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Introduction to the programme *

by

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The development of resistance among insect vectors of human disease to DDT and other insecticides led to the initiation in 1960 of a programme for the evaluation and testing of new insecticides by the World Health Organization. Since then more than 1300 prospective insecticides have been entered into the programme by the leading pesticide manufacturers of the world. The evaluation of these compounds is carried out in seven stages (two laboratory and five field) by 12 laboratories and field research units. Only those compounds which successfully meet the criteria established for each stage are considered for further testing. Each succeeding stage requires a prospective insecticide to meet more exacting criteria to evaluate its ability to perform safely and satisfactorily in the practical control of various species. Thus, the evaluation of the compound moves from its early testing under controlled laboratory conditions to the ultimate testing under the stress of the environment.

Stage I screening of prospective insecticides has been carried out under the direction of Dr Robert METCALF at the University of California, Riverside, utilizing adults of a dieldrin resistant strain of *Anopheles albimanus,* of a susceptible strain of *Culex fatigans* and of chlorinated hydrocarbon and organophosphorus resistant and susceptible strains of houseflies. Larvae of the mosquito strains are also used in the tests. Dr METCALF has recently moved to the University of Illinois and will carry out the screening there in the future.

Stage II involves the exposure of flies and mosquitos to sprayed panels of plywood, mud and other surfaces likely to be encountered in the field. Evaluation is carried out by bioassay at intervals following spraying. This work is performed under the direction of Dr H. F. SCHOOF, Technical Development Laboratory, NCDC, Savannah, Georgia, Dr D. WEIDHAAS, Entomology Research Division, US Department of Agriculture, Gainesville, Florida and Dr A. B. HADAWAY, Tropical Pesticides Research Unit, Porton Down, UK.

At this stage the candidate insecticide is also screened for effectiveness in controlling other insects of public health importance such as houseflies, ticks, fleas, body lice, bed bugs and reduviid bugs. The path of testing insecticides against these other vectors takes a different direction beyond this stage from that being used for evaluating residual sprays for control of adult mosquitos which is being described in this paper.

Stage III consists of the study of the duration of effectiveness of a residual application of insecticide in buildings on natural populations and released mosquitos. This work is performed under the direction of Drs SCHOOF and WEIDHAAS.

* This paper was presented at the 8th International Congresses of Tropical Medicine and Malaria, by Dr R. PAL, Vector Biology and Control - WHO Geneva, Section B. 2.3., Teheran, Iran, Sept. 7-15 1968.

The results of the evaluation of new insecticides at stages I, II and III will be summarized by Dr GEORGHIOU in the following paper.

Stage IV utilizes experimental huts with human bait and natural populations of mosquitos, principally anophelines. These specially constructed huts are of a type similar to that used by the local population. Entomological evaluation consists primarily of floor sheet, window trap, verandah trap and pyrethrum spray collections and the bioassay of sprayed surfaces. This work is performed under the direction of Dr A. SMITH, Tropical Pesticides Research Institute, Arusha, Tanzania, Dr J. HAMON, Chief ORSTOM Team/OCCGE, Centre Muraz, Bobo Dioulasso, Upper Volta and Dr C. PANT, WHO *Anopheles* Control Research Unit I, Kaduna, Nigeria.

Stage V of the programme for evaluating new insecticides consists of village scale trials designed primarily for the entomological assessment of the effectiveness of these new compounds when they are sprayed in occupied houses in established villages by a field operations team. However, this trial also permits the collection of certain other valuable information concerning the stability of the formulations, the reactions of villagers particularly if the compound has a noticable odour and the adequacy of the safety precautions recommended by the toxicological advisers to the Organization. In this trial the houses of one to three entire villages are sprayed. It is considered that a minimum of 400 sprayed houses is necessary to attain the objectives of Stage V. Entomological evaluation during this stage is essentially the same as in stage IV with the addition of night biting and outdoor resting collections. If earlier stages have indicated that an insecticide has an irritant, deterrent or airborne effect, efforts are made to measure the extent of these characteristics. Precipitin tests of mosquito blood meals are generally carried out to determine the feeding habits of the vector in the sprayed and unsprayed villages. Stage V village scale trials are under the direction of Dr C. P. PANT, WHO *Anopheles* Control Research Unit I.

The results of stage IV and V evaluation of new insecticides will be presented in a paper by Dr J. HAMON which will follow.

Stage VI Operational Evaluation is designed to recognize and eliminate any difficulties which may be encountered when the insecticide is used in large scale field operations. The houses of 10,000 to 25,000 persons living in an area of about 260 to 780 km^2 (100 to 300 square miles) are sprayed under field conditions. A trial of this magnitude requires 20 to 30 spraymen divided into 4 to 6 teams spraying for at least 6 weeks. It permits an assessment of the stability (active ingredient content and suspensibility) of commercially produced formulations and the facility by which they may be handled in the field. It also affords an opportunity to observe further the effectiveness of the recommended safety precautions and to secure more entomological data for evaluation of the insecticide's usefulness in controlling mosquitos, particularly anophelines. The entomological evaluation is carried out essentially as in stage V trials. These entomological observations are made principally in four or five of the sprayed villages (index sprayed villages) and a similar number of unsprayed (comparison) villages. These operational evaluations are under the direction of Dr Avid CARMICHAEL, *Anopheles* Control Research Unit II Kisumu, Kenya.

Stage VII Epidemiological Evaluation is carried out under the aegis of the Malaria Eradication Division of WHO. In order to minimize the effect of movement of people on malaria incidence, an area up to 7800 km^2 (3,000 sq. miles) containing about 200,000 people may be desirable for the epidemiological evaluation of a new insecticide. Evaluation consists of careful epidemiological (including entomological) studies in certain key index villages in the sprayed area and in an adjacent unsprayed comparison area. If it is demonstrated in this trial that the insecticide is capable of interrupting malaria transmission then it can be considered for use in the malaria eradication programme whenever a new insecticide is required for that purpose.

The results of stage VI and VII evaluations of new insecticides is covered in a separate paper. (WHO, 1968 *a*).

INTRODUCTION TO THE PROGRAMME

Although the evaluation of new insecticides in stages I through VI is primarily entomological, careful toxicological studies are carried out at all stages. When the manufacturer of a compound enters it into the programme he also provides basic toxicological data which have been derived from studies in his laboratories. If the compound passes the criteria for stage I, samples are sent to Dr J. M. BARNES, Medical Research Council Laboratories, Carshalton, Surrey, UK, for additional toxicological studies. If a chemical appears to be too toxic for routine use in spraying the interior of occupied houses, it is dropped from the programme immediately.

When the Directors of collaborating Laboratories review these new compounds to determine whether or not they should be recommended for stage IV Experimental Hut Trials, the toxicological data are carefully reviewed and safety precautions considered to be adequate for the safe use of the compound are recommended. During the spraying of the insecticide in stages IV, V and VI a medical toxicologist is present to examine the spraymen and villagers to ascertain that the safety precautions recommended are adequate to prevent any undue effect from the insecticide.

REFERENCES

World Health Organization, 1968.
Evaluation of Insecticides for Vector Control, Part. I. WHO/VBC/68.66, 201 p. multigr., Geneve.

WHO PROGRAMME FOR TESTING AND EVALUATING NEW INSECTICIDES