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Results of Recent Experiments on the
Use of DDT and BHC Against Adult
Mosquitoes at Taveta in Kenya.

by

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In connexion with the discussion on the relative merits of DDT and BHC, I should like to give a brief account of experiments I have been carrying out over the past year at Taveta in southern Kenya.

You will all have heard of the startling results obtained recently by Muirhead Thomson in both West and East Africa in his experiments with DDT and BHC employed as residual insecticides in native huts against A. gambiae and A. funestus. Muirhead Thomson concluded that DDT applied to the internal surfaces of these huts only irritated resting A. gambiae and A. funestus causing them to leave the huts without actually killing them. BHC, on the other hand, proved a most efficient residual insecticide and during the period of his observations (13 weeks in his later experiments) no mosquitoes were observed to escape its killing action.

At Taveta I have been repeating and elaborating Muirhead Thomson's experiments. There I have constructed ordinary native mud and thatch huts more or less light-tight except for an opening one foot square in one of the side walls, into which is fitted a window trap for collecting the mosquitoes which attempt to escape from the hut. Gaps in the eaves of the roof provide means of entry for the mosquitoes. Each hut is occupied by one or more volunteer Africans.

In these huts before any insecticide was applied, it was found that A. gambiae and A. funestus, entering during the night and early morning to feed on the occupants, rest inside the hut after feeding until their blood is digested and their ovaries fully matured. The gravid mosquitoes then leave the hut in

the evening to lay their eggs, possibly returning the same night to feed again. It is thought that the average time spent resting inside the huts by A. gambiae is 2 - 3 days and by A. funestus 3 - 4 days, but that this time is dependent to a great extent on prevailing temperatures.

Of four huts originally constructed: one was sprayed with Gammexane wettable powder P 530 at 150 mg. BHC per sq. ft.; one with DDT wettable powder 'Ditrene' at 100 mg. DDT per sq. ft.; and one with a DDT oil-bound suspension at 300 mg. DDT per sq. ft.; the fourth hut was left untreated as a control. The concentrations of insecticide were estimated chemically from sample papers fixed at random on the walls and roofs of the huts at the time of spraying.

Mosquito catches were made each day in all four huts in three ways:-

1. Hand catches of live mosquitoes flying or resting inside the huts in the early morning.
2. Floor catches of dead mosquitoes inside the huts.
3. Window trap catches of mosquitoes leaving the huts.

Observation in these four huts have now been carried on for a period of 6 months after spraying. Unfortunately one month after spraying the mosquito densities fell naturally to very small numbers but the results obtained in the first month show clearly a marked difference between the effects of the two insecticides DDT and BHC. As Muirhead Thomson found, very few mosquitoes escaped the action of BHC, that is to say, most of the mosquitoes were found dead on the floor each morning. The very few found alive in the hut at this time died within a few hours of capture. A small proportion of the mosquitoes managed to escape into the window trap but these again died within a few hours. In later months, as the killing-power of the insecticide declined, more and more mosquitoes were found alive inside the huts, but an appreciable 24-hour mortality continued among them. Even after 6 months mosquitoes artificially applied to the wall surfaces of this hut for one hour under Petri-dishes all died within 24 hours after application although the mosquitoes caught alive in the hut at this period only showed a mortality of about 50%.

In the DDT-treated huts we found quite a different state of affairs. Most of the mosquitoes collected each morning were in the window trap, although a few were found dead on the floor. This was similar to Muirhead Thomson's findings but, whereas Muirhead Thomson found little mortality among the mosquitoes escaping from the hut into the window trap, we found that about 80% of the A. gambiae and a slightly higher proportion of the A. funestus so caught died within 24 hours. Actually the DDT wettable powder 'Ditrene' proved a less efficient killer than the DDT oil-bound suspension, and it was the former formulation which was used by Muirhead Thomson in his experiments. Moreover, Muirhead Thomson had no chemical estimation of his

deposit made and may well have had a lower concentration than the 100 mg. DDT per sq. ft. used in these experiments. This may account for his almost negligible mortalities among escaping mosquitoes.

The real difference between DDT and BHC would appear to be that the time of contact with the insecticide, before irritation and flying towards light is induced, is sufficient in the case of BHC to kill the mosquitoes, at least in the first few weeks after treatment, whereas this contact-time with DDT only kills about 80% of the mosquitoes shortly after treatment, and this mortality decreases as the treated surface ages.

This difference between the two insecticides has been further demonstrated by laboratory experiments using two one-foot-cube chambers, joined together by a perspex chamber of similar dimensions. Mosquitoes introduced into the middle of the perspex chamber had the option of flying into one chamber or the other and settling; the slippery nature of the perspex prevented them from settling for more than a few moments in the perspex chamber. One of the pair of chambers had the whole of its internal surface treated with insecticide, while the other was left untreated. Two sets of these chambers were used and in one set one chamber was treated with a BHC oil-bound suspension at 100 mg. BHC per sq. ft. and in the other set one chamber was treated with a DDT oil-bound suspension at the same concentration of DDT. When introduced mosquitoes settled in the treated chamber the time of contact with the insecticide before irritation and flying into the perspex chamber was induced, was noted. This was taken as an escape-reaction and the irritated mosquitoes were caught and kept for 24 hours.

There was definitely no question of either of the insecticides exerting a repellent effect. At least as many mosquitoes on introduction into the perspex chamber flew to the treated cage as to the untreated one. The most striking outcome of these experiments was that, with both A. gambiae and A. funestus, the contact-time before irritation and flying was induced was shorter in the case of DDT than in the case of BHC, and, what is more, this time was not sufficient with DDT to produce a significant kill among female A. gambiae. In the first week after treatment only 20% of the A. gambiae which had contact with DDT died within 24 hours. The average contact time before irritation and flying was induced was 12 minutes. In the case of BHC this time was 26 minutes and 85% of the mosquitoes died within 24 hours. With A. funestus the average contact-time with DDT was 11 minutes and the mortality 62%, whereas with BHC this time was 16 minutes and the mortality 100%.

In conclusion I should like to stress that these experiments are only in their infancy, and it might be that other DDT formulations containing the insecticide in very small crystals may prove as effective as BHC is initially (as has been indicated by laboratory work in the United Kingdom) and may retain their effectiveness over a longer period.