

Highlights of Research Activities under IDVC Project

5.1 Bengaluru (Karnataka)

- A Phase III, randomized, non-inferiority trial, to assess the efficacy and safety of Dihydro-artemisinin + piperazine (DHA+PPQ, Artekina) in comparison with Artesunate + Mefloquine (AS+MQ) in 54 patients affected by acute, uncomplicated *Plasmodium falciparum* malaria was successfully carried out in Mangalore. Clinical trial on Artesunate + Pyronaridine against uncomplicated *P. falciparum* and *P. vivax* was initiated. The drug is found to be very effective. Project on HPR2 and pLDH-based diagnosis for malarial parasites has been initiated.
- Alpha-cypermethrin treated (@ 0.2 g/m²) long-lasting insecticidal nets were found effective against *Anopheles stephensi* in Mangalore City. No adverse effects on the bednet users were observed. A Project on *Aedes* control using C21 attracticide has been initiated in Bengaluru City.
- Molecular studies on therapeutic efficacy revealed that the prevalence of chloroquine resistance which can be correctly estimated by the PfCRT T76 genotype resistance index as against genotype failure index in Africa.
- Larvivorous fishes which have proved very effective for malaria control are being implemented in Karnataka through NRHM and Panchayat Raj Institution.
- As support to the national programme, malaria control monitoring was carried out in three high *Pf* incidence districts and a malaria outbreak investigation was carried out in Raichur district. DDT was found totally ineffective against *An. culicifacies* in two districts of Andhra Pradesh. Besides the above, this field unit is supporting the State Health Department on capacity building and vector control activities.

5.2 Chennai (Tamil Nadu)

- Work on environmental, social and behavioural risk factors related to persistent malaria transmission was carried out in Chennai.
- Phase III trials of Lambda-cyhalothrin 10% CS as indoor residual spray were undertaken in Thangachimadam PHC of Rameswaram Island, Ramanathapuram district and subsequent assessment indicated similar effectiveness of Lambda-cyhalothrin in both CS and WP formulations. Field efficacy trial of enhanced doses of Fenthion (82.5% EC) was carried out in moderately polluted unused wells, polluted drains and cess pools in Chennai against the immature stages of *Cx. quinquefasciatus*.
- Entomological investigations undertaken in the suspected chikungunya outbreak districts of Kerala revealed high breteau and pupal indices.

- Technical support was provided to various centres/institutes, and health education/training programmes on malaria were undertaken. Malaria clinic continued to cater to the needs of general public by providing early diagnosis and prompt treatment.

5.3 Hardwar (Uttarakhand)

- NIMR, Field Unit, Hardwar is working on industrial malaria control since 1986 and successfully controlled malaria in Bharat Heavy Electricals Limited (BHEL), Hardwar, Indian Drugs and Pharmaceuticals Limited (IDPL), Rishikesh and Indian Oil Corporation (IOC), Mathura.
- High performance liquid chromatography (HPLC) method has been developed for simultaneous determination of curcumin and piperine in plasma.
- Work on the search of new molecules with antimalarial and insecticidal properties is in progress. Impact of insecticides on the environment and monitoring of the levels of antimalarials in malaria cases as per the mandate of the field unit are underway.
- Field evaluation of Aza neem as larvicide supported by BMR, Pune and field evaluation of Bacticide WP (wettable powder) and Bacticide DT (dispersible tablets) formulation of *Bacillus thuringiensis* var. *israelensis* H-14, strain 164 against larvae of mosquito vectors were also carried out.
- Consultancy services on control of mosquitoes/malaria to NTPC, Rhindnagar and Ordnance Factory, Kanpur were provided.

5.4 Jabalpur (Madhya Pradesh)

- Under the project on 'Preparation of a field site for Malaria Vaccine trial in and around Jabalpur', genetic polymorphism in the vaccine candidate antigen genes (MSP-1,

MSP-2, MSP-3, TRAP, RAP-1, CSP, EBA-175&AMA-1) and drug resistance genes (*pfprt*, *pfdhfr* and *pfdhps*) were studied. Altogether, 348 new pregnant women were included in the community cohort (Population 98,632). IgG transfer from mother to infants revealed that in blood smear MP negative placenta, maternal side has higher levels of IgG antibodies than cord side against all *Pf* and *Pv* stage-specific synthetic peptides.

- Work on assessment of burden of malaria in pregnancy in Jharkhand revealed that peripheral parasitaemia was significantly more common in pregnant women in the semi-urban and rural anti natal clinics (ANCs) ($p < 0.001$) and in primigravid and secundigravid relative to multigravid ($p = 0.0042$).
- Under the study on 'Burden of malaria in pregnancy in Chhattisgarh, India', a total of 857 women were enrolled in delivery unit, of which 33 were positive for malaria (21 *Pf* and 12 *Pv*). Rapid assessment of the burden of malaria in pregnancy in Madhya Pradesh revealed that 26.5% samples were positive for malaria parasite by PCR, while only 11.4% were positive by microscopy.
- Facilities for diagnostic PCR, vector incrimination by ELISA, identification of sibling species complex and sequencing of genes were established.
- Support was provided to the national programme by undertaking monitoring of NVBDCP micro action plan to control *Pf* malaria in five districts of Madhya Pradesh. Two training workshops on malaria and other vector borne diseases for Medical Officers of various districts of Madhya Pradesh were organized in January and February 2008 at IDVC Field Unit, Jabalpur.

5.5 Nadiad (Gujarat)

- The major research studies conducted during the reporting periods were: randomized controlled trial of an indigenous fish, *Aphanius dispar* for malaria control in Gujarat; assessment of the impact of Sardar Sarovar Narmada water resources development project (SSP) on communicable diseases with particular reference to mosquito-borne diseases; developing a framework for predicting malaria outbreaks in rural and urban Gujarat; assessment of malaria treatment practices in public and private health sectors; and monitoring of susceptibility status of *An. culicifacies* to malathion and pyrethroids in Gujarat.
- Work on the assessment of mosquitogenic potential created by the development of Ahmedabad-Vadodara Express Highway and mosquito breeding in relation to aquatic vegetation and some physico-chemical factors in central Gujarat was initiated.
- Technical support/consultancy to the national programme on routine surveillance in District Kheda; monitoring of chikungunya and dengue vectors in Bhavnagar; epidemiological investigation on high malaria risk in brick kiln hutment in District Bharuch; situation analysis and assessment of malaria in districts with high incidence of *P. falciparum*; and cross-checking of blood smears and training in malaria to the state health officials was provided.
- Characterisation and bioassays of eight *Bacillus* strains pathogenic to mosquito larvae isolated from sediment soil of mangrove vegetation from Goa showed that *Bacillus* sp KSD-2, 3, 4 & 7 were more effective against *Cx. quinquefasciatus* than *An. stephensi*.
- Situational analysis of chikungunya outbreak in Kerala in 2007 revealed that there was enormous breeding of *Aedes albopictus* (predominant species) and *Ae. aegypti* (restricted to Kozhikode and Kasargod districts) involving multiple sites. Retrospective study on outbreak of chikungunya in Maharashtra state revealed that there was great potential for *Aedes* breeding in both Latur and Ratnagiri districts.
- Evaluation of HRP-II based detection system for *P. falciparum* antigen test by latex agglutination developed by Defence Research and Development Establishment (DRDE), Gwalior revealed that the serum of the *Pf* positive patients showed agglutination with the reagent while with *Pv* did not.
- In Phase III randomised, non-inferiority trials to assess the efficacy and safety of Dihydroartemisinin plus Piperaquine (DHA+ PPQ, Artiken) in comparison with Artesunate plus mefloquine in patients affected by acute uncomplicated falciparum malaria, 28 patients were enrolled which were being followed up for 63 days. Assessment of efficacy, safety and population-pharmacokinetics of the fixed-dose combination of Artesunate-Mefloquine in the treatment of acute uncomplicated *P. falciparum* malaria is also being undertaken.

5.6 Panaji (Goa)

- Estimation of malaria burden in Jharkhand state of India conducted in six districts revealed that highest malaria was found in irrigation paradigm followed by mining, border, forest and plains in the rural paradigms. Expectedly, malaria in urban areas was far less compared to rural areas in all the three urban paradigms.
- Technical support was provided to NVBDCP on training of Medical Officers, MPHs, Health Supervisors and Insect Collectors; special cross-checking of blood smears of PHCs, assessment of preparedness of Navi Mumbai Municipal Corporation for World Bank assistance and out-

break investigation of chikungunya in Kerala and Maharashtra states.

5.7 Raipur (Chhattisgarh)

- Field evaluation of long-lasting insecticidal nets (LNs) impregnated with alpha-cypermethrin (Interceptor®) against vector mosquitoes was carried out in malaria endemic villages of Amoda CHC in District Kanker.
- Two formulations of Bacticide (*Bacillus thuringiensis* var. *israelensis*) wettable powder (WP) and dispersible tablet (DT) were tested against *Ae. aegypti*, *An. stephensi* and *Cx. quinquefasciatus* larvae in various breeding habitats in urban areas.
- A field evaluation of organophosphate larvicide fenthion 82.5% EC was undertaken against the mosquito larvae in polluted waters at two enhanced dosages, viz. 150 and 200 ml/ha.
- Therapeutic efficacy of chloroquine was monitored against uncomplicated *P. falciparum* malaria in Antagarh CHC of District Kanker.
- Technical support to the national programme was provided by monitoring of malaria control activities in seven high *Pf* endemic districts of Chhattisgarh; entomological survey for dengue vectors in Bhilai; monitoring of insecticide resistance in malaria vectors in various parts of the state; facilitating the cross-checking of blood slides (for malaria and filariasis parasites) received from various districts and organizing training programmes for laboratory technicians and MBBS students.

5.8 Ranchi (Jharkhand)

- Studies on mosquito fauna, biology of mosquito vectors, cytogenetic studies, insecticide resistance, incrimination of malaria vectors, and survey for fish fauna were un-

dertaken. *An. culicifacies*, *An. fluviatilis* and *An. annularis* were incriminated as vectors of malaria by sporozoite detection by ELISA. Insecticide susceptibility status of anophelines revealed development of resistance in *An. culicifacies* and *An. annularis*.

- Survey for prevalence of filariasis undertaken in Ranchi and Bokaro elicited microfilaria rate up to 6.9% in the age group ranging from 6 to 60 years. Investigations of outbreaks in Silli and Bundu PHCs of Ranchi brought the inadequacy of surveillance and intervention measures.
- Hatcheries of *Gambusia* and guppy fishes were established in Ranchi district.
- Malaria and filaria clinic of the unit provided early diagnosis to 1298 and 131 patients respectively. Of 1298 fever cases, *P. falciparum* was found in 68 (*Pf* % 14.8).
- As support to the national programme, monitoring of programme implementation was undertaken in Dumka, East Singhbhum, West Singhbhum, and Simdega districts; IRS activities against Kala-azar vector were supervised in Araria district of Bihar; 40 group meetings were organized in Bundu and Silli PHCs of Ranchi district; two health education camps were organized in TB Sanitorium, Ranchi in which 140 Anganwadi workers and 800 tribals attended the exhibition for health education.

5.9 Rourkela (Orissa)

- Development of a field site for malaria vaccine trial was continued and the project was evaluated by external experts from Barcelona Centre for International Health Research (CRESIB), Spain and Manhiça Health Research Centre (CISM) Mozambique.
- Under evaluation of new tools for vector control, studies were undertaken on field evaluation of long-lasting insecticidal net

(LN) impregnated with alpha-cypermethrin (Interceptor®); Evaluation of ZeroFly® –an insecticide incorporated plastic sheeting against mosquitoes; and field evaluation of long-lasting PermaNets impregnated with deltamethrin. There was a significant reduction of 57 and 76% in malaria incidence in Interceptor net used area as compared to untreated net and without net area respectively. In ZeroFly plastic sheeting area, there was a significant reduction of 86.7, 100 and 84% in the entry rate of *An. culicifacies*, *An. fluviatilis* and other anopheline species respectively.

- Assessment of therapeutic efficacy of sulphadoxine-pyrimethamine + artesunate and Coartem (Artemether+Lumifantrine) in uncomplicated *P. falciparum* in Keonjhar rural and urban areas and a phase II, randomised, open label, multicentre study to assess the antimalarial efficacy and safety of arterolane (RBx 11160) maleate and piperazine phosphate coadministration and Coartem® in patients with acute uncomplicated *P. falciparum* malaria.
- As a support to NVBDCP, surveys were undertaken in Sundargarh and Mayurbhanj districts for evaluation of judicious use of DDT spray; monitoring of IRS quality in Sundargarh and Keonjhar districts and malaria monitoring in seven high *Pf* endemic districts, namely Jharsuguda, Bargarh, Angul, Nuapada, Sambalpur, Phulbani and Rayagada were undertaken.

- Malaria clinic provided early diagnosis and prompt treatment to 13,878 fever cases examined till January 2008 of which 886 cases were found positive for malaria (*Pv* 292, *Pf* 567, *Pm* 1 and *Mix* 26).

5.10 Sonapur (Assam)

- Studies were continued on field evaluation of long-lasting insecticidal nets (LNs) impregnated with alpha-cypermethrin (Interceptor®) against malaria transmitting mosquitoes in Assam; characterization of *P. falciparum* strains prevalent in north-eastern states; and therapeutic efficacy studies in selected sentinel sites in north-eastern states of India.
- New projects have been initiated on follow-up efficacy of Olyset nets against malaria vectors and incidence of malaria and bio-monitoring of organochlorine residue in human populations from Assam.
- Technical support was provided to the national programme in strengthening malaria control activities specific to north-eastern region; in-depth review of the malaria control activities in high-risk districts of Assam; evaluation of DDT susceptibility of vectors of malaria; health education and capacity building measures; mass propagation and distribution of larvivorous fishes (guppy) in town areas; and malaria outbreak investigations in affected districts of Assam.

