



EXPERT COMMITTEE ON LEISHMANIASSES

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*Leishmaniasis - pre
 sand flies
 Insect vectors*

PREVENTION OF LEISHMANIASSES THROUGH THE CONTROL OF THEIR VECTORS

Insect control methods

by

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Like any other vector borne disease, one of the ways of controlling leishmaniasis is through the control of their vectors: i.e. sandflies.

Sandflies are blood-sucking insects which breed in soil containing decaying organic substances and having suitable temperature and high humidity. Their flight range is limited and according to their breeding, resting and feeding habits, they can be divided into wild and synanthropic (peri-domestic and domestic) sandflies.

1. SANDFLY CONTROL METHODS

1.1 Measures for reducing man-vector contact

Generally speaking, control of sandflies for the prevention of leishmaniasis is either by measures which reduce man-vector contact or by elimination of sandflies. Reduction of man-vector contact is either by mechanical means (bed nets especially for children, mosquito nets, screening of doors and windows, etc.) or by the use of repellents. Bed nets and window screens should have a very fine mesh to prevent the entry of sandflies. They are effective only while the person is at rest or inside the protected rooms. Though these methods are very valuable in preventing the nuisance of the bites of blood-sucking diptera, they have little effect in preventing the transmission which takes place mostly outdoors especially in places where the vectors are not numerous enough to be a nuisance.

Repellents are used in the form of lotions, sprays, creams or sticks for individual protection or to impregnate head nets, jackets, trousers or nets hung at the entrances of rooms, tents, etc. Various compounds have been used as repellents such as dimethyl-phtalate, dibuthylphtalate, Indalone, etc., but after the discovery of diethyltoluamide it was found that this compound was very effective in keeping off most biting insects, including sandflies. At present most of the repellents which are being used, are made of pure dimethyltoluamide or a mixture of this compound with other repellents. These substances are useful especially when other methods of protection are not feasible. The disadvantages of their use are among others, the short duration of protection time, their high cost, their unavailability in most circumstances and their being quickly washed out by sweating in hot climates. Repellents used for individual protection have a protection time of two to six hours. Those used to impregnate net curtains with a large mesh are claimed to have a protection effect of 17 to 20 days if prepared and kept according to instructions.

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1.2 Measures for eliminating the sandflies

Elimination of sandflies is theoretically feasible by using genetic, biological, chemical and mechanical methods. Genetic control consists of the elimination or reduction of the insect population by releasing sterile male insects. This method is dependent on the breeding of very large numbers of sandflies in the laboratory, a technique which is not yet practical. Biological control is the reduction of the insect population using their parasites or predators. As present knowledge on the parasites and predators of sandflies is very limited, there is no known biological method of control for sandflies.

Chemical methods are based mainly on the use of residual insecticides. Other types of chemical control such as insect growth regulators and inhibitors of chitin development have not been tested on sandflies.

Various insecticides have been used against sandflies: DDT, BHC, dieldrin, malathion, propoxur, etc., and have been shown to be effective. The residual effect depends on the type of the insecticide and the method of its application and may last from several months to a few hours. Generally, the residual effect is longer if indoor resting places of the insect are sprayed according to methods and formulations used in malaria control. It is shorter if outdoor resting places are sprayed using insecticides in the form of vapour or space spraying.

The application of insecticides is one of the most important methods of control of leishmaniasis but only in some instances has this been used solely for the control of this disease. In most cases, the purpose of insecticide treatment of human dwellings has been the control of mosquitos or other insects, the control of sandflies being a side product. Reports on the efficacy of these insecticide treatments seems to be contradictory. The antimalaria spraying campaign in north eastern India led to long-term reduction of kala azar morbidity during the years of spraying while the disease incidence rose after the cessation of antimalaria spraying. In Greece, antimalaria treatment resulted in the reduction of sandfly fever but not of visceral leishmaniasis. In Iran antimalaria spraying had a dramatic effect on urban cutaneous leishmaniasis but it was less effective for the control of zoonotic cutaneous leishmaniasis. The explanation for these seemingly contradictory effects are the differences in the epidemiology of the disease in different foci as well as in the ecology of different sandfly vectors.

Knowledge on the breeding places of sandflies is limited and even in cases where something is known about the breeding places, they are either inaccessible, as for example the depth of the soil cracks or rodent burrows, or scattered over vast areas such as forest grounds in the Neotropical zone. Therefore, insecticides are of no practical use for the elimination of sandflies at the larval stages.

Until recently, there were no reports of sandfly resistance to insecticides. At present the report of P. papatasi resistance to DDT in northern Bihar, India, may have serious consequences on sandfly control campaigns.

Mechanical methods include the mechanical destruction of all likely breeding sites. Larvae develop in decaying organic substances such as human or animal excrements, dead forest leaves, in the cracks of damp soil containing such substances, and in the depth of burrows of wild animals, especially rodents. Mechanical filling up of all possible breeding places to close all the entries of the burrows, or all the holes and cracks at the base and lower parts of walls will lead to the elimination of sandflies. However, in places of wide-spread distribution of breeding sites, such as forest grounds in the Neotropical zone, these methods are useless.

Mechanical methods seem to be the most promising in towns and built-up areas where it has been shown that changes in the construction of houses, especially the building of firm strong bases for the walls, the paving of courtyards and the asphaltting of the pathways and streets, result in the natural disappearance of the sandflies and the disease.

2. SELECTION OF METHODS OF SANDFLY CONTROL

Whatever type of leishmaniasis is to be controlled, complete knowledge of the biology and ecology of the vector is a prerequisite to successful control. If vector control activities are undertaken without a thorough knowledge of the species composition, the vector species, possible breeding sites, flight range, seasonal and hourly activity, food preference, etc., the cost of the programme will be increased and its effectiveness will be poor.

2.1 Anthroponotic cutaneous leishmaniasis

This type of the disease is transmitted by synanthropic sandflies. It is possible to control it by spraying the house and other likely resting places with residual insecticides. As regards long-term control planning, environmental changes by changing the type of buildings and the construction materials, by planned urban development designed to prevent possible increase in the breeding of sandflies and by environmental sanitation, will lead to reduction of the breeding sites of sandflies and control of the disease.

The disease has been eradicated from foci in the USSR by "widely applied antimalaria insecticide spraying in the 1950's, improved housing conditions as well as specific measures of sandfly control". In Iran, an epidemic of this type of the disease in Neishabur was controlled by spraying all the houses in which a case of disease had been found and also all the neighbouring houses with DDT at 2 g/m². Fifty years ago, the southern part of Teheran had been one of the most active foci of urban cutaneous leishmaniasis, but now, the disease is practically unknown in this part of the city due to alterations in the structure of the houses and other environmental changes.

2.2 Zoonotic cutaneous leishmaniasis

This type is transmitted by both wild and synanthropic sandflies. Although the spraying of houses and other dwellings decreases transmission it does not interrupt it. In the Isfahan focus in Iran, a study showed that the antimalaria spraying reduced transmission but, once the spraying programme stopped, the incidence of the disease jumped up to very high levels.

Spraying of rodent burrows which are the main breeding and resting sites for the sandflies has no practical value in their control. In Isfahan, spraying of Rhombomys burrows with 75% DDT (approximately 4.5 grams of pure insecticide per burrow) only decreased the number of sandflies collected for only a short period of time so that 10 to 15 days after each spraying the sandfly catch on treated burrows reached the level of that on control burrows.

If the disease is present among soldiers and/or a labour force stationed at a transmission site, the only method of control will be the use of repellents. Unfortunately, this method is not sufficiently effective (see section 1.1).

The mechanical method of destroying gerbil burrows by ploughing eliminates not only the animal reservoirs but also the sandfly breeding and resting places. This method has been found effective in certain places in the USSR but it does not seem to be feasible in most other countries especially when the disease is associated with other species of rodents having different types of habitat.

2.3 American cutaneous and mucocutaneous leishmaniasis

These diseases do not seem to be amenable to control through the control of sandflies. They are transmitted by wild sandflies breeding in forest land. At present these insect vectors are impossible to control either in the adult or in the larval stages. The only feasible ways of reducing the disease by vector control are by reducing man-vector contact with the use of nets or repellents or by changing the environment around human settlements to make them unsuitable for sandfly resting and breeding.

2.4 Visceral leishmaniasis

In its anthroponotic form (Indian type) this disease is transmitted by a peri-domestic sandfly controllable by residual insecticide spraying as long as no noticeable resistance develops in the vector. In its other forms, kala azar is a zoonosis with animal reservoirs (mainly wild carnivores) which is transmitted by wild sandflies. It does not seem feasible to control this type of kala azar through the control of its vector.

2.5 Conclusion

Finally, although it is possible in some instances to control leishmaniasis by the control of sandflies using insecticides, these methods have only temporary effects. The environmental control of breeding sites, though much more expensive and time consuming, usually has better results. The health authorities should be urged to include these environmental changes in their planning for long-term control of leishmaniasis.

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