

Highlights of Research Activities under IDVC Project

Bangalore (Karnataka)

WHO 28-day extended *in vivo* studies to detect chloroquine resistance against *P. falciparum* were carried out in PHC Narsapura, District Kolar and PHC Tavarkere, District Tumkur. A total of 71 *Pf* cases were successfully followed-up. All the 9 cases from Kolar were resistant to chloroquine and showed positive correlation to *Pfcr* and *Pfmdr1* genes. Screening of 62 samples from Tumkur is under process. Lambda-cyhalothrin 10 CS formulation against *An. culicifacies* was found very effective up to 12 weeks and was found safe to human beings. Situational analysis of malaria in three districts in Karnataka namely Kolar, Chitradurga and Raichur were carried out. Malaria in all the districts is under control. Mosquito control in Bangalore City and malaria control in Mangalore City were continued. It was found that malaria in Mangalore City was restricted to construction areas and needs administrative control over the building owners by the local administration. Malaria in all the areas where larvivorous fish were released is under control. Malaria outbreak investigation was carried out in Hassan and Tumkur districts and found that the cause of the outbreaks was due to labour migration. NIMR supervised the Elimination of Lymphatic Filariasis programme in Karnataka.

Chennai (Tamil Nadu)

During the year, studies pertaining to environmental, social and behavioural risk factors related to

malaria transmission in Chennai have been initiated. Geographical reconnaissance has been completed in the experimental area and is being carried out in the control area. Assessment of therapeutic efficacy of chloroquine in the treatment of falciparum malaria has been undertaken in Besant Nagar area in Chennai after repeated complaints on malaria among treated patients. Study indicated 38% late treatment failure. Phase III trials of Lambda-cyhalothrin 10% CS as indoor residual spray has been initiated and pre-treatment survey undertaken in Hogenekkal and Ootamalai areas in Dharmapuri District, Tamil Nadu. Other activities included technical support to various centres/institutes and collaborative research/scientific work. Health education and training programmes were undertaken as usual. Malaria clinic continued to function catering to the health needs of the public by providing prompt diagnosis and treatment.

Haldwani (Uttaranchal)

Therapeutic efficacy of chloroquine in the treatment of *P. falciparum* malaria was undertaken in Bel Parao PHC and Haldwani and the results revealed 13.6% late clinical failures, 31.8% late parasitological failures and 54.6% adequate clinical and parasitological response. Seroepidemiological studies were undertaken to investigate malaria endemicity in collaboration with NIMR Hqs. A total of 87 blood smears were collected and the study is in progress. Diagnosis and treatment services were provided to the patients reporting with fever to the malaria clinic at the field unit. Technical support was provided by

organising health camps, training courses, group meetings, live demonstrations, etc.

Hardwar (Uttaranchal)

Fraction code MRCHAR/03/05S from plant code MRCHAR/03/05 showed excellent activity against *An. stephensi*, *Aedes aegypti* and *Culex quinquefasciatus*. Gas chromatography-mass spectrometer analysis showed 80 and 62 peaks, on mass spectrum data base search. Major six components (5–10%) identified were namely (i) 2-Butanone, 4-(2,6,6-trimethyl-2 cyclohexen-1-yl) (10.11%); (ii) Patchouli alcohol (8.55%); (iii) Cubenol (5.97%); (iv) Caryophyllene oxide (5.46%); (v) Cadinol (5.23%); and (vi) Aristolene (5.19%). Total contributions of all these six compounds were 40.51%. The work has been filed for patent [Application number 3234 /DEL/2005]. Four plants with codes NBDB 022, NBDB041, NBDB 048 and NBDB 056 have been short-listed for further fractionation and formulation to develop as novel insecticides against mosquitoes. Fraction code MRCHAR/04/04/S possessed good adulticide activity against *An. stephensi*, *Ae. aegypti* and *Cx. quinquefasciatus*. Fraction codes MRCHAR/03/04/1 and MRCHAR/03/04/4 of plant code MRCHAR/03/04 showed good antiplasmodial activity with their IC_{50} values of 0.62 and $1.5 \mu\text{g ml}^{-1}$ respectively. Plant code MRCHAR/04/03 from Garhwal region of northwest Himalayas possessed good antiparasmodial activity by *in vitro* method. About 246 samples of soil, sediment, water, human blood and human milk collected from Garhwal region were processed for the determination of organochlorine residues.

Bioenvironmental control methods successfully controlled malaria in industrial townships of Bharat Heavy Electricals Limited (BHEL), Hardwar, Indian Drugs and Pharmaceutical Limited (IDPL), Rishikesh and Indian Oil Corporation (IOC), Mathura. Technical support was also provided to other industries. Malaria cases declined at National Thermal Power Corporation (NTPC), Rihand Nagar due to effective control measures. Entomological and parasitological investigations were carried out to know the transmission dynamics of malaria in the villages of Laksar PHC, Hardwar. Studies have indicated the existence

of a new *An. fluviatilis* sibling species at Laksar PHC. Efficacy of larvivorous fish *Poecilia reticulata* against mosquito larvae was monitored in a polluted water blocked drain at BHEL, Hardwar, India. *Poecilia reticulata* failed to feed on *Cx. quinquefasciatus* larvae in this drain and preferred to feed upon the other available food present in the polluted water compared to *Culex* larvae.

Jabalpur (Madhya Pradesh)

Study on 'Cerebral malaria associated neurological disorders in India' was carried out at Medical College Hospital, Jabalpur and Maihar Civil Hospital. A total of 199 prospective cases were admitted in the hospital. The case fatality rate was 41%. Base line census of 52 study villages (Pop. 28,789) under the project 'Preparation of a field site for malaria vaccine trial' is completed. HRS book (log book of each village) has been printed as "National resource". About 6800 women of reproductive age were identified to be enrolled. On an average about 80% women were anaemic. Study on 'Transmission dynamics of malaria in tribal areas' showed significantly higher malaria and *P. falciparum* prevalence in Baiga villages of Dindori district as compared to Kanha villages of District Mandla ($\beta = 1.67$ z state 14.4, $p < 0.0001$). The pattern of mosquitoes and vectors were also different. *An. fluviatilis* 'S' was found only in Baiga villages. Clinical trial with α - β Arteether in paediatric age group was carried out in collaboration with Central Drug Research Institute (CDRI), Lucknow and Paediatrics Department of Medical College, Jabalpur. A total of 47 children were enrolled. The results revealed rapid clearance of fever and parasitaemia (24–72 h). No adverse effect was recorded and drug was well tolerated. Studies on migration malaria revealed that prevalence of malaria is still very high in Panna (59% SPR with 83% *Pf*) in spite of intervention measures. A rapid spread of malaria was recorded in all adjoining districts—Katni (SPR 36%), Satna (SPR 42%), Umaria (SPR 57%) and Jabalpur (SPR 31%) where malaria incidence was low. Six malariology training workshops for Medical Officers of various districts of Madhya Pradesh were organised at Jabalpur on the request of Directorate of Health Services, Bhopal.

Nadiad (Gujarat)

Health impact assessment of Sardar Sarovar Water Resources Development Project has made good progress. A large-scale randomised controlled trial of a native fish species (*Aphanius dispar*) has been initiated for malaria control in a semi-arid zone in north Gujarat. New insecticide and larvicides were field evaluated. Technical support was provided to the vector borne disease control programme in Gujarat state for various activities such as planning of antimalaria activities, malaria epidemic investigation/containment, malaria situation analysis in flood-affected areas, dengue surveillance, preparation of fish hatchery designs, MDA, malaria treatment at clinic, cross-checking of slides, IEC and human resource development.

Panaji (Goa)

Geographical reconnaissance studies were undertaken in Panaji to map the breeding sites of *An. stephensi* and other mosquitoes. The study brought in focus a large variety of habitats supporting breeding of *An. stephensi*, *Ae. albopictus*, *Ae. aegypti* and *Cx. quinquefasciatus*. Monitoring of programme implementation was undertaken in North Goa and a detailed report based on findings in epidemiological, entomological questionnaire based surveys was submitted to NVBDCP. Malaria incidence in Panaji after the introduction of sulphadoxine-pyrimethamine (SP) as second line therapy in the treatment of uncomplicated *P. falciparum* malaria was monitored and the results showed desired impact of SP therapy in reducing the malaria incidence. Malaria burden estimation was undertaken in six districts of Chhattisgarh state. Advocacy workshop was conducted at Ranchi and the work was initiated. A survey was conducted in Goa to study the prevalence of dengue vectors and their breeding places and the results confirmed the presence of *Ae. aegypti* and *Ae. albopictus* in Goa and the study will be continued to study the seasonal trends in the population. Evaluation of Parabank, a rapid diagnostic test for the detection of malaria in blood bank samples was undertaken in Goa and the results revealed high sensitivity and specificity of the test kit in the diagnosis of malaria in blood bank

samples. Diagnostic and treatment facilities were provided to the patients reporting to malaria clinic at the field unit.

Rourkela (Orissa)

Longitudinal parasitological and entomological studies were carried out in forest and plain area villages that were selected for the development of a site for malaria vaccine trial. On the basis of existing epidemiological data as well as immune status of the study population, 1–5 yr age group are eligible for malaria vaccine trial and as a pre-requisite to the vaccine trial, the methods of data collection and measurements have been standardised. *Bacillus thuringiensis* formulation BtiAS, VCRC B17 strain was evaluated for its efficacy against mosquito larvae and the results revealed that the compound is effective against culicine larvae up to one week and up to two weeks against anopheline larvae. Phase II evaluation of PermaNets, a long-lasting insecticide treated net has been completed and the results revealed high efficacy of these nets in reducing the mosquito densities and high bioefficacy even after 20 washes. Village-scale trial of Olyset nets was initiated. Efficacy of insecticide treated net programme in Mayur Bhanj and Koenjhar districts was undertaken. Detailed report and recommendations on the basis of bioassays and field surveys were submitted to the programme personnel. Assessment of therapeutic response of antimalarials in Koenjhar and Mayur Bhanj districts was undertaken and the results indicated that the pattern of efficacy of chloroquine and sulphadoxine-pyrimethamine in falciparum malaria was highly variable in different parts of the state although with similar epidemiological scenario. Monitoring of programme implementation at PHC level was undertaken in districts with high malaria burden in Orissa. Diagnostic and treatment services were provided at the malaria clinic. Technical support was provided by imparting trainings, organising health camps, meetings, etc.

Shahjahanpur (Uttar Pradesh)

Diagnosis and treatment services were provided to malaria and filariasis patients attending the

clinic. Entomological evaluation was undertaken in Paintapur and Saijana villages in Daudrul PHC where bioenvironmental control strategy was undertaken earlier. Malaria survey was undertaken in Shahjahanpur district to study the prevalence of malaria where large number of fever cases were reported. Monitoring of antimalaria activities were undertaken in two districts of Bihar upon directions of NVBDCP and detailed report regarding measures taken by the health personnel for the control of malaria was submitted. Monitoring of intensified malaria control project under Global Fund was undertaken by the Shahjahanpur field unit in Changlang district of Arunachal Pradesh and Imphal district of Manipur. Group meetings and health camps were organised to sensitise the community in controlling malaria.

Shankargarh (Uttar Pradesh)

Diagnosis and treatment services were provided to patients attending malaria clinic at the field unit. Technical support in epidemic investigation, therapeutic efficacy studies and situational analysis was provided.

Sonapur (Assam)

The major thrust areas of research included, (i) phase III evaluation of long-lasting insecticidal nets (Olyset nets) against *Anopheles minimus* transmitted malaria in Assam; (ii) assessment of therapeutic efficacy of Artemisinin based combination therapy against uncomplicated *P. falciparum* malaria; (iii) clinical trials of α - β Arteether for the treatment of uncomplicated *P. falciparum* malaria in children; and (iv) assessment of State Implementation Capacities under Global Fund supported Intensified Malaria Control Project of NVBDCP. Other activities included technical inputs to strengthen the malaria control activities specific to Northeastern region; these were, health education and capacity building measures, observance of antimalaria month and, mass propagation and distribution of larvivorous fishes (guppy) in town areas. Effective linkages are being developed with the State Health Directorate for control of epidemic malaria, and other institutions for providing evidence based interventions.

