Studies on Other Vector Borne Diseases

Strategy for Integrated Control of Malaria and Dengue Vectors in Northern Gujarat

A research project was undertaken in collaboration with Government of Gujarat with funding support of WHO India office during 2002–04 in six districts Kutchh, Banaskatha, Surendranagar, Ahmedabad and Anand of north-central Gujarat. The objectives of project were to develop an integrated strategy for control of malaria and dengue vectors in combination and synergistically, to suggest a rapid response mechanism to prevent disease outbreaks, to assess training needs of the vector control programme, and to conduct training and inter-sectoral workshops at different levels. Since the early 1990s, dengue has emerged as a serious public health problem throughout Gujarat. Expansion of the provision of piped water supply in the rural areas has led to the progression of *Aedes* mosquitoes from urban areas to the villages. In the absence of drugs and vaccine against dengue, at present vector control alone remains the sole intervention method against the disease. The Vector ecology, bionomics and insecticide susceptibility, dengue situation analysis, health system response to epidemics, staff and training need assessment were studied. Inter-sectoral workshops and trainings of the staff were organized. Evidence-based Integrated Vector Control Strategy comprising of following major components was proposed: (i) assessment of the risk of disease and stratification; (ii) MIS and epidemic containment; (iii) dengue surveillance, diagnosis and treatment; (iv) strengthening of laboratory and diagnostic services; (v) drug supplies and drug resistance monitoring; (vi) dengue surveillance, diagnosis and treatment; (vii) vector management; (viii) biological control; (ix) environmental management; (x) advocacy (IEC); (xi) inter-sectoral cooperation; (xii) legislation; (xiii) capacity strengthening; and (xiv) monitoring and evaluation.

A national workshop was organized by the National Institute of Malaria Research to disseminate outcomes of the studies conducted at three study sites in India, viz. in Gujarat, Madhya Pradesh and Karnataka states.

Dengue Vector Surveys

Vector prevalence surveys and situation analysis were carried out in different states as part of technical support to the National Vector Borne Disease Control Programme (NVBDCP).

Gujarat

On the request of the Joint Director, NVBDCP, Gandhinagar, NIMR teams had carried out dengue vector surveys in the peri-urban areas of Ahmedabad (2004) and Bhavanagar districts (2005) where suspected cases of dengue were reported. High house, container and breteau indices were recorded. Based on the reports intervention measures were strengthened to control the vector population.

Maharashtra

Scientists of the field unit provided technical assistance to the Central Emergency Medical Relief team deployed by the Director General of Health Services (Emergency Medical Relief), New Delhi from 12 to 19 August 2005 in the Leptospirosis and dengue affected areas in Kalyan-Dombivali in Maharashtra. Entomological surveys were carried out in affected localities of Kalyan-Dombivili and Thane Municipal Corporation areas.

Review of Vector Management Programme in West Bengal and Kolkata City for Containment of Dengue

There was a report of wide scale occurrence of dengue cases in Kolkata City and in West Bengal state since mid-August 2005. Till September 12, a total of 2026 cases of dengue were reported in the state by the health department, of which majority (1332) were from Kolkata City alone. Next most affected area was North 24-Parganas district from where 121 cases had been reported. In all, there were 19 deaths of which there were 13 seropositive (IgM) confirmed deaths due to dengue. A rapid assessment of vector management programme in Kolkata City was carried out to provide technical support for containment of dengue from September 9 to 13, 2005. An assessment of vector management programme in Kolkata and West Bengal and breeding potential of dengue vectors was carried out to suggest appropriate remedial measures for effective implementation of various intervention measures to control dengue vectors.

Breeding of *Aedes* mosquitoes was found in almost all the places visited including the premises

of a Borough office and its surroundings and in and around houses in the wards. The breeding was mainly found in discarded tyres, scraps, empty coconut shells, mud/earthen pots, iron/plastic barrels, earthen pots, jerry cans, plastic buckets, bottles, tube-well cap, cement tanks inside/outside houses, flower vases and many other scrap items kept on the roof top. *Aedes aegypti* (59.5%) *Ae. albopictus* (35.2%) and *Ae. vittatus* (5.3%) emerged from the larval samples collected from different areas.

The recommendations based on investigation were given to health authorities to improve anti-larval operations, fogging operations IEC activities and establishment of a Vector Management Programme. Need of Capacity building, Implementation of civic byelaws and Inter-sectoral coordination was emphasized in Kolkata City. In view of the wide prevalence of dengue in West Bengal, measures similar to Kolkata City were recommended to implement in other urban areas of the state.

GIS-based Dengue Information System for Delhi

In India, 21 states have reported dengue cases in 2006. A total of 10,935 cases and 171 deaths were reported from all over the country (provisional). Out of total cases, 31% were reported from Delhi and adjoining areas. Delhi also reported maximum number of deaths among all the states. A GIS-based Dengue Surveillance System was developed for monitoring and control of dengue in Delhi.

Delhi consists of about 139 million population spread over three localities, namely Municipal Corporation of Delhi (MCD), New Delhi Municipal Committee (NDMC) and Cantonment area. In MCD, there are 12 zones and 133 wards. NDMC consists of one zone and nine wards whereas in Cantonment area, there is only one ward in one zone. Digital map up to street level was used to create the GIS database. For all the three areas ward wise number of households, population, literacy rate, scheduled caste population, etc. as per 2001 census were attached. Streetwise reported dengue cases were mapped to identify clusters requiring intense attention for the control of disease (Fig.129). A routine sample survey for breeding sites supporting breeding of dengue vector was carried out by the NIMR. The data was overlaid to identify breeding source contributing more for proliferation of dengue vectors, to undertake situation-specific control measures. Based on GIS mapping, formulation of focused control strategy for dengue is in progress.

Dengue and Chikungunya studies by IDVC Field Unit, Bangalore, Karnataka

NIMR jointly conducted a study on dengue with St. John Medical College in Anugondanahalli, Hoskote, Bangalore rural district from May to July

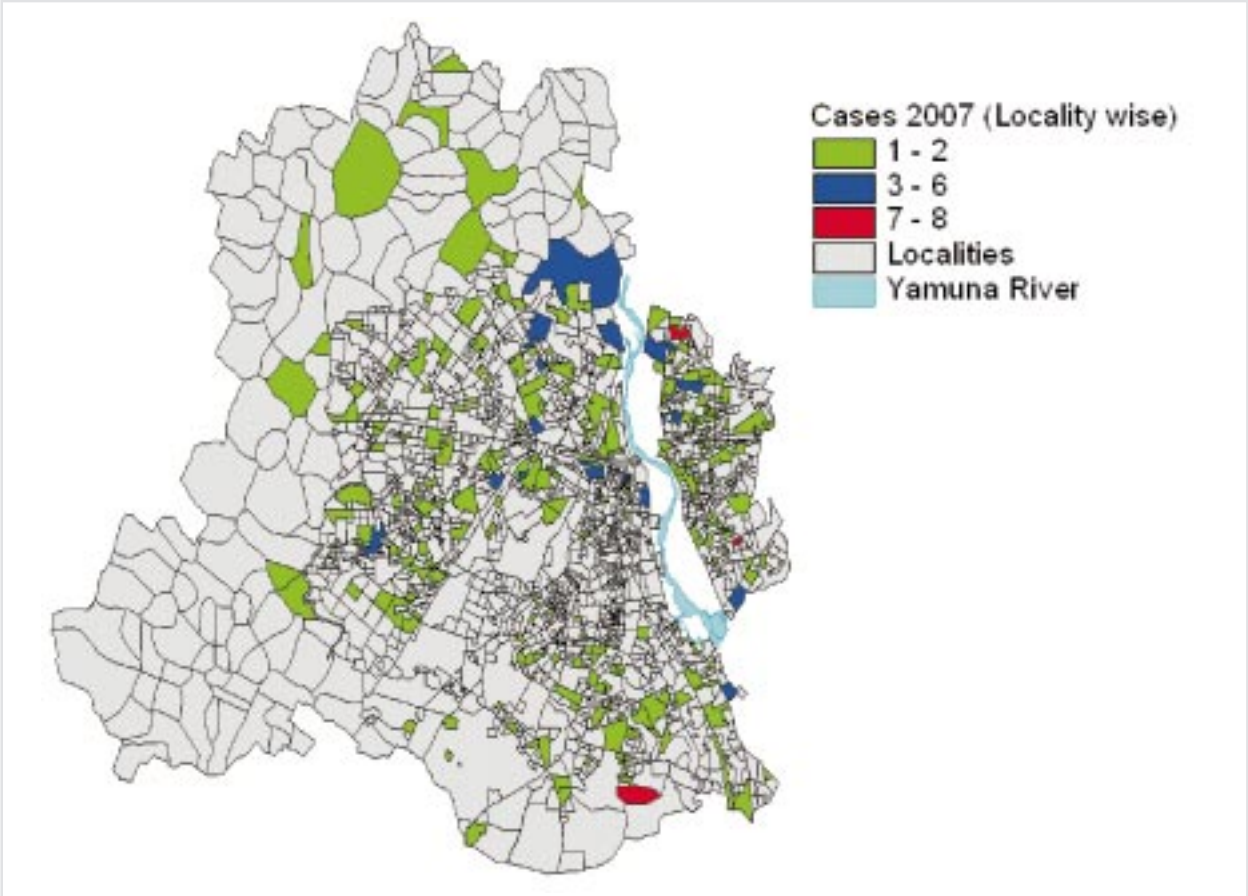

Fig. 129: GIS map showing locality wise dengue cases in Delhi

1991. In this study *Ae. aegypti* was found to breed mainly in indoor cement tanks (91%) whereas *Ae. albopictus* in mud pots (78%). Jointly carried out a dengue outbreak in July 2000 in Bangalore City along with NICD, Community Health Cell, Bangalore and Bangalore Mahanagara Palike. Here *Ae. aegypti* was the main vector mainly breeding in cement tanks. In Bangalore City an action plan has been given to the Bangalore Mahanagara Palike where emphasis has been made for house-to-house survey for control of breeding of all types of mosquitoes including *Aedes* mosquitoes. In Mangalore City, routine mosquito surveys were carried out and the same action plan to the Mangalore City Corporation was suggested. Soon after the recent outbreaks of chikungunya in Karnataka, a study was carried out in Tumkur and Kolar districts. Here indoor cement tanks were the main breeding sources of *Ae. aegypti*. Most of the cement tanks are attached to an oven that maintains temperature at 26 to 28°C and are the most preferred breeding habitats of this mosquito. In all cement tanks checked there was no lid on the tanks and we suggested for use of mosquito proof cement tanks based on experience gained in the field.

A study was undertaken to develop a strategy for Integrated Control of Vectors of Malaria, JE and dengue in Karnataka funded by WHO Country budget. This study was conducted in Mandya district from 2003 to 2004. A total of 769 villages were surveyed in seven talukas. It was found that of the total of 28,584 breeding habitats surveyed 6361 were found dry and in 3928 (13.7%) habitats different mosquitoes were found breeding. Principal malaria vector *An. culicifacies* was breeding mainly in tanks, irrigation wells and seepage water while JE vector *Cx. tritaeniorhynchus* was breeding in tanks, seepage and streams. It is important to note that dengue vector *Ae. aegypti* was exclusively breeding in water storing cement tanks in all the villages surveyed. *Aedes* indices for containers, house, and breteau were 22.8, 18.8 and 20.2% respectively.

Under the Elimination of Lymphatic Filariasis (ELF) programme mass drug administration has been advocated. In this regard, eight northern and coastal districts in Karnataka have been covered under MDA. Two districts Bijapur and Bagalkot were given to NIMR for implementation of the programme.

GIS-based Information System of Decision Support of Kala-azar Control in Bihar

For the first time in India, an attempt has been made to design kala-azar control strategy at national level utilizing GIS platform for Bihar state. There are 38 district in Bihar, where 31 are endemic for kala-azar and eight are severely affected namely, Gopalgunj, Muzaffarpur, Saharsa, Saran, Vaishali, Araria, East Champaran and Madhepura, Despite implementation of various control strategies, the status of morbidity and mortality due to kala-azar in several districts remained the same. For GIS platform geo-referenced digital map of villages/tehsils/districts were used. A three tier database was constructed-districtwise , tehsilwise and village-wise, Attribute data such as village wise population, schedule caste/ schedule tribe population, medical facilities, primary health centres, etc. and data on kala-azar incidence death for six years–from 2001 to 2006, were attached to the village maps and were used for the analysis for decision support in formulation of control strategies.

Overlaying year wise kala-azar cases over Musahar population, a tribe in Bihar, revealed a strong correlation of kala-azar cases with Musahar population. Fig. 130 shows a correlation of Musahar population with kala-azar cases of 2006, the year of high incidence. Villages with Primary Health Centres were mapped and a buffer zone was created at 2 km

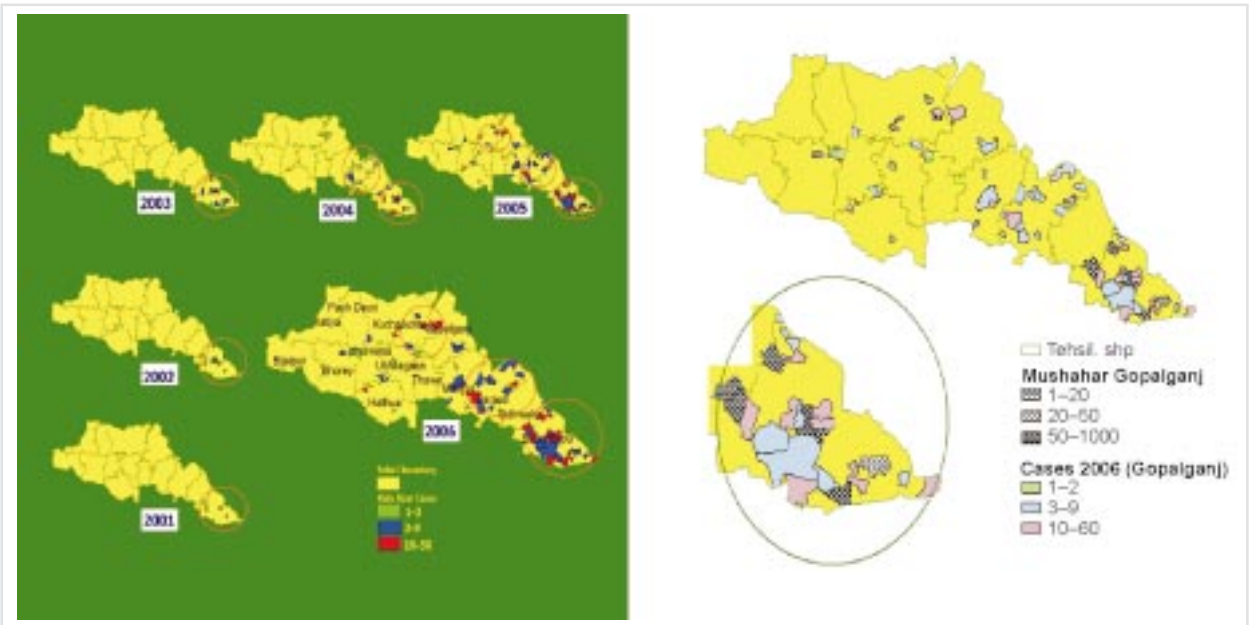

Fig. 130: Kala-azar incidence from 2001 to 2006 and correlation with Musahar population

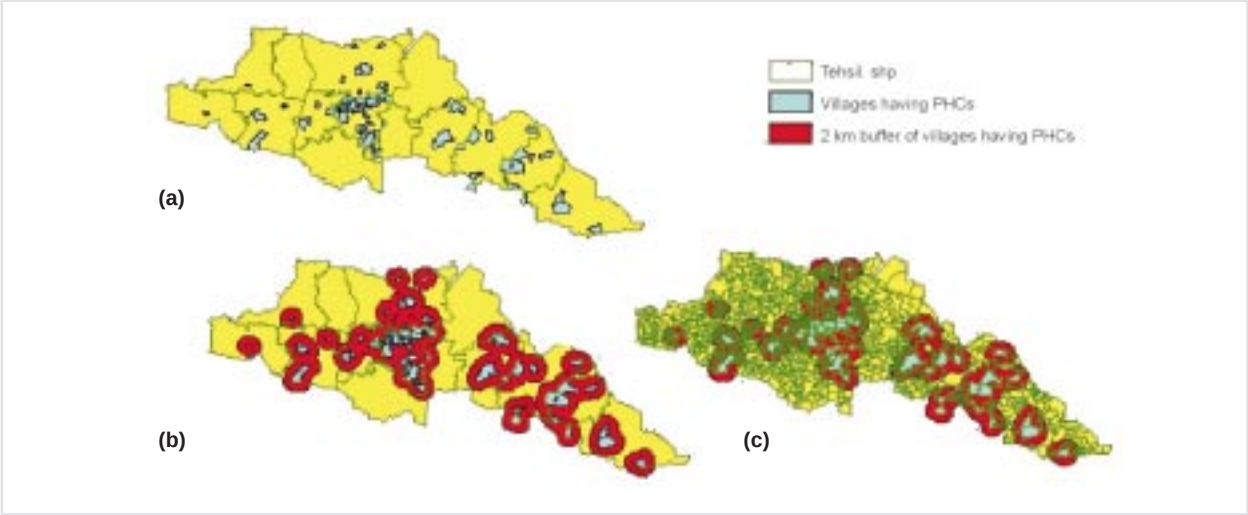

Fig. 131: GIS-based maps for kala-azar endemic pockets in Gopalgunj district

and village boundaries were overlaid to show the accessibility for patients to closest PHCs and the areas where there is need to establish new PHCs. Similar studies have been conducted for other kala-azar affected districts in Bihar and West Bangal. A case study from Gopalgunj is presented here.

Gopalgunj

Gopalgunj has about 8.3 thousand to 2.9 lakh population in its 14 tehsils. In the year 2001 to 2003, the kala-azar cases were 6,19 and 52 respectively, confined to only Baikunthpur tehsil/ PHC of Gopalgunj district. The problem started from east of Gopalgunj and gradually built-up cases in western tehsils with time and in 2006, there was widespread incidence of kala-azar and the disease engulfed 50% of the tehsils and 23 villages having > 10 cases (Fig. 131). Overall eight tehsils of Gopalgunj namely, Baikunthpur, Barauli, Gopalgunj, Hathua, Kuchaikot, Bhorey, Uchkagaon and Manjha have reported kala-azar cases from 2001 to 2006 and kala-azar control may be intensified in these villages.

Chikungunya Outbreak Investigation and Containment in Ahmedabad and Vadodara Cities

In August 2006, a major outbreak of chikungunya transmitted by *Ae. aegypti* was reported in Ahmedabad city. For rapid assessment of the situation and contain the outbreak, NIMR, Nadiad provided technical support. Weekly entomological surveillance was set up in all the 43 municipal wards and newly annexed peripheral municipality areas. *Ae. aegypti* was recorded breeding in all kinds of stored waters in houses, roof tops, zoo/garden tanks, disused tyres, metal scraps, earthen pots with water hung for birds etc. The situation and intervention efforts were monitored by NIMR and municipal authorities on a regular basis.

A household chikungunya morbidity survey was organized with the involvement of Municipal Medical College, Ahmedabad and state health department. NIMR staff participated in entomological surveillance, monitoring of vector borne disease morbidity, review meetings and assisting the govt. and municipal authorities in organizing intensive intervention efforts including training/orientation of newly deployed staff, and IEC at various levels. A number of lectures were given on the need for inter-sectoral coordination for municipal corporators, school teachers and the NGO community. There were > 7000 patients who reported fever with joint pain on 27 August 2006. The breteau index in different wards ranged from 16 to 48 and Container index was >5 in each ward. There was a gradual decline in the prevalence of *Ae. aegypti* (3 per room) with BI <2 together with the patients suffering from fever and joint pain (321) in about 8 weeks of continuous efforts. It was suggested to sustain the intervention by strengthening health system capacity and implementing effective interventions along with monitoring and evaluation of the disease for further containment of chikungunya in the city.

A similar support was given in Vadodara Municipal Corporation. An intradomestic survey was carried out in 10 wards. Altogether, 1000 houses were surveyed in 10 wards (100 houses in each ward) for breeding of *Aedes*. The house, container and breteau indices were 4.8, 2.4 and 5.5%, respectively. Only in Jublinagar ward breteau and house indices were >10%.

Retrospective Study on Chikungunya Outbreak in India

A retrospective study on chikungunya outbreak in India was initiated during 2007 in five states, viz. Delhi, Madhya Pradesh, Orissa, Maharashtra and Kerala (Fig. 132). Seven questionnaires, namely household survey—Q1A; information of all household members—Q1B; knowledge, attitude, belief, practice regarding chikungunya fever prevention and control —Q1C; patient inventory-Q1D; mortality in

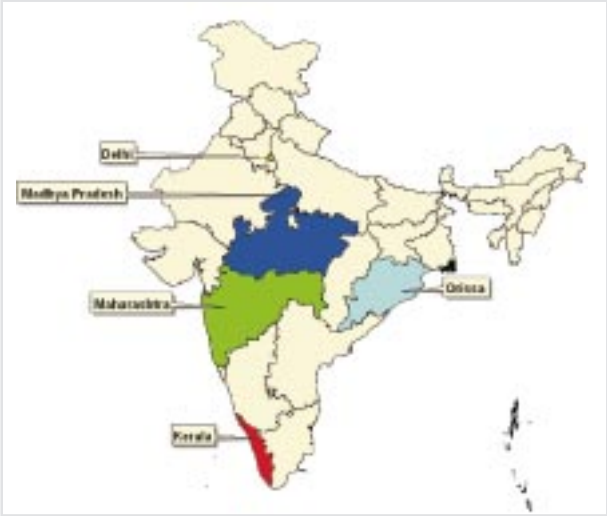

Fig. 132: Study sites selected for the retrospective study on chikungunya outbreak in India

household—Q1E; health facility survey—Q2; and stakeholder interview—Q3 were filled up from urban and rural areas of each state except Delhi from where only urban areas were taken (Fig. 133).

The highest incidence districts identified were: Sundargarh in Orissa, Latur in Maharashtra, Betul in Madhya Pradesh, Alappuzha in Kerala, MGF Zone and Dilshad colony in Delhi. The lowest incidence districts identified were Ganjam in Orissa, Ratnagiri in Maharashtra, Katni in Madhya Pradesh, Kannur in Kerala and Sadar Paharganj, Najafgarh zone and Dwarka in New Delhi. Thus, a total of five states, 10 districts, 20 sub-centres, 20 urban wards and 2000 households each from urban and rural areas were covered. All filled up questionnaires from different states were analysed at NIMR.

Orissa appeared as the most ignorant state as far as knowledge, attitude, belief and practices for chikungunya fever prevention and control was concerned. Loss of man days/school absenteeism per attack was mostly recorded as 5–10 days and the symptoms were mainly recorded as fever, headache and bodyache. Many patients told the duration of treatment as 5–10 days and the expenditure on treatment and food was mostly ≤Rs. 500 and ≤Rs. 250. Besides, the study revealed that the facilities for chikungunya case management did not exist in any of the surveyed hospitals of Orissa.

Maharashtra appeared as the second most

Fig. 133: Filling up of the questionnaire

ignorant state regarding knowledge, attitude, belief and practice for chikungunya fever prevention and control. The average loss of man days/school absenteeism was more than 15 days. Symptoms were mainly recorded as fever and bodyache, and most of the patients took treatment for more than 15 days. In some families of Maharashtra, many members suffered from the disease simultaneously and on an average the expenditure on treatment was high. Chikungunya case management facility was provided by all the health facilities surveyed during this study. Major *Aedes* mosquito breeding sources in Maharashtra are shown in Fig. 134.

In Madhya Pradesh, most of the houses were *Kuchcha* type especially in rural areas. In some high incidence areas, air coolers were found. General sanitary conditions around most of the urban houses of the highest incidence area were found good. Water storage containers mostly used were cement tanks, metal tanks, overhead tanks and buckets (Fig. 135). Regarding other water collection in the houses/ surroundings, mostly water for animals and pet bowls figured out. As far as emptying/drying of all water containers was concerned; some residents said that they did on weekly basis while others said that they did once in a while. Loss of man days/school absenteeism was mostly recorded as 5–10 days. Symptoms were mainly recorded as fever and arthralgia. The duration of treatment recorded was >15 days in most of the cases. Treatment expenditure was mostly ≤Rs. 500 and expenditure on food was ≤Rs. 250. Majority of the patients in Madhya Pradesh didn't receive any information of

Fig. 134: Mosquito breeding sources in Maharashtra

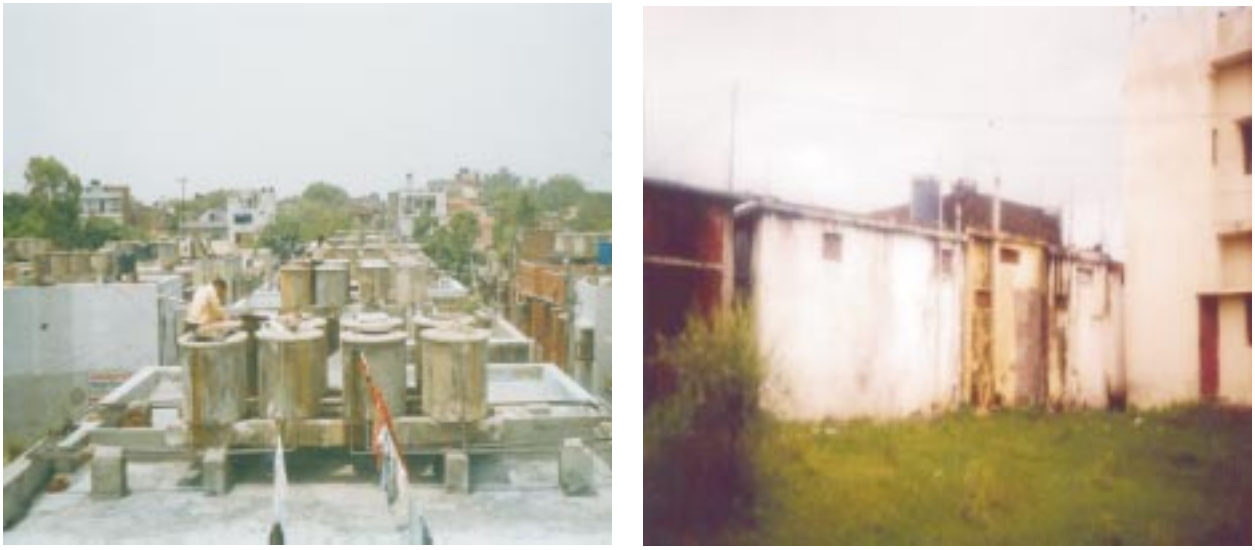

Fig. 135: *Aedes* mosquito breeding sources in Madhya Pradesh

treatment from local hospital and private agencies/ doctors. Chikungunya case management facility was provided by all the health facilities surveyed in Madhya Pradesh.

In Delhi, most of the houses were *Pucca* types and had air coolers. General sanitary conditions around most of the houses were found good. Water storage period in some areas was for 3–6 and >6 days. The key containers in Delhi were overhead tanks, underground tanks, ground level tanks and buckets (Fig. 136). In the highest incidence areas, emptying/drying of water containers was mostly done on weekly basis. Migration has been featured out as a major problem in Delhi. Loss of man days/school absenteeism was mostly recorded as 1–5 days in the highest incidence areas. Symptoms mostly recorded were fever and headache. Duration of treatment in the highest incidence urban area was 1–5 days. Treatment expenditure was mostly ≤Rs. 500 and on food ≤Rs. 250. Chikungunya case management facility was not provided in the MCD Hospital surveyed during the study.

In the urban areas of the highest incidence district of Kerala, more people were found residing in *Kuchcha* houses. In the urban areas of the highest incidence district, very few households had air coolers, but in the low incidence urban areas under the lowest incidence district, all the houses had air coolers. Water storage containers mostly used were: overhead tanks, plastic drums and buckets. Regarding other water collection in the houses/ surroundings were mostly troughs for drinking and coconut shells figured out (Fig. 137). Most of the respondents from Kerala knew answers to the questions related to knowledge, attitude, belief and practice for chikungunya fever prevention and control. Loss of man days/ school absenteeism was mostly recorded as >15 days. Symptoms were mainly recorded as fever and bodyache. Duration of treatment in the highest incidence urban area was >15 days; while in rural areas it varied from 5–10 to 10–15 days. Treatment expenditure was mostly ≤Rs. 500 and on food ≤ Rs. 250. Majority of the patients in Kerala received information for treatment from local hospitals and other sources. Chikungunya case management facility was provided by all the health

Fig. 136: *Aedes* mosquito breeding sources in Delhi


Fig. 137: *Aedes* mosquito breeding sources in Kerala

facilities surveyed in the highest incidence district.

Application of Attracticide (Oviposition Pheromone in Combination with Insect Growth Regulator) for Surveillance and Control of Dengue and Chikungunya Mosquitoes

The experiment was initiated in Delhi during October 2007 and in Banglore during December 2007. The experiment at Kerala is yet to be started. In Kerala, baseline data has been collected on the basis of which localities have been decided upon. In Delhi about 6500 ovitraps were placed in five localities viz. Mayur Kunj (Trilok Puri), Valmiki Colony (Panchkuiyan Road), Netaji Nagar, R.K. Puram and Railway Colony (Tughlakabad). In Banglore, about 6000 ovitraps were placed in three localities, viz. Ashok Nagar, Kanteerava Nagar and Sanjay Gandhi Nagar + Narayanpura. The experimental ovitraps contained 395 ml water treated with 5 mg C-21, IGR and solvent. Untreated ovitraps contained 400 ml water with solvent only.

Before starting the experiment, a meeting with community was organized at Delhi and Banglore to make them aware about this experiment taking place. Delhi experiment at R.K. Puram location was launched by Mr. Deepak Gupta, IAS, Special Secretary, Ministry of Health & Family Welfare. Training to the newly appointed supervisors and surveillance workers was provided to carry out the experiment and to check the breeding. A surveillance worker was asked to check ovitraps and record the breeding in about 50 houses in a day. Thus a surveillance worker covered about 250 houses in a week. The supervisors monitored the work of the surveillance workers, collected data from the field for processing on computers and provided IEC to the community regarding the experiment being carried out. The study is in progress.

Review of the Progress of Mass Drug Administration in Valsad and Junagarh Districts in Gujarat

National Vector Borne Disease Control Programme, Delhi, had assigned NIMR, Field Unit, Nadiad to assist in the monitoring of the progress of MDA Phase-II for elimination of lymphatic filariasis. In June 2005, the MDA programme in Valsad and Junagarh districts was reviewed by NIMR, Nadiad. District Valsad located in south Gujarat is endemic to lymphatic filarisis. As per the sentinel *mf* survey carried out during June 2005, the average *mf* rate in the district was 0.68% (ranging from 0 to 3.98%), highest rate was in Valsad town (3.98%).

During the verification of MDA activity in district Valsad, two urban areas, viz. Valsad and Vapi towns and two villages of PHC Magod in Valsad taluka, viz. Nanakwada and Bhagdawada were visited. Overall, MDA coverage was 78.2% ranging from a low of 56% to a high of 88.1%. During the field visit, some of the householders were asked the following questions: Whether they knew in advance about the MDA programme? Whether they knew for what purpose the drug is being distributed? Whether they experienced any side effect due to the DEC drug being administered? People informed that announcements were being made over the loud-speakers mounted on auto-rickshaws in the city areas to announce the launch of this programme and to cooperate in this campaign. The MDA teams also carried with them adequate health education materials at the time of the MDA programme to inform the people about various aspects of filariasis. Line-listing of cases with clinical manifestation of cases was also done.

In Junagarh district, the overall MDA coverage was high (89.1%) during 11–13 November 2005. During this period, a major fair was held where the floating population was also administered DEC.

During the visit, discussions were held with the DDO, the CDHO and the District Malaria Officer in Valsad. As mentioned earlier, the District Collector, the DDO and the CDHO took the initiative to achieve the maximum coverage. The DMO was also instructed to implement this programme in all the schools and colleges in the district in consultation with the District Education Officer and heads of various schools and colleges to increase the coverage. ❑