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ANTI-LARVAL MEASURES, THE OPERATIONAL USE OF GAMBUSIA AND EVALUATION OF THEIR EFFICACY

by

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I HISTORY

Use of mineral oils as larvicides was introduced into the country in 1934.

Following the introduction of residual spraying, larval control measures were given low priority in malaria eradication programmes.

The development of resistance to DDT in A.stephensi, the main vector of malaria in the south of Iran, (1957) followed by dieldrin resistance (1959) in the area, caused some outbreaks of malaria in the area.

It was known, at the time, that no other type of insecticide was available to replace DDT and dieldrin in the area. Consequently no spraying operation was carried out in most parts of the resistance areas.

Despite the technical, operational and administrative difficulties which were encountered in interrupting the transmission of malaria by spraying alone, the attention of malaria workers was directed to the importance of larva control.

On the other hand, the Iran Malaria Eradication Assessment Team (WHO-US AID) in 1963, recommended that:

> "......emphasis should be on anti-larval measures throughout the entire Persian Gulf littoral, using oil, Paris Green or unleaded petrol, in accordance with the suitability to the different type of breeding places......." (Report of the I.M.E.A.T. 1963, p 117).

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As a result it was clear that an expansion of larviciding programme would eliminate further outbreaks. But considering the number of breeding places, stress was laid on the breeding places around cities and the areas of much economical importance.

II MATERIALS

At the beginning, because of budgetary restrictions, crude oil was the only available material to be used for larviciding. Later, a mixture of diesel oil and furnace oil was used in the programme.

By 1966, following some field trials, use of spreading agents (Tritom X 100 and Macon 10) was introduced in the programme (IPHR No. 1512, July 1966, NIOC unpublished report, 1968, IPHR No. 1745, February 1970), and a formulation of 80 per cent diesel oil, 20 per cent crude oil, plus 0.5 per cent spreading agent, was suggested for use all over the country.

III DOSAGE AND INTERVAL

Larviciding is carried out during the transmission season (April-November), at ten-day intervals and at a dosage of 10 cc/m^2 (100 ls/hectar).

The larvicide is used in four gallon Hudson sprayers, and the two following nozzle tips are used for spreading the materials:

1. Tx3 Cone spray Nozzles with 280 ml/mi. discharge.

2. 5 500 adjustable cone-jet nozzles with 300-780 ml/mi. discharge according to the distance.

IV BIOLOGICAL CONTROL OF MOSQUITO LARVA

1. Use of Gambusia

Since, inspite of the feasibility and effectiveness of larva control operations, it was found that due to lack of budgetary allocations it was not possible to extend this programme to all infected areas, the use of larvivorous fishes was taken into consideration (1967).

The studies showed that a sufficient reservoir of Gambusia fish existed in the Ghazian Marshes on the Caspian littoral (introduced from Italy before the Second World War). It was then decided to distribute the fish in the southern parts of the country.

The first raising ponds were chosen in Bandar Abbas, Shiraz, and Kermanshah and three batches of fishes were transported to these centres.

2. Method of transportation

As already mentioned, the main source of Gambusia in Iran, was the marsh of Ghazian on the Caspian littoral.

In 1966-1967, about 75 000 fishes were distributed from this marsh to the raising ponds in Shiraz, Kerman (Bandar Abbas) and Kermanshah. The distance from the place of origin to the raising ponds was from 1 000 to 2 000 km. They were transported in a Jeep pick-up, on which an oxygen cylinder was installed. Double-walled polyethylene bags of 30-40 litres capacity were used to transport the fishes over long distances, the bags being kept in strong carton boxes.

About 300-500 fishes were placed in each bag, which was half filled with water, then pumped full with oxygen and sealed. The bags were checked once every two hours during transportation and, if they had collapsed, oxygen was added. In this way, very few fish died, and they were easily introduced into the ponds already prepared.

3. Distribution

Experience showed that Gambusia fish can be easily introduced into the southern areas of the country.

By considering this factor, distribution of Gambusia fish became a serious part of the programme since 1966, and during the last three years millions of them were distributed in rural, and suburban mosquito breeding places, by using plastic churns.

In areas where distribution of Gambusia fish is included in the operational programme, the District Leader of the MEO is made responsible for this job. Sufficient fish are taken from the permanent raising pond, (carrying them in plastic churns) and are distributed among the pools, swamps and streams of the district as required. The presence of Gambusia fish in breeding places is routinely checked, at the end of any rainy period.

V OBSERVATION AND DISCUSSION

The Iran Malaria Eradication Programme has introduced Gambusia as an auxiliary measure along with other attack measures, (residual spraying, case detection, treatment and larviciding). Since in most areas, these measures have been combined, it has not been possible to evaluate the effectiveness of any one measure. However, during the years 1967-1971 of the distribution of Gambusia, some observations have been made which, in general, confirm the efficiency of this measure.

For instance, no anopheline larva are now found in the stagnant water around Shahaba-i-Gharb (Kermanshah) following the introduction of Gambusia to all breeding places.

In a breeding place of 15 000 m^2 around the village of Bisheh Baba Haji near Shiraz, where Gambusia was introduced, no larva was actually seen since 1968, despite the high density recorded in the transmission season in previous years.

The large potential breeding place of Islamloo village near Shiraz (more than 200 km surface) is another good example of the efficiency of Gambusia.

Villages surrounding the mash had high malaria prevalence prior to the introduction of Gambusia (1967). The marsh is surrounded by rocky hills with favourable shelters for exophilic vectors. In 1967, out of 127 blood slides examined from one village twenty-seven positive cases were found. The village has received one round of DDT spraying in May, and Gambusia was introduced. No larva was collected, in routine surveys in 1968, and out of thirty-nine slides examined only two were positive.

In conclusion, the Iran Malaria Eradication Organization believes that, although the use of Gambusia fish should never be employed as the sole anti-malarial attack measure, a considerable benefit can result in some areas from the distribution of these fish. The decrease in anopheline density has been quite striking in some regions, up to a point where the contact between man and vector has become very low. This improvement has been achieved at low cost since the maintenance of Gambusia involves very low running expenses compared with the application of chemical larvicides, and costs have in most cases been confined to the initial transportation and distribution expenses, together with the hidden costs of periodic checking on the presence of fish and the absence of larvae in potential breeding places. The importance of this checking must be emphasized. It is imperative to instil into those responsible that, once Gambusia have been distributed in an area, a regular watch for their continued presence must be maintained. It should be noted that there are many factors that may interfere with the development of the fish, such as extreme temperatures, flooding or drying, natural predators, or changes in the chemical nature of the water.

In Iran, the distribution of Gambusia fish has been carried out in over 3 000 permanent water collections in the south, and during 1969 over 1 1/2 million, and in 1970 over one million fish were distributed. It has proved of particular value where the prevalent vector species have been mainly exophilic and thus little affected by residual spraying. The breeding places of these vectors have often been in areas not suitable for the application of chemical larvicides, on the edges of streams, in areas with standing vegetation or in rocky pools, and biological vector control with Gambusia has assumed considerable importance. As the prevalence of malaria in south Iran decreases, exophilic vectors will probably play a more and more important part in transmission and consequently all available forms of attack will be required. It is felt that the use of Gambusia fish can help in attaining the goal of eradication of malaria from the whole country.