

INTRODUCTION

Integrated vector control is universally accepted as an effective tool for vector borne disease control programme. Among the available vector control methods, chemical control is decisively superior over environmental and biological control strategies that have limited applicability in mitigating sporadic unpredictable outbreaks of vector borne diseases in our country. Deployment of chemical control embraces the whole gamut of strategies, which include indoor residual sprays (IRS), different types of larvicides, insecticide treated nets (ITN) and an ever-lengthening list of household insecticide formulations for personal protection measures. In India, vector control measures recommended and practiced by the National Vector Borne Disease Control Programme (NVBDCP), the nodal agency of the Government of India for vector borne disease control relies largely upon situation-specific chemical control strategies to ensure effective control. Insecticides belonging to different groups are in use for interventions namely IRS, larvicides and ITN. A major impediment to this programme has been the development of insecticide resistance by vector species, which necessitates frequent replacement of the existing insecticides in the control programme with new insecticides having adequate human and environmental safety. NVBDCP has the ultimate responsibility to introduce the insecticides into the programme based on the results of scientific evaluation of the compounds. For this, industry (national and international), collaborating institutes and NVBDCP have to commission insecticide trials to evaluate the compounds on different aspects to arrive at the decisions (regulatory aspects are given in Box 1). These trials have to be carried out in multi-centric mode in different sites with variable ecology to ascertain their adaptation for control in diverse ecological situations in the country. Further, it is mandatory that only Central Insecticide Board (CIB) registered insecticides are to be used in the control programme. The WHO Pesticide Evaluation Scheme (WHOPES) is the only International programme aiming at promotion and evaluation of pesticides for public health use by providing technical assistance to the member countries and also encouraging the industries to develop better insecticides for public health programmes.

Need for protocols for uniform evaluation

Selecting insecticides for national vector control programme on the basis of their suitability and adaptability to Indian conditions is an ongoing activity of NVBDCP. This necessitates multi-centric laboratory and field trials to assess the suitability of the insecticide to Indian conditions. It is a mandatory requirement for NVBDCP that these trials should furnish data on both entomological and epidemiological aspects of new compounds for countrywide use.

Though general guidelines prepared by WHOPES for the evaluation of insecticides are available, past experiences have shown discrepancies in the results generated by different institutes. WHOPES guidelines being general, considerable variations are likely to

Box 1: Regulatory aspects for introduction of insecticides into the national programme (NVBDCP)

- Under the National Vector Borne Disease Control Programme insecticides used are based on certain epidemiological and entomological criteria. The programme uses insecticides for indoor residual spray, space spray and treatment of mosquito nets. Larvicides are also used for urban malaria, filaria and other vector borne diseases control.
- As per the Insecticides Act, only those insecticides are to be used in the country, which have the approval of the Central Insecticide Board (CIB).
- The trials are conducted by various research institutions to determine the safety, efficacy and cost-effectiveness of chemical larvicides and adulticides before introduction into the programme. Multi-centric trials through common protocols are encouraged. Once the results of the trial become available and indicate the potential use of particular insecticide(s) under the programme, these results are also discussed in a sub-committee of technical experts. Thereafter the findings of the trials and recommendations of the committee are deliberated in the Technical Advisory Committee (TAC), headed by the Director General of Health Services, Ministry of Health and Family Welfare, Government of India.
- Based on the details of the trial, national and international data available in respect of the product, approval of CIB through a valid registration is sought by the manufacturers. Before procurement of the products the specifications are approved by a Technical Committee headed by the Additional Director General, Directorate General of Health Services, Government of India. The TAC makes appropriate decision. Such TAC decisions are then taken up by the programme after the approval of the Ministry of Health and Family Welfare, Government of India for application and appropriate policy decision.

occur in data generated by different institutions and a meaningful comparison becomes difficult. In order to avoid such discrepancies, development of protocols for uniform evaluation of insecticides suitable to Indian conditions has become imperative. The results obtained with such protocols will minimise the discrepancies and provide meaningful comparison of results generated by different institutions and facilitate NVBDCP to

arrive at a decision. Keeping this in view, Malaria Research Centre has decided to develop protocols for the evaluation of insecticides in collaboration with Vector Control Research Centre, National Institute of Communicable Diseases and National Vector Borne Disease Control Programme.

Procedure for evaluation of insecticides

The laboratory and field evaluations for testing of insecticides are performed under three Phases. Summary of activities under each phase is given in Table 1.

Phase I

Evaluation of the new technical products or their formulations is done on laboratory-bred arthropods. This phase includes studies on candidate insecticide's efficacy and persistence, and cross-resistance in vectors to other insecticides currently in use.

Phase II

Evaluation is carried out in the field on a small-scale under well-controlled conditions. This phase provides sufficient information on various aspects related to efficacy in field conditions including safety of the insecticide to operators and inhabitants. It is also an opportunity to verify the effect of the insecticide on non-target fauna. This phase is important, as this is the first field experiment with flexibility of testing different doses and different evaluation methods. This phase suggests the suitability of the candidate insecticide for testing in Phase III.

Table 1. Activities to be undertaken in each phase

Phase	Type of studies	Activities
I	Laboratory testing	Efficacy to target vector Cross-resistance to insecticides Persistence
II	Limited field trials/ simulated trials in the field	Efficacy under different ecological conditions Dose and method of application Persistence Safety observations
III	Field trials (moderate or large-scale)	Efficacy to target vectors Persistence Entomological studies Epidemiological studies Safety observations Acceptance and other social aspects Collateral effects/ benefits

Phase III

Evaluation in this phase is on a large scale [village(s) scale] against disease vectors prevalent in the area. This phase includes entomological, epidemiological and safety evaluation. Introduction into the programme depends on the results of this phase.

Special instructions

- Phase I evaluation may be avoided for WHOPEs passed insecticides
- Sponsoring industries (national/international) to provide data on human/mammalian toxicity and environmental safety
- Investigators may consult specifications of WHOPEs (www.who.int/whopes/en/) and Bureau of Indian Standards (earlier ISI)
- Evaluations must be in multi-centric mode involving different ecological conditions, social strata, etc.
- Duration of the study has to be strictly adhered to
- It is important to keep the state and district health programme personnel apprised of the trial throughout and should be involved as investigators
- It is important to keep NVBDCP, Delhi be posted with the trials and their progress
- Products to be tested should have clearance from the ethical committee
- Informed consent should be obtained from the human volunteers associated with the evaluation

