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ENTOMOLOGICAL EVALUATION OF THE USE OF LARVIVOROUS FISH FOR MOSQUITO CONTROL IN ANTI-MALARIA PROGRAMMES

by

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INTRODUCTION

For the proper evaluation of any action, the objective of the action must be clearly understood, including the various stages or targets that are necessary pre-requisites before the achievement of the final goal. Once the objective is well defined, the methodology and activities also need to be defined, taking into consideration the various human and material resources available.

Evaluation is a process of comparison between what is happening naturally and what is expected to happen because of the introduced action. It may be relevant to previous happenings (past trend) in the same or similar area, or to the present and future trends. Therefore, it is essential to choose and define properly, from the beginning, what are the initial areas or situations to be compared.

In a small trial, it is more convenient to have two comparable areas, one to be left without intervention as a control and the other as experimental. The findings after intervention are better understood and interpreted if compared not only by what is happening in the control area at the time, but also in the relative happenings in both areas before intervention which, in biological studies,should cover a period representing the natural happenings over different seasons during not less than a year.

Evaluation of the use of fish against mosquito larvae may have two differing objectives : one, as a means of controlling mosquitoes per se, and the other, as a measure of disease control.

To evaluate its effect as a mosquito control measure, one needs to know its impact on overall mosquito density; but to assess it as a measure for disease control, it is necessary to determine the relative importance of the reduction in density in relation to the reduction caused in transmission of the disease, or the resulting incidence of the disease among the population. Here, one has to take into consideration not only the effect on the number of mosquitoes remaining but on their expectation of life and potential capacity to transmit the disease.

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Entomological evaluation is therefore an essential component of the epidemiological evaluation in vector campaings. The most important entomological data required are the adult or larval vector density indices, derived from adequate sampling. The density indices used are the following :

1. Larval density indices

These represent the average number of larvae per dip using a standard dipping measure, or the number of larvae per unit area of a breeding site. Uniformity of procedure and previous experience of the collector are determining factors in adopting one or the other of these indices. For the evaluation of the efficacy of fish against larvae, baseline observation or density trends should be established before the introduction of fish, and afterwards, at intervals consistant with the size of the breeding place, the number of fish introduced and the possibility of the formation of secondary breeding places.

2. Adult density indices

These represent an estimate of the relative density of the adult vector species in different types of indoor and outdoor resting sites, and are used in the evaluation of overall control operations.

The methods used are :

2.1 Indoor day resting density, using pyrethrum space spray or a torch and sucking tube (hand collection). The index is the number of vectors collected per room, or per man/hr, depending on whichever method is applied.

2.2 Outdoor day resting density, using either hand collection, as in 2.1, or drop nets in potential resting shelters. Outdoor resting sites may be natural in the form of caves, rodent holes, tree holes, under bridges and culverts, vegetation near breeding sites, host gathering sites, etc,; or artificial, in the form of pits, boxes or drums burried under soil or other containers placed in shaded areas.

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2.3 Trap collection. These could be in the form of window traps applied to bedroom windows and/or doors, verandah traps, baited traps (with man or animal baits), light traps and other mechanical traps. The index is the number collected per trap per unit time.

2.4 Night biting rate. Direct biting collections are made indoors and outdoors either on man or on animal, at hourly intervals, throughout the night (sunset to sunrise). These cdlections are made by hand either by the bait himself or by another collector if the bait is sleeping. The index is the average number of vector bites per man per night taking into consideration the proportion of man's availability outdoors in relation to indoors.

BASELINE DATA

A good summary of the subject is given in the 9th report of the WHO Expert Committee on Malaria and is reproduced below !

" A broad spectrum of entomological baseline data should be gathered in every zone where these are not already well-established by earlier field studies. The identity of the vectors must be checked. The geographical limits of their influence on malaria transmission must be defined as precisely as possible, as well as the seasonal variations of their biting activity. The periodical fluctuations of the amount of contact between man and vector, and the dsitribution of this contact indoors and outdoors, should receive particular attention".

EVALUATION

The purpose of evaluation in malaria control is to bring about a certain degree of reduction in transmission. This is reflected in the changes that occur in the parasite rate of any age group of the population, particularly the infants who are born after the initiation of the control measures, when taken at regular intervals. The annual parasite incidence in the whole population is another index of this change.

Entomological investigations are essential to provide support to the parasitological finding. Some of these studies which related to anti-larval measures include :

a) larval density ;

b) adult density (in and out) ;

c) man-biting rates (in and out) ;

d) adult longevity ; and

e) adult vectorial capacity.

To assess the results of control measures, information will be required from all the various epidemiological situations which occur throughout the country. It is therefore necessary to divide the country into ecologically homogeneous zones by a process known as stratification. From each stratum or zone a representative number of villages is selected for longitudinal observations.

Entomological observations should be carried out at least once every month, preferable every fortnight, in the selected fixed localities and houses (or stations).

To avoid bias, caused by the fact that selected indicator villages and houses tend to be treated better than others, spot checks in non-fixed villages of similar stratifications should also be carried out in order to have a more complete picture of what is actually happening.

In applying entomological evaluation, the main difficulty is the practical limitation in the scale of sampling. Unlike malariometric surveys, entomological surveys have no single best index. Practically all methods of sampling vector populations still need improvement. However, some methods are, at times, preferred to others, depending on the objective and prevailing condition. A reduced vector density or degree of contact with man, and a decrease in the longevity of surviving vectors, give clear indications as to whether transmission is being reduced. The normal methods of choice for entomological evaluation in malaria control are the following :

1. <u>Density Factor</u>

1.1 Day resting densities of vectors, indoors and outdoors, in a representative number of prevailing habitats.

1.2 Night biting rates of vectors, using human and/or animal baits at strategic sites expected to be frequented by the vectors, like bedrooms, outside human or animal gatherings, near breeding sites, at the edge of forests, etc.

1.3 Larval surveys, especially when the measure is applied against the larvae.

However, the most appropirate entomological criteria for assessing progress towards the interruption of transmission are the overall reduction in vector/man contact, and the shortening of the life expectancy of vectors biting man (WHO Expert Committee on Malaria, 9th Report, 1962, Technical Report Series No 243). Therefore, it is not necessary, for epidemiological purposes, to spend too much time in the investigation of the vector's day resting density.

2. Longevity Factor

The mosquito's expectation of life, in general, and of infective life, in particular, can be determined from the proportion parous, when determined at a season of stable vector density. The simplest and easiest method of determining parity is by the appearance of the ovarian tracheoles and the unwinding of skeins in unfed and freshly fed females, i.e., the Detinova method.