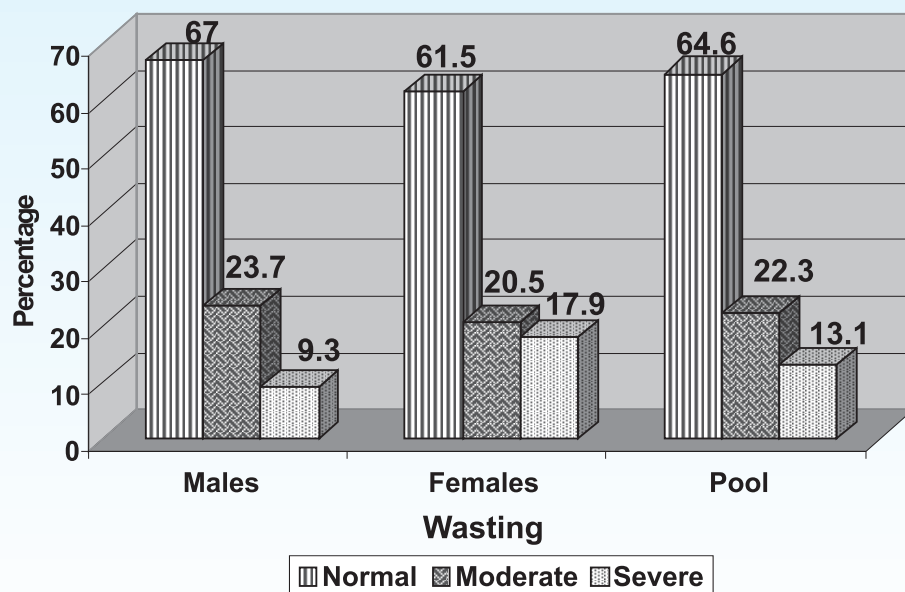


Table 8. Distribution of adults (≥ 18 years) according to BMI classification

Gender	Obese II ≥ 30	Obese I 25-30	Normal 20-25	Low wt Normal 18.5-20	CED I 17-18.5	CED II 16-17	CED III <16
Male (N=38)	0	2.6	34.2	18.4	15.8	10.5	18.4
Female (N=301)	0.3	5.0	27.6	20.3	22.9	7.6	16.3
Total (N=339)	0.3	4.7	28.3	20.1	22.1	8.0	16.5

Fig 4. Body Mass Index in adults

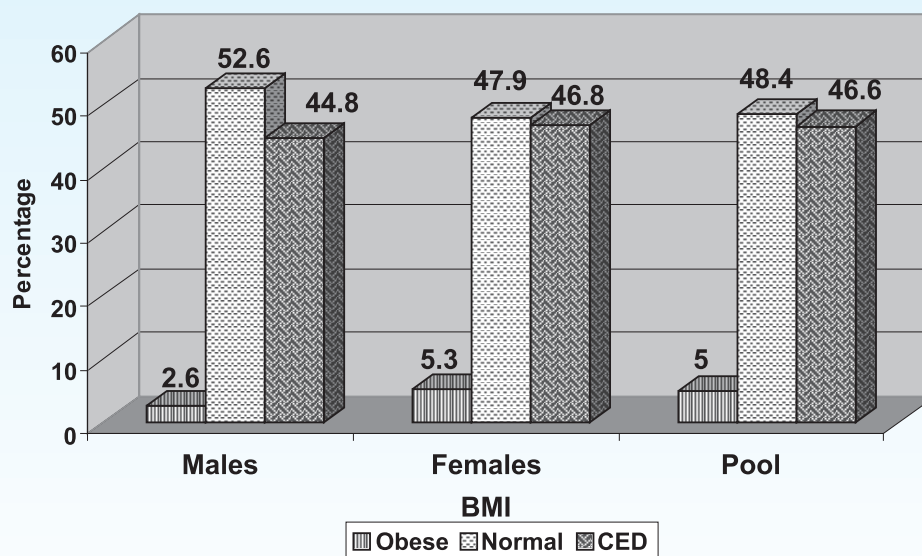


Fig. 5. Distribution of preschoolers according SD classification

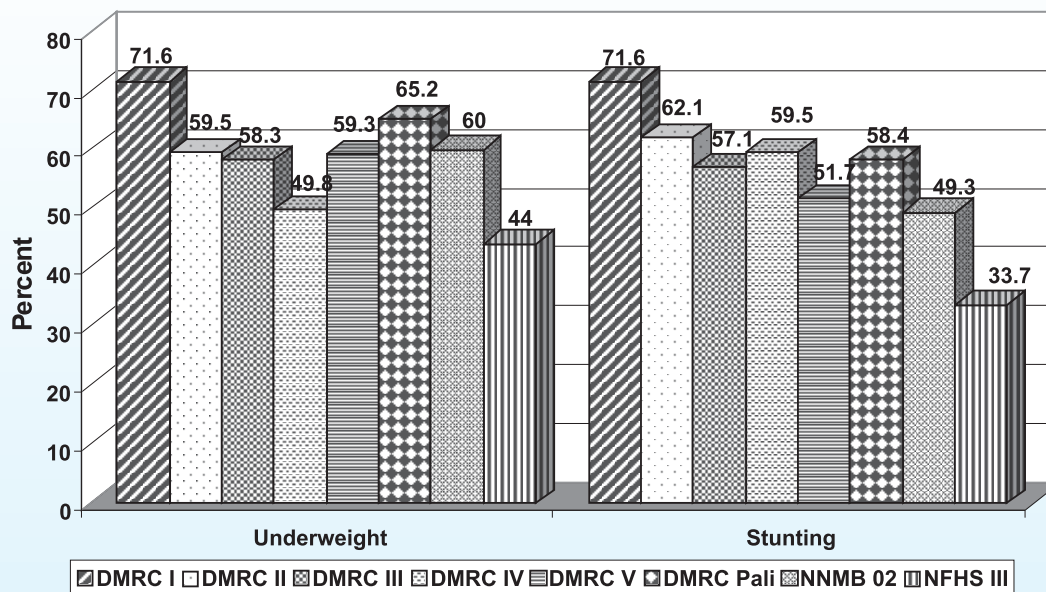
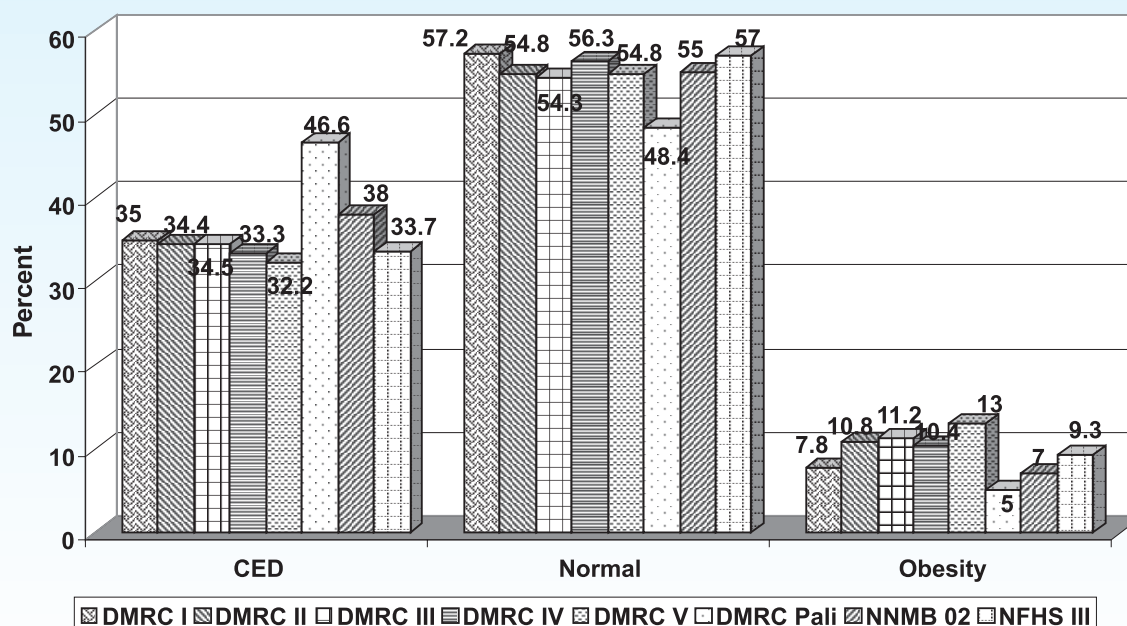


Fig.6. Distribution of adults by BMI Grades

IMPORTANT LEADS/ OUTCOMES

The results of the study carried out on representative segment of the population in desert areas as well as non-desert areas would provide information and useful guidelines for food policies and also to assess the impact of the nutritional programs currently in progress and for future planning in the state of Rajasthan.

3.2 Estimation of Zinc deficiency, under nutrition and morbidities especially ARI, Diarrhoea and Fever in school children of Rajasthan-

Principal Investigator: Dr. Madhu B. Singh, Scientist 'F'

Co-Investigators: Dr. Ranjana Fotedar, Scientist 'C', Dr. M.S. Chalga, Technical Officer and Mr. Pankaj Kumar, Research Assistant

Commencement: May, 2012

Duration: Two years

Status: Ongoing

Funding: Desert Medicine Research Centre (Intramural)

OBJECTIVES

1. Estimation of extent of Zinc deficiency in school children of Rajasthan
2. Estimate the prevalence of under nutrition and morbidities especially ARI, diarrhoea and Fever
3. To facilitate the health functionaries in the reduction of the Zinc deficiency disorders in school children of Rajasthan

PROGRESS

This project has been initiated recently. Sampling has been done in detail. According to WHO/UNICEF/ICCIDD, for school based survey, 30 cluster sampling approach has to be adopted keeping in view the operational feasibility. Recently DGHS (2005) has given new guidelines for sampling according to which sample size is calculated on the basis of prevalence of Zinc deficiency as 11 % (collectively cluster of under nutrition and micronutrient deficiencies caused about 6 million deaths in 2000) i.e.11% of the global total has been considered as the basis for sample size, level of confidence - 95 %, relative precision - 20 %. Using formula $(Z_a)^2 Q / (L^2) P$, sample size worked out to be 810 children (rounded off) from Jodhpur district or $810/30=27$ or 30 children (rounded off) per cluster. Keeping in view the operational feasibility, 15 clusters/schools have been adopted to cover 450 school children i.e. 30 children per cluster for the identification of the problem in this area. At first step, listing of all the government and private schools with children 6-11 years of age from both rural and urban areas were listed from district education office of Jodhpur. Secondly cumulative enrollment was determined. Finally schools were selected using PPS sampling technique as recommended by WHO. In the selected schools, children were selected randomly using Tippets random number table. Equal proportion of boys and girls and proportionate distribution of children from 6-11 years were covered from the selected schools.

All children have been interviewed/ examined for Socio-demographic profile, nutritional deficiency signs, morbidity for last 15 days and anthropometry (Height, Weight and FFT) using standard WHO techniques.

Blood samples have been collected for estimation of Zn deficiency along with anemia and urine samples for estimation of UIE in laboratory. Blood samples have been collected from school children, for that, collection tubes and the cryotubes (in which serum was stored) were labeled. Each child was given a code number that was also the same on the collection tube, cryotube and prescribed form. The blood collected in the tube was allowed to clot at room temperature in dark for 15 minutes. After, 15 minutes, tubes with clotted material were kept in the rotor of a battery operated centrifuge machine and spun @ 1,500 to 2,000 rpm for 5 minutes. After centrifuging the clotted material, serum that was separated from the clot was removed very carefully with the help of a micropipette and immediately transferred to cryotubes. Precaution was taken at the time of separating the serum from the clot, so that the tip of micropipette should not come in contact with the clot. For each sample, a new micropipette tip was used to avoid contamination. A casual urine sample was also collected. Zn deficiency was assessed by AOAC method using flame mode of Atomic Absorption Spectrophotometer. Anemia was assessed by Hemoglobin levels (Cyanmethaemoglobin technique), and was classified as per WHO classification. Iodine deficiency disorders was assessed by clinical examination of thyroid gland using the standard method as recommended by the joint WHO/ UNICEF/ICCIDD consultation. A casual urine sample was also collected for estimation of Urinary Iodine Excretion (UIE) levels to assess the Iodine nutriture status. UIE was determined by Ammonium Persulphate Digestion on Microplate method (APDM) using standard laboratory technique. UIE level less than 10 mcg/dl have been considered as indicator of iodine deficient nutriture.

Initially District Education Officer of Jodhpur was contacted regarding this project and letter of cooperation addressed to all the principles of primary and middle schools of Jodhpur district for providing the necessary help at their school level was obtained. List of all the high schools was collected from the same office and 15 clusters/schools have been selected by random sampling for study purpose. Rapport has been established with some of the selected school and started field work. Till now, data has been collected from 210 school children of 6 to 11 years belonging to seven schools of Jodhpur district. Standardization of the techniques has been done for estimation of Zn by Atomic Absorption Spectrophotometer by flame mode.

Preliminary analysis of 210 school children has been done. Table 1 showed age and sex wise distribution of population (121 males and 89 females). It was observed that 31.4 percent children belong to low income group and 98.8 percent of population was Hindus.

School children suffering from Acute Respiratory infection, GIT (Diarrhoea, stomach ache) and Fever were 3.8, 7.1 and 1.9 percent respectively. Regarding nutritional deficiency signs, it is observed that discoloration of hair, a sign of protein calorie malnutrition was observed to be high i.e. 20.5 percent. Angular stomatitis, Cheliosis and glossitis were 1.9, 0.9 and 0.5 percent. Vitamin A deficiency i.e. Bitot spot were 1.9 percent.

The extent of different types of malnutrition viz. stunting (Height for age), under nutrition (Weight for age), wasting (Weight for Height) were computed by adopting standard deviation classification using WHO standards. All the children with any of the above anthropometric measurement less than Median-2SD of WHO values were considered as undernourished.

Stunting (Height for age) was 18.6 percent in school age children with the prevalence of severe stunting 3.8%. Underweight (Weight for age) in school age children was observed 27.1 % and wasting 8.6%. Both stunting and wasting were observed higher in females than males though statistically insignificant (Fig 1-3).

Table 1. Age and sex wise distribution of school children covered

Age group	Males	%	Females	%	Total	%
6+	22	18.2	16	18.0	38	18.1
7+	17	14.0	26	29.2	43	20.5
8+	29	24.0	15	16.9	44	21.0
9+	14	11.6	11	12.3	25	11.9
10+	21	17.3	14	15.7	35	16.6
11+	18	14.9	7	7.9	25	11.9
Total	121	100	89	100	210	100

Fig 1. SD classification for Height for Age in School children

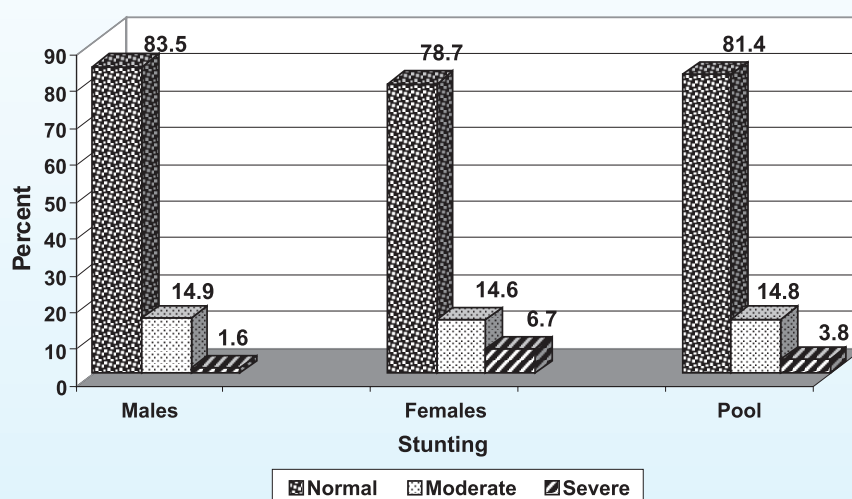
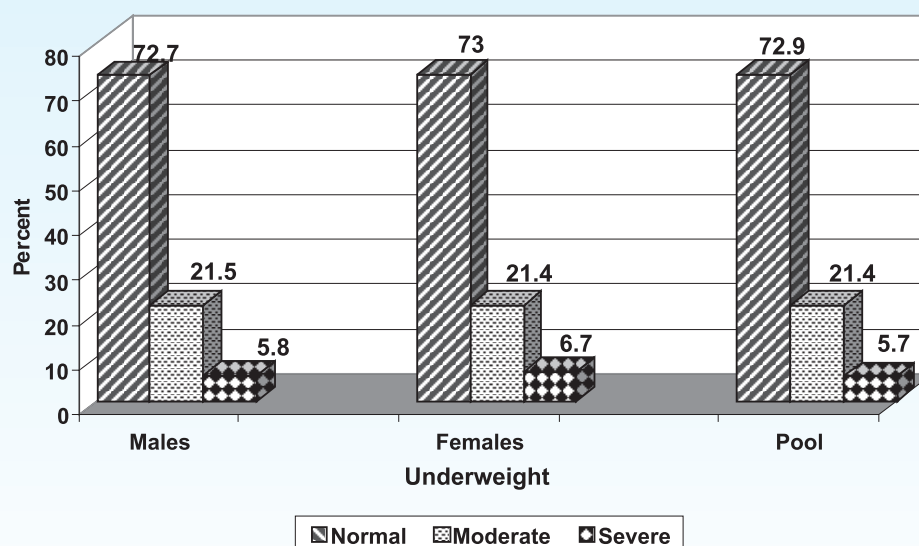
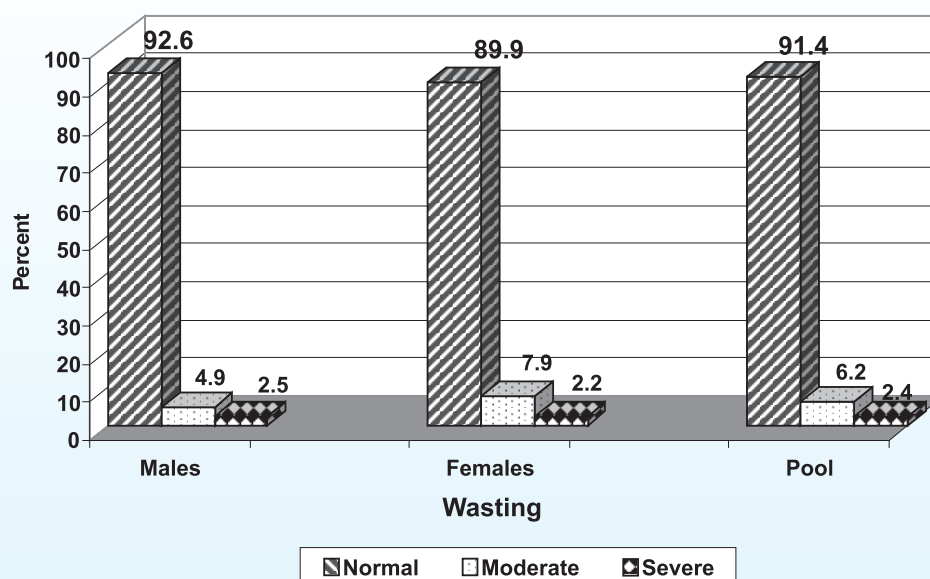


Fig 2. SD classification for Weight for Age in school children**Fig 3. SD classification for Weight for Height in school children**

Analysis of the serum zinc has been done for 196 school children. It was observed that 63.8% school children were normal and 36.2% children were deficient in serum zinc i.e. serum Zn level was less than 0.65 mg/l (Table 2). It was observed that serum zinc deficiency was more in early age group i.e. 50 percent in 6 to 7 years age group than 11 years age group. It was observed that serum zinc deficiency was 36 percent in boys whereas 36.6 percent in girls (Fig 4).

Table 2. Age wise distribution of school children according to Serum Zinc

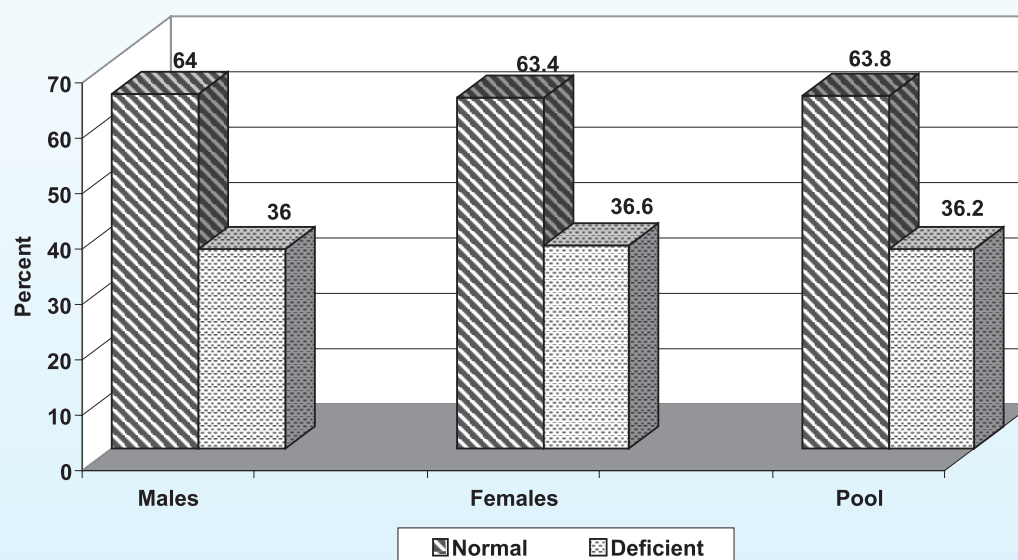
Age Years	Normal Serum Zn level ≥ 0.65 mg/l (less than 10 years)		Deficient Serum Zn level < 0.65 mg/l (less than 10 years)	
	N	%	N	%
6+ (N=37)	22	59.5	15	50.0
7+ (N=39)	22	56.4	17	50.0
8+ (N=41)	25	61.0	16	39.0
9+ (N=23)	13	56.5	10	43.5
10+ (N=32)	22	68.8	10	31.3
11+ (N=24)	21	87.5	3	12.5
Total (N=196)	125	63.8	71	36.2

Cut offs for 10 years and above: Ref. IZiNCG, 2004

Male- Normal: Serum Zn level ≥ 0.70 mg/l; Deficient: Serum Zn level < 0.70 mg/l

Female- Normal: Serum Zn level ≥ 0.66 mg/l; Deficient: Serum Zn level < 0.66 mg/l

Fig 4. Distribution of school children according to serum zinc level



Analysis of 153 school age children according to Hb estimation revealed that only 26.8 percent children were non anaemic ($\text{Hb} \geq 11.5 \text{ g/dl}$) where as 52.9 percent children belong to mild category (10-11.5 g/dl) and 20.3 percent to moderate category (7-10 g/dl) of anaemia.

Epidemiological criteria, as prescribed by WHO, for assessing iodine nutrition is based on median urinary iodine concentrations/ levels. Analysis of 108 urine samples has been done so far. Median urinary iodine value was 124.65 mcg/l. It was observed that proportion of school children less than 100 mg/L were 34.2 percent, whereas, proportion of school children less than 50 mg/L were 14.8 percent. Iodine content of 73 salt samples has been estimated using standard iodometric titration method. 53.4 percent children consumed salt adequately iodized i.e. 15 ppm or more. Overall high proportion of children (46.6%) consumed salt having inadequate iodine content i.e. less than 15 ppm. 4.1 percent children consumed salt having negligible iodine content (Less than 7 ppm). Project is ongoing. Data will be collected from 8 schools of Jodhpur district covering 240 school age children.

RESEARCH OUTCOME

This will be helpful in assessing extent of Zinc deficiency in Rajasthan. It will facilitate health functionaries in reduction of Zinc deficiency disorders in Rajasthan.

3.3 Nutritional status along with morbidity and mortality of under five children - a follow up study of earlier registered Neonates and Infants up to 5 years-

Principal Investigator: Dr. Ranjana Fotedar, Scientist 'C'

Co-nvestigators: Dr. Madhu B. Singh, Scientist 'F', Dr. M.S. Chalga, Technical Officer and Mr. Pankaj Kumar, Research Assistant

Commencement: September, 2010

Duration: 5 years

Status: Ongoing

Funding: Desert Medicine Research Centre (Intramural)

OBJECTIVES

1. To study profile of Health and Nutritional Status of earlier registered infants followed up to 5 years of age group by means of anthropometry, and clinical examination for nutritional deficiency signs along with feeding practices and their follow up to 5 years of age group at the interval of 6 months
2. To study the types of morbidity, mortality and their causes of earlier registered infants followed up to 5 years of age group
3. To study the time trend analysis of growth and nutrition of earlier registered infants followed up to 5 years of age group

RATIONALE

The childhood period, especially the second year of life, is notoriously fraught with risk. The young child is "transitional" as regards to diet, immunity to infections and psychological dependence. This is a period of rapid growth with high nutrient needs, particularly of protein for swiftly increasing muscle tissue. It is the time several meals a day are required and when foods should be easily masticable and digestible. It is at this time also that the non-immune child comes in contact with a succession, or more often accumulation, of bacterial, viral and parasitic infections. Lastly, it is often the occasion for the psychological trauma that occurs as a result of the sudden separation from the mother after a prolonged period of continuous intimate contact and permissive breast - feeding frequently caused by a further pregnancy.

Certain vitamin and mineral deficiency disease occur with varying frequency in under 5 children in different parts of the world, including, for example avitaminosis A, rickets and iron-deficiency anemia. The incidence varies greatly from place to place, depending upon the local dietary and social factors. Thus, rickets in sunnier parts of the world may be related to lack of exposure to available ultraviolet light due to overcrowding in urban dwellings, as in old style walled cities or in slums, or to a deliberate sheltering of young children from the sun for various cultural reasons, e.g. to prevent their acquiring a darker complexion or to escape the "evil eye". However, the principal forms of malnutrition

seen during this transitional period are those now termed “protein calorie malnutrition of early childhood” including kwashiorkor. However, time trend analysis of growth and nutrition is still lacking from desert part of Rajasthan where conditions are very harsh, demanding a great amount of work to be done. So are no data / information is available from this part of the country.

PROGRESS

This is continuation of the earlier project study entitled ‘Nutritional status along with morbidity and mortality of Neonates and Infants in Jodhpur district’. It is a follow up study and study will be continued on earlier registered 300 neonates & infants from 28 villages (Fig. 1 and Table 1) from Luni Panchayat Samiti of Jodhpur District which will be followed up to 5 year of age group at an interval of 6 months in the above mentioned project. The study will be continued on same 300 subjects as mentioned above.

In the last SAC meeting held on 20-22nd May 2010, SAC Chairman suggested to continue of earlier registered 300 neonates & infants in Jodhpur district.

Thus regular survey was initiated from September, 2010. The survey is going on. So far 300 infants have been completed at the interval of 6 months up to the age of 3 years. They were examined clinically for morbidity, mortality and nutritional deficiency signs, anthropometry (height, weight, arm circumference, chest circumference, head circumference and fat fold triceps following standard techniques of WHO) and feeding practices.

Fig. 1. Map of study villages

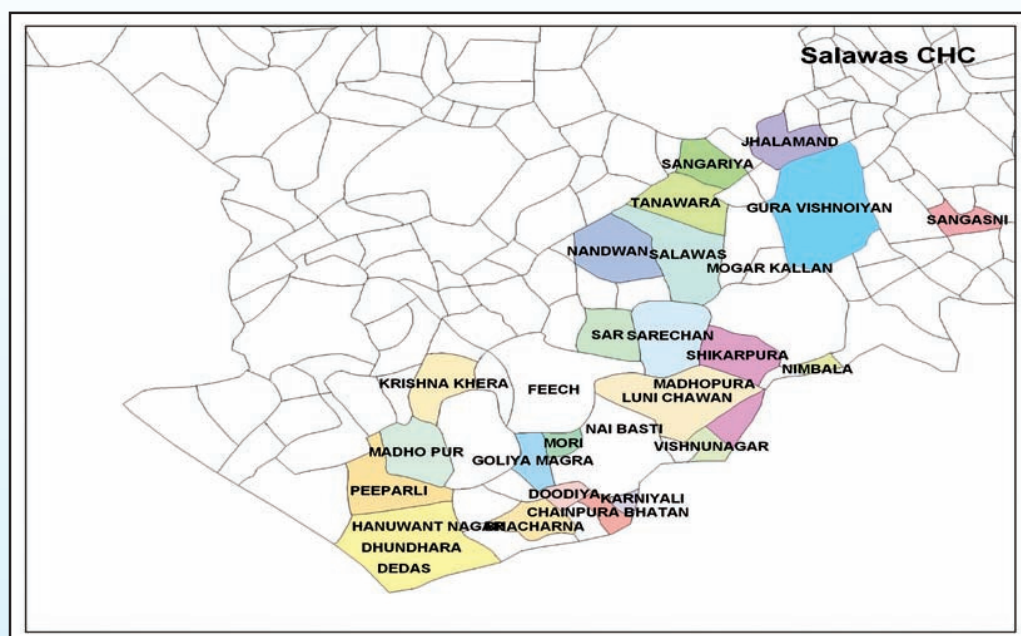


Table 1. List of Villages from Salawas CHC from where the earlier registered neonates and infants were covered

S. No.	Villages	S. No.	Villages
1	Tanavda	15	Shikarpura
2	Sangaria	16	Jhalamand
3	Salawas	17	Nimbla
4	Nandvan	18	Guda Bishnoi
5	Sarecha	19	Sangasani
6	Sar	20	Bacharna
7	Mogarkalla	21	Chainpura Bhatan
8	Feach	22	Karnayali
9	Dhundhara	23	Modi
10	Hanwant Nagar	24	Golia Magra
11	Piparli	25	Madopur
12	Dedas	26	Dudia
13	Luni	27	Nai Basti
14	Vishnu Nagar	28	Krishna Kheda

The analysis of the children belonging to one & half years age group (N= 275) revealed that that 40.7 percent were males and 59.3 percent were females (Table 2).

Table 2. Sex wise distribution of children of 18 months age group covered

Males		Females		Total
No.	Percent	No.	Percent	No.
112	40.7	163	59.3	275

The extent of different types of malnutrition viz stunting (Height for age), under weight (Weight for age) and wasting (Weight for Height) were computed by adopting standard deviation classification using WHO standards. All the children with any of the above anthropometric measurement less than Median-2SD of WHO values were considered as undernourished.

Under weight (Weight for age): Table 3 shows the distribution of children of 18 months age group according to under weight i.e. Weight for age using WHO standards. It was observed that 68.8% boys were normal whereas 31.2 percent were under weight. In case of girls, 36.8% were under weight. Overall 34.6% children were under weight and 6.5% belong to severe category.

Stunting (Height for age) was 63.6 % among children of 18 months age group with the prevalence of severe stunting 26.9%, which needs attention. Stunting was 67.1% in boys and 61.3% in girls (Table 4). Wasting (Weight for Height) computed by adopting standard deviation classification using WHO standards was 6.9 percent with the prevalence of severe wasting 1.4% (Table 5).

Table 3. Distribution of children of 18 months age group according to WHO classification for Weight for age

Sex	No.	Normal		Moderate <-2SD		Severe <-3SD	
		No.	Percent	No.	Percent	No.	Percent
Boys	112	77	68.8	28	25.0	7	6.2
Girls	163	103	63.2	49	30.1	11	6.7
Total	275	180	65.4	77	28.0	18	6.5

Table 4. Distribution of children of 18 months age group according to WHO classification for Height for age

Sex	No.	Normal		Moderate <-2SD		Severe <-3SD	
		No.	Percent	No.	Percent	No.	Percent
Boys	112	37	33.0	46	41.1	29	25.9
Girls	163	63	38.7	55	33.7	45	27.6
Total	275	100	36.4	101	36.7	74	26.9

Table 5. Distribution of children of 18 months age group according to WHO classification for Weight for Height

Sex	No.	Normal		Moderate <-2SD		Severe <-3SD	
		No.	Percent	No.	Percent	No.	Percent
Boys	112	103	92.0	7	6.3	2	1.7
Girls	163	153	93.9	8	4.9	2	1.2
Total	275	256	93.1	15	5.5	4	1.4

Main morbidities observed among children of 18 months age group were, acute respiratory infection (21.5%), fever (16.4%), GIT (15.3 %) and Ear disease 4.4 percent. Fever and ARI observed higher in males (20.5% & 22.3%) in comparison to females (13.5% & 20.9%) whereas GIT was higher in females (17.2%) than males (12.5%) (Table 6).

Table 6. Distribution of children of 18 months age group according to Morbidity

Morbidity	Males N=112		Females N=163		Total N=275	
	No	Percent	No	Percent	No	Percent
N.A.D.	61	54.5	90	55.2	124	45.1
Fever	23	20.5	22	13.5	45	16.4
GIT	14	12.5	28	17.2	42	15.3
ARI	25	22.3	34	20.9	59	21.5
Eye Disease	3	2.7	2	1.2	5	1.8
Ear Disease	3	2.7	9	5.5	12	4.4
Skin Infection	0	0.0	1	0.6	1	0.4

Regarding nutritional deficiency signs, it was observed that discoloration of hair, a sign of protein calorie malnutrition was observed to be high i.e. 57.1% and Marasmus was observed to be 0.4%. Dental caries was 1.5%. It was observed that 96.7% of children belong to category of 'Breast feeding & Top Milk consumption' up to the age of 18 months.

Out of 300 neonates registered earlier, 13 died up to the age of one year and 10 were not available/ not co-operated. The children followed up to the age of 18 months were 278, out of which 3 died (Table 7). Mortality between one year - one & half year age group was 10.8/1000 whereas Mortality up to one & half year age (0-18 months) was 53.3/1000 (Table 8).

Table 7. Distribution of neonates registered earlier & their follow up at the age of 18 months

No. of neonates followed up to age of one year in earlier completed project				
No. of neonates registered	Followed up Up to one year age group	Died up to one year	Non cooperation	Out of Station
300	277	13	4	6
No. of earlier registered neonates followed up to age of one & half year				
No. of neonates registered	Followed up to one & half year age group	Died up to one & half year age group	Non cooperation	Out of Station
300	278*	3	0	0

*One neonate registered came back to village

Table 8. Distribution of neonates according to mortalities rate (N=300)

Types	Age	No.	Per 1000's
Perinatal*	0-7 days	3	10.0/1000
Neonatal*	0-28 days	4	13.3/1000
Post-neonatal* (Infant)	29 days-12 months (1 year)	6	20.0/1000
Mortality between one year-one & half year age group	1 year- 1& half year	3	10.8/1000
Total Mortality up to one & half year age group	0-18 months	16	53.3/1000

*Earlier completed project on Neonate

WORK TO BE CARRIED OUT DURING 2013-14

The project is on going and the survey would be carried out to cover remaining earlier registered infants followed up to 5 years of age group children belonging to 28 villages of Salawas CHC of Jodhpur District. Each earlier registered child/ infant will be followed up every six month for clinical examination of nutritional deficiencies, morbidities, mortality, anthropometry, feeding practices and socio-cultural causes for mortality. Analysis and Data entry is under process.

EXPECTED OUTCOME

Results of the study will be helpful in formulation of simple interventional plan for under five children for reduction of under nutrition, morbidity and mortality reduce the health problems. The Research output of this project will also help in developing package for under 5 children, which will be useful to functionaries of state health department.

3.4 Setting up of new unit of National Nutritional Monitoring Bureau of Indian Council of Medical Research (ICMR)-

Principal Investigator (Jodhpur Unit): *Dr. G. S. Toteja, Scientist 'G' and Director*

Commencement: October, 2012

Duration: Long term

Status: Ongoing

Funding Agency: Indian Council of Medical Research (Extramural)

PROGRESS

National Nutrition Monitoring Bureau (NNMB) was established under the aegis of Indian Council of Medical Research in the year 1972, with the Central Reference Laboratory at the National Institute of Nutrition (NIN), Hyderabad and its ten units in the states of Kerla, Tamilnadu, Karnataka, Andhra Pradesh, Maharashtra, Gujrat, Madhya Pradesh, Orissa, West Bengal and Uttar Pradesh. In 2012, NNMB has been expanded to six more states namely Assam, Andaman & Nicobar Islands, Bihar, Rajasthan, Puducherry and New Delhi.

The new unit in Rajasthan is located at Centre and is currently working on "Assessment of Diet and Nutritional Status of Urban Population and Prevalence & Determinants of Hypertension and Diabetes among the Adults". The NNMB work would be carried out in 5 cities of Rajasthan, namely Jaipur, Jodhpur, Kota, Hanumangarh and Dholpur. The unit is supervised by the Director himself. There is one Scientist (medical), two Research Assistants, one Technician and one Attendant in this project. The survey work in Jodhpur has been completed except estimation of blood sugar level and cholesterol which is in progress.

4. LIST OF PAPERS PUBLISHED/ACCEPTED /PATENT/ CHAPTER IN BOOK DURING 2012-13

1. Agarwal, R., Virmani, D., Jaipal, M., Gupta, S., Sankar, M.J., Bhatia, S., Agarwal, A., Devgan, V., Deorari, A., Paul, V. K., and Toteja, G. S.: Investigators of the LBW Micronutrient Study Group. Poor zinc status in early infancy among both low and normal birth weight infants and their mothers in Delhi. *Neonatology*. 2013,**103**,54-59
2. Ansari, F. and Dixit, A. K.: Reproductive Health Care in Rajasthan: A situational Analysis. *American Journal of Mathematics and Mathematical Sciences*, 2012, **1**:1-7.
3. Bansal, S. K., Singh, Karam V., Sharma, Sapna and Sherwani, M.R.K.: Laboratory observations on the larvicidal efficacy of three plant species against mosquito vectors of malaria, dengue fever/dengue hemorrhagic fever (DF/DHF) and lymphatic filariasis in the semi-arid desert. *Journal of Environmental Biology*, 2012, **33**: 617-621.
4. Chalga, M. S. and Dixit, A. K.: Development of a system for monitoring disease occurrence by networking of different ICT technologies. *Proceeding 2nd International Conference on Open Source for Computer-Aided Translational Medicine*, 22-25th February at Institute of Microbial Technology, Chandigarh, 2012, 94-96.
5. Joshi, V., Angel, B., Purohit, A., Singh, H., Bohra, N. and Angel, A., Chauhan, R., Singhi, M. and Mathur, A.: Cases of pandemic influenza A (H1N1) 2009 in western Rajasthan, India. *Indian Journal of Medical Research*, 2012, **135**: 437-438.
6. Joshi, V., Angel, B., Chauhan, R., Bohra, N., Angel, A., Singhi, M., Mathur, A. and Solanki, A.: Immunity in Dengue Haemorrhagic Fever patients could be sensitized by Fresh blood transfusion. *Indian Journal of Medical Case Reports*. 2012, **1**, 13-14.
7. Longvah, T., Toteja, G. S. and Upadhyay, A.: Iodine content in bread, milk and the retention of inherent iodine in commonly used Indian recipes. *Food Chemistry*, 2013, **136**, 384-388.
8. Mohanty, S. S., Singh, Karam V. and Bansal, S. K.: Changes in glucose-6- phosphate dehydrogenase activity in Indian desert malaria vector *Anopheles stephensi* during aging. *Acta Tropica*, 2012, **123**: 132-135.
9. Siri, Nair, Singh, Madhu B., Sharma, S. K., Pandey, R. M. and Kapil, Umesh. A Multicentric study on Validation of Spot Testing Kit. *Indian Journal of Pediatrics*, 2012, **79**: 751-754.
10. Vasanthi, Siruguri, Kumar, Uday, Raghu, P., Rao, P., Vardhana, Vishnu, Sesikeran, M. B., Toteja, G. S., Gupta, Priyanka, Rao, Spriha, Satyanarayana, K., Katoch, V. M., Bharaj, T. S., Mangat, G. S., Sharma, Neerja, Sandhu, J. S., Bhargav, V. K. and Rani, Shobha.: Study on aflatoxin contamination in stored PAU 201 rice variety collected from Punjab region in India. *Indian Journal of Medical Research*, 2012 **136**: 89-97.
11. Yadav, S. P. and Kumar, P.: A study of knowledge, treatment seeking behaviour, and socio-economic impact of malaria in desert part of Rajasthan, India. *Southern African Journal of Epidemiology and Infection*, 2012, **27**: (In Press)

 Paper No. 1,7, and 10 are from the work done at ICMR/CNRT, New Delhi

5. WORKSHOPS / CONFERENCES / SYMPOSIA / SCIENTIFIC MEETINGS ATTENDED BY SCIENTISTS DURING 2012-13.

Dr. Karam V. Singh, Scientist 'F'

- Meeting of Tribal Health Forum on January 12, 2013 held at ICMR Hqrs. to review the quarterly progress of the projects under the Chairmanship of DG, ICMR.
- Symposium on 'Development in Desert: Challenges and Solutions' organized jointly by Jodhpur branch of Vigyan Parishad Prayag and Mahila Adhayan Kendra, JNVU, Jodhpur on February 8, 2013 and delivered an invited talk on '*Natural Insecticides: their mode of action and future prospects in vector control*'.

Dr. Madhu B. Singh, Scientist 'F'

- 'International Conference on Food and Nutrition Technology for Public Health Care' and presented a paper on '*Effect of cooking practices on retention of Iron, Zinc, Phytate and Polyphenols with particular reference to Pearl millet consumption pattern in Nagaur, a desert district of Rajasthan*' and adjudged first for best paper award for oral presentation on 4th - 5th May, 2012 at JNU, Delhi.
- 'Workshop on Quality Control of Medicines' and delivered an invited talk as Resource person & Chief Guest on '*Micronutrient Deficiency Disorders, their estimation & Quality Control*' on August, 9 & 10, 2012 at Faculty of Pharmaceutical Science, Jodhpur National University, Jodhpur
- Delivered an invited talk on '*Malnutrition in Girls*' in Rajbhasha workshop on '*Hamari Beti Hamari Shan*' organized by CAZRI, at Jodhpur on 10th July, 2012.
- First meeting of working group one on '*Operational and translation research to improve the contents and delivery of existing micronutrient supplementation or other programmes based on existing knowledge*' and 'presented the DMRC work on MDDS and related issues on MDDs for operation and Translation Research' on 17th September, 2012 at ICMR campus II, TAI building New Delhi.
- 'Delivered a talk on '*Malnutrition in desert areas*' in workshop on '*Women in Old Age and Economic Aspects*' organized by Gramin Vikas Vigyan Samiti (GRAVIS) at Jodhpur on 3rd October, 2012.
- Technical Advisory Committee meeting of POC project organized by Gramin Vikas Vigyan Samiti (GRAVIS) at Jodhpur on 20th November, 2012.
- Delivered an invited talk on '*Nutrition and Health*' in a Camp of National Service Scheme (NSS) organized by NSS unit, KN college, JNVU University, Jodhpur on 9th November, 2012.

Dr. A. K. Dixit, Scientist 'E'

- 'All India Rajbhasha Conference' organized by Bharitya Rajbhasha Parishad, Ujjain, from October 31st to November 2nd, 2012.

Dr. Manju Singhi, Scientist 'C'

- Acquired training to learn the documentation system required for the accreditation process of NABL from September 9-10, 2012 at CNRT Nutrition division of ICMR (ICMR), New Delhi, 2012
- 3 days training course ISO 15189 for Medical Laboratories- particular requirements for quality and competence organized by National Bureau of Standard 6-9th November 2012 at NOIDA
- 33rd Annual conference of Rajasthan state branch of IADVAL -2012 on 23rd December, 2012 at Jaipur.

Dr. S. S. Mohanty, Scientist 'C'

- Acquired training to learn the documentation system required for the accreditation process of NABL from September 9-10, 2012 at CNRT Nutrition division of ICMR (ICMR), New Delhi, 2012
- 3 days training course ISO 15189 for Medical Laboratories- particular requirements for quality and competence organized by National Bureau of Standard 6-9th November 2012 at NOIDA
- Acquired training on '*virus inoculation and amplification in embryonated egg, sequencing of H1N1 virus and Haemagglutination test*' at Avian Influenza Laboratory, National Institute of Virology, Pune from 29th to 31st of January 2013.
- Workshop on "*New Born Screening for Hemoglobinopathies and Micro-Mapping of G6PD deficiency*" organized by National Institute of Immunohaematology on 19th and 20th of March, 2013.

Dr. Manjeet Singh Chalga, 'TO'

- Workshop on "Basics of Bioinformatics and its application" organized by Biomedical Informatics Centre, NIRRH, Mumbai from 5th-7th June, 2012 at Mumbai.
- Workshop on "Systems Biology" organized by Indian Institute of Information Technology (IIIT), Allahabad, from 16th to 17th March 2013.

Dr. P. K. Dam, 'TO'

- Participated in a Meeting of '*Tribal Health Research Forum*' held at RMRC Bhubaneswar and presented DMRC's work on Tribal Health aspect and work of Nutrition Division, ICMR from 8-9th August 2012.

6. AWARDS/HONORS BY SCIENTISTS DURING 2012-13.

Dr. Madhu B. Singh, Scientist 'F'

- *Best paper award: Adjudged First for best paper award* for oral presentation on paper on 'Effect of cooking practices on retention of Iron, Zinc, Phytate and Polyphenols with particular reference to Pearl millet consumption pattern in Nagaur, a desert district of Rajasthan' in 'International Conference on Food and Nutrition Technology for Public Health Care' on 4th and 5th May, 2012 at JNU, Delhi
- Selected as one of the members in working group 1 on '*Operational & translation research to improve the contents and delivery of existing micronutrient supplementation or other programs based on existing knowledge*' under '*Interagency group on Micro-nutrients*' constituted by Division of Nutrition, ICMR, New Delhi

7. SCIENTIFIC ADVISORY COMMITTEE

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8. ETHICS COMMITTEE

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Director

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1. Dr. K. R. Haldiya, Scientist - F
2. Dr. Vinod Joshi, Scientist - F
3. Dr. M. L. Mathur, Scientist - F
4. Dr. Karam V. Singh, Scientist - F
5. Dr. S. K. Bansal, Scientist - F
6. Dr. S. P. Yadav, Scientist - F
7. Dr. Madhu B. Singh, Scientist - F
8. Dr. Raman Sachdev, Scientist - E
9. Dr. A. K. Dixit, Scientist - E
10. Dr. Phoolchand Kanojia, Scientist - E
11. Dr. Ranjana Fotedar, Scientist - C
12. Dr. Manju Singhi, Scientist - C
13. Dr. P. K. Anand, Scientist - C
14. Dr. S. S. Mohanty, Scientist - C

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2. Sh. Raj Kumar Kalundha
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1. Sh. Anil Purohit
2. Sh. Pankaj Kumar

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2. Sh. Pooran Mal Meena
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4. Sh. Santosh Kumar Dhawal
5. Sh. Rohit Prasad Joshi
6. Sh. Rajendra Kumar Chouhan
7. Sh. Trilok Kumar

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1. Sh. Anil Kumar

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1. Sh. Narender Bajaj

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3. Sh. Rajinder Singh

STENOGRAPHER

1. Sh. Joginder Singh, Stenographer- Grade-II

JUNIOR HINDI TRANSLATOR

1. Smt Kanchan Bala

UPPER DIVISION CLERK

1. Sh. Shamshad Ali
2. Sh. M.C. Pargi
3. Smt. Chandra Kala
4. Sh. Yash Pal Singh

LOWER DIVISION CLERK

1. Sh. Ram Nivas
2. Sh. Nand Kishore
3. Sh. Manohar Singh Seervi

DRIVERS

1. Sh. Raghu Nath Singh
2. Sh. Mohd. Gaffar
3. Sh. Ishwar Khetani
4. Sh. Manohar Singh
5. Sh. Rana Ram
6. Sh. Naveen Kumar

LABORATORY ATTENDANTS /ATTENDANTS / PEONS

1. Sh. Banwari Lal, Laboratory Attendant
2. Sh. Sridhar Bohra, Laboratory Attendant
3. Sh. Lal Chand Bandra, Laboratory Attendant
4. Sh. Raghu Nath Singh Bisht, Animal Attendant
5. Sh. Babu Lal Bunker, Animal Attendant
6. Sh. Mahaveer Prasad, Animal Attendant
7. Sh. Satya Prakash, Animal Attendant
8. Sh. Mahesh Chand Sharma, Attendant
9. Sh. Jodha Ram, Attendant
10. Smt Laxmi Kanta, Attendant
11. Sh. Khushal Singh, Attendant
12. Sh. Ram Lal, Peon
13. Sh. Ladhu Ram, Peon

14. Smt. Sua Devi, Sweeper
15. Smt. Soni Devi, Peon (Under Suspension)

TRAINEE

1. Sh. Bhawar Manohar Singh

PROJECT STAFF

1. *National Nutrition Monitoring Bureau, Jodhpur Unit-PI: Dr. G.S. Toteja, Scientist 'G' & Director*
 1. Dr. Rameshwar Lal, Scientist - B
 2. Ms. Kanchan Jaiswal, Research Assistant, (Nutrition)
 3. Mr. Nikhil Batra, Research Assistant (Sociology)
 4. Bharat Jawa, Field Attendant
2. *Prevalence of Diabetes mellitus and impaired Glucose tolerance in the Raika & other communities with similar life style in Rajasthan-PI: Dr. BELA Shah, Scientist 'G' & Director -in-Charge*
 1. Mr. Rishi Pal, Field Investigator
 2. Ms. Suman Rathor, Lab Technician
 3. Mr. Ravinder, Lab Technician
3. *Translational Research for development and testing of ICMR-DMRC module of Dengue control for Rajasthan-PI: Dr. Vinod Joshi, Scientist 'F'*
 1. Mrs Annett angel, Field Investigator (Ph.D Student)
 2. Mr. Ajay Vyas, Field Investigator
 3. Mr. Gajender Singh, Field Investigator
 4. Mr. Narender Vyas, Field Investigator
 5. Mr. Chandan Singh, Field Attendant
4. *Mapping of risk of dengue hemorrhagic fever (DHF) through dengue virus typing in Aedes mosquitoes in different settings of Rajasthan-PI: Dr. Vinod Joshi, Scientist 'F'*
 1. Dr. Bennet Angel, Scientist B
 2. Mr. Dhan Raj Choudhary, Insect Collector
5. *Development of molecular markers for the identification of Biological forms of Anopheles stephensi prevalent in arid areas of Rajasthan--PI: Dr. Karam V. Singh, Scientist 'F'*
 1. Mr. Robin Marwal, Junior Research Fellow (up to June, 2012)
 2. Ms. Anusha Mishra, Research Assistant
6. *Surveillance of pyrethroid resistance in important malaria vectors of western Rajasthan and studies on genetic and biochemical mechanisms of pyrethroid resistance in An. stephensi-PI: Dr. Karam V. Singh, Scientist 'F'*
 1. Mr. Robin Marwal, Research Assistant
 2. Mr. Prashant, Insect Collector
 3. Mr. Deva Ram, Insect Collector

7. *Mapping of mosquito breeding habitats and location of vertebrate hosts in North and Southern parts of Rajasthan state prone for emergence of JE virus using space technology (RS & GIS)*

-PI: Dr. P.C. Kanojia, Scientist 'E'

1. Mr. Manohar Singh, Junior Research Fellow
2. Mr. Bhanwar Lal, Insect Collector
3. Mr. Hari Singh, Insect Collector

10 केंद्र में राजभाषा को प्रोत्साहन

1. केन्द्र की वैबसाइट का द्विभाषी रूप में शुभारंभ



दिनांक 15 अक्टूबर, 2012 को स्वास्थ्य एवं अनुसंधान विभाग के सचिव एवं भारतीय आयुर्विज्ञान अनुसंधान परिषद्, नई दिल्ली के महानिदेशक डॉ. विश्व मोहन कटोच ने विडियो कॉन्फ्रेंसिंग के माध्यम से केन्द्र की द्विभाषी वैबसाइट का शुभारंभ किया। पहले यह वैबसाइट अंग्रेजी में ही उपलब्ध थी। इस अवसर पर परिषद् की ओर से डॉ. बेला शाह, वैज्ञानिक 'जी'

एवं प्रभागाध्यक्ष, असंचारी रोग प्रभाग व श्री अरुण बरोका, वरिष्ठ उपमहानिदेशक (प्रशासन) तथा केन्द्र की ओर से निदेशक के साथ केन्द्र के वैज्ञानिक, अधिकारी एवं कर्मचारी भी मौजूद थे।

2. संसदीय राजभाषा समिति द्वारा केन्द्र में राजभाषा कार्यान्वयन का निरीक्षण



सरकार के किसी भी संस्थान में संसदीय समिति द्वारा निरीक्षण विशेष महत्वपूर्ण है क्योंकि उस संस्थान में राजभाषा के अनुप्रयोग की समीक्षा के लिए यह सर्वोच्च समिति है। हमारे केन्द्र में दिनांक 17 अक्टूबर, 2012 को इस समिति द्वारा दूसरी बार समीक्षा की गई। इससे पहले दिनांक 2 फरवरी, 2006 को संसदीय राजभाषा समिति की तीसरी उपसमिति ने केन्द्र में यह निरीक्षण किया था। समिति ने केन्द्र में राजभाषा अनुपालन की स्थिति पर संतोष व्यक्त करते हुए, उत्कृष्टता हेतु सुझाव दिये।

3. त्रैमासिक पत्रिका

केन्द्र की द्विभाषी त्रैमासिक पत्रिका "चेतना" केन्द्र की अनुसंधानिक एवं अन्य गतिविधियों को जन-साधारण तक सम्प्रेषित करने का सशक्त माध्यम है। साथ ही पत्रिका में प्रकाशित स्वास्थ्य संबंधी लेखों से पाठक और भी लाभान्वित हो रहे हैं। वर्ष 2002 से यह पत्रिका अनवरत रूप से प्रकाशित की जा रही है। केन्द्र की वैज्ञानिक सलाहकार समिति की संस्तुति पर अप्रैल-जून, 2007 के अंक से यह पत्रिका द्विभाषी रूप से प्रकाशित की जा रही है प्रकाशित अंकों की एक झलक:



4. युनिकोड प्रशिक्षण



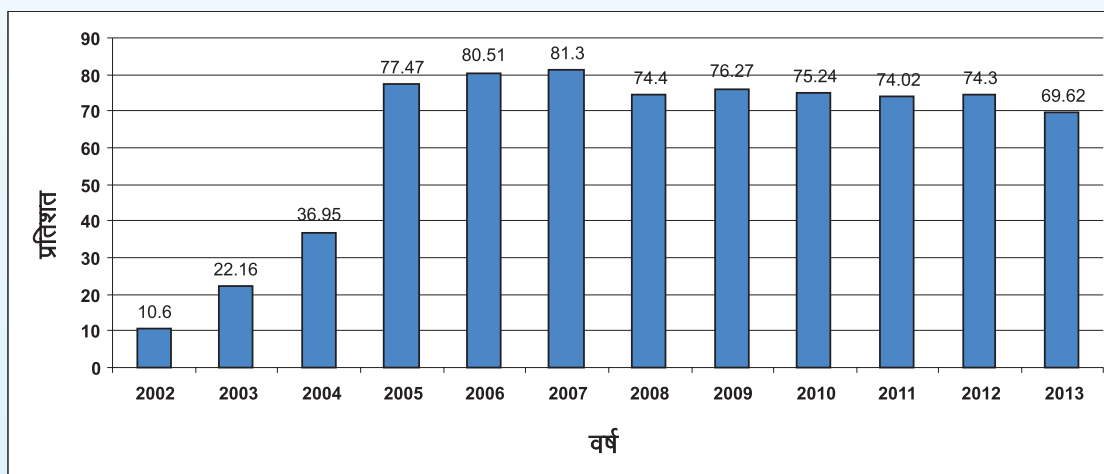
केन्द्र में कार्यरत सभी वैज्ञानिकों, तकनीकी, प्रशासन एवं लेखा अनुभाग के सभी अधिकारियों एवं कर्मचारियों को हिन्दी में कम्प्यूटर पर कार्य करने के लिए दिनांक 20 फरवरी, 2013 से विभिन्न बैचों में युनिकोड का प्रशिक्षण दिया जा रहा है। केन्द्र के तकनीकी अधिकारी एवं आई.टी. प्रोफेशनल डॉ. मंजीत सिंह सभी प्रतिभागियों को युनिकोड पर विस्तृत जानकारी प्रदान कर रहे हैं। साथ



ही, नराकास के विशेष अनुरोध पर, केन्द्र में नराकास के सदस्य कार्यालयों के प्रतिभागियों के लिए भी दिनांक 14 अक्टूबर तथा 2 व 3 नवम्बर, 2011 को तीन अर्द्धदिवसीय युनिकोड प्रशिक्षण कार्यक्रमों का आयोजन किया गया। दिनांक 11 मार्च, 2013 को केन्द्रीय ऊन विकास बोर्ड, जोधपुर तथा दिनांक 13 दिसम्बर, 2012 को राष्ट्रीय प्रतिदर्श सर्वेक्षण संगठन, जोधपुर में भी उनके विशेष अनुरोध पर, इन संस्थानों में इस प्रशिक्षण का आयोजन किया गया जिससे केन्द्र को युनिकोड प्रशिक्षणदाता के रूप में पहचान मिल रही है।

5. हिंदी में पत्राचार

केन्द्र में अनुसंधान कार्यों पर ध्यान देने के साथ-साथ राजभाषा हिंदी के अनुपालन पर भी विशेष ध्यान दिया जाता है। राजभाषा नीति के अनुसार हिंदी में पत्राचार के लक्ष्यों को प्राप्त करना एक प्रमुख बिन्दु है। पिछले कुछ वित्तीय वर्षों के अंत में प्राप्त प्रतिशतता की झलक निम्न दंड तालिका में दर्शाई गई है :



6. राजभाषा कार्यान्वयन समिति की बैठकें

केन्द्र में नियमित रूप से प्रति तिमाही राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन किया जाता है। वर्ष 2012-13 में दिनांक 29 जून, 2012; 27 अगस्त, 2012; 19 दिसम्बर, 2012 एवं 19 मार्च, 2013 को इस समिति की बैठकों का आयोजन हुआ। इन बैठकों में राजभाषा विभाग, गृह मंत्रालय, भारत सरकार द्वारा प्रतिवर्ष जारी वार्षिक कार्यक्रमों के लक्ष्यों की प्राप्ति तथा राजभाषा संबंधी विभिन्न नियमों के अनुपालन की समीक्षा की जाती है।



7. हिंदी सप्ताह



गत वर्षों की भांति इस वर्ष में केंद्र में दिनांक 10 से 14 सितम्बर 2012 तक हिंदी सप्ताह का आयोजन किया गया। सप्ताह के दौरान विभिन्न प्रतियोगिताओं यथा वैज्ञानिक विषय पर निबंध लेखन एवं वाद-विवाद, हिन्दी में व्याख्यान, कार्यालय शब्दावली ज्ञान, सुलेख, प्रश्न मंच प्रतियोगिता आदि का आयोजन किया गया।

8. हिन्दी कार्यशालाएं



कर्मचारियों की राजभाषा हिन्दी में काम करने की झिझक को दूर करने तथा राजभाषा के प्रयोग को बढ़ाने के लिए केन्द्र में हिन्दी कार्यशालाओं का आयोजन किया जाता है। इस वर्ष दिनांक 14 सितम्बर एवं 18 अक्टूबर, 2012 को हिन्दी कार्यशालाओं का आयोजन किया गया जिनमें क्रमशः के. एन. महाविद्यालय, जोधपुर की निदेशिका डॉ. सुधि राजीव तथा स्वास्थ्य एवं परिवार कल्याण मंत्रालय भारत सरकार के उपनिदेशक (राजभाषा) श्री मनोज आबूसरिया को आमंत्रित किया गया। डॉ. सुधि राजीव ने नए युग में उपजती मशीनी भाषा के प्रयोग पर चिन्ता जताई वहीं श्री आबूसरिया ने संसदीय राजभाषा समिति के निरीक्षण से संबंधित कई महत्वपूर्ण जानकारियां दीं। उन्होंने अनुवाद कार्य को तरल बनाने के लिए जी-मेल की सहायक भूमिका पर प्रकाश डाला।

9. राजभाषा के प्रति केंद्र के वैज्ञानिकों का योगदान

राजभाषा संगोष्ठी में केन्द्र की प्रतिभागिता



केन्द्र की वैज्ञानिक 'इ' डॉ. मधुबाला सिंह ने केन्द्रीय शुष्क क्षेत्र अनुसंधान संस्थान, जोधपुर में दिनांक 19 जुलाई, 2012 को "हमारी बेटी – हमारी शान" विषय पर आयोजित राजभाषा वैज्ञानिक संगोष्ठी में "बालिकाओं में कुपोषण" विषय पर हिन्दी में स्लाइड प्रदर्शन के माध्यम से अपना शोध कार्य प्रस्तुत किया। डॉ. मधुबाला ने समाज में महिलाओं के अनुपात, शिक्षा एवं उनके आहार में भेदभाव पर चिन्ता प्रकट की।

कार्यशाला में केन्द्र के वैज्ञानिक की प्रतिभागिता



केन्द्र की वैज्ञानिक 'इ' डॉ. मधुबाला सिंह को दिनांक 9 व 10 अगस्त, 2012 को जोधपुर राष्ट्रीय विश्वविद्यालय, जोधपुर के "औषधीय गुणवत्ता नियंत्रण" कार्यशाला में मुख्य अतिथि एवं स्रोत वक्ता के रूप में आमंत्रित किया गया। इस कार्यशाला में डॉ. मधुबाला ने "सूक्ष्मपोषक अल्पता विकार, उनका ऑकलन एवं गुणवत्ता नियंत्रण" पर हिन्दी में स्लाइड प्रदर्शन के माध्यम से व्याख्यान दिया।

केन्द्र के वैज्ञानिक की संगोष्ठी में प्रतिभागिता



केंद्र के वैज्ञानिक 'एफ' डॉ. कर्मवीर सिंह ने दिनांक 08 फरवरी, 2013 को महिला अध्ययन केंद्र, जयनारायण व्यास विश्वविद्यालय, जोधपुर एवं विज्ञान परिषद् प्रयाग, जोधपुर शाखा के संयुक्त तत्वाधान में आयोजित विज्ञान संगोष्ठी 'मरुस्थल में विकास – चुनौतियाँ एवं समाधान' पर भाग लिया एवं संगोष्ठी के तकनीकी सत्र में 'प्राकृतिक कीटनाशक : कार्य प्रणाली एवं भविष्य में वेक्टर नियंत्रण में संभावनाएं' विषय पर हिन्दी में स्लाइडों के माध्यम से व्याख्यान दिया।

राजभाषा सम्मेलन में केन्द्र की प्रतिभागिता



केंद्र के वैज्ञानिक 'इ' एवं राजभाषा प्रभारी डॉ. आशुतोष कुमार दीक्षित ने, भारतीय राजभाषा परिषद्, नई दिल्ली द्वारा दिनांक 31 अक्टूबर व 1-2 नवम्बर, 2012 को उज्जैन (मध्यप्रदेश) में आयोजित अखिल भारतीय राजभाषा सम्मेलन में केन्द्र की ओर से प्रतिभागिता की। सम्मेलन में कई महत्वपूर्ण विषयों पर परिचर्चा की गई जिसमें संनिहित थे – सरकारी कामकाज में राजभाषा के प्रति सजगता और विज्ञान एवं तकनीकी क्षेत्र में भाषा की गतिशीलता।

11. DMRC ACTIVITIES 2012-13 : A PICTORIAL VIEW



Training to State Health Workers on Dengue prevention and control, 10th May, 2012



Dr. G.S. Toteja, Director, DMRC Addressing faculty & staff on Independence Day, 15th August, 2012



Meeting of Scientific Review Group on Medical Sociology & Biostatistics, 12th & 13th September, 2012



Meeting of Scientific Review Group on Nutrition, Biochemistry and Non-Communicable Diseases, 11th & 12th October, 2012



Formal Handing- Taking-Over of the newly constructed Building of the Centre, 12th October, 2012



Vigilance Awareness Week observed from 29th October to 3rd November, 2012



Meeting of Scientific Review Group on Infectious & Vector Borne Diseases, 5th & 6th November, 2012



Jodhpur Conclave – 2nd December, 2012



Chief Guest Dr. Rajpurohit, VC, JNV University, Jodhpur lighting the lamp



Dr. G. S. Toteja, Director of the Centre delivering welcome address



Chairpersons of the Session on NCDs and Nutrition



Experts and audience - A view



Experts and audience - A view



Chairpersons of Session on Communicable Diseases



Pre- Scientific Advisory Committee Meeting, 3rd December, 2012



Pre- Scientific Advisory Committee Meeting, 3rd December, 2012



Meeting of Ethics Committee of the Centre, 15th December, 2012



Visit of Dr. B. R. Bhandari, Honourable Chancellor, Jain Bharti Sansthan University, 24th January, 2013



Republic Day Celebration, 26th January, 2013



Equipment Specification Committee Meeting,
1st February, 2013



Participation of DMRC in 4th Vision Rajasthan-
2013 Exhibition, 4th to 6th February, 2013



Lectures on Laboratory Accreditation by Prof. Venkatesh Thuppil, Principal Adviser, Quality Council of India, Bangalore and Mr. Ashok Kumar Garg, Accreditation Officer, NABL, New Delhi, 5th February, 2013





Brain Storming Session of Stake Holders for Identification of Research Areas for Collaboration
13th February, 2013



Training of DMRC Technicians - 27th February, 2013



Dr. G. S. Toteja, Director of the Centre planting tree in the campus - 20th March, 2013

12. IMPLEMENTATION OF RESERVATION POLICY FOR SCHEDULED CASTES

Regarding the implementation of reservation policy for scheduled castes in the Centre, the following measures were taken during the report period.

- i. In each selection committee for the recruitment of the staff directions for including the scheduled castes representative have been followed.
- ii. In both, direct recruitment as well as in promotions the policy of Government was followed in toto and the relaxations/concessions were given to Scheduled Castes employees as per the guidelines.
- iii. The Centre has no back log of Scheduled Castes on vacancy based roster in all categories prior to 01. 01.1997 and the short fall as switching over to post based roster vide DOP&T O.M. No. 36012/12/96-Estt.(Res) dated 02.07.1997. During the report period no vacancy has been filled-up under Special Recruitment Drive.
- iv. For ensuring the implementation of the government policies for Scheduled Castes and review and monitoring of rules of reservation and service safeguard provided to the Scheduled Castes under the constitution, the Centre has 'SC-ST Cell', a designated 'Liaison Officer' and a 'Grievances Committee'. However, during the report period no complaint of any type was received by the above statutory bodies/officials.

Besides above, the information on the implementation of the government policies for Scheduled Castes monitoring of rules of reservation and service safeguard provided to the Scheduled Castes under the constitution, has been provided by the Centre as and when required for monitoring or review purposed.
